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500
MOST PROBABLE
QUANT QUESTIONS

Mock 1

1. If $f(n) = \left[\frac{2^n}{3}\right] + \left[\frac{2^{n+1}}{3}\right]$, where [X] is the greatest integer less than or equal to X, then the value of f(50) is
   (a) 2^{50} (b) $2^{50} - 1$ (c) -2^{49} (d) $2^{49} + 1$

2. The average speed of HYD VSKP DT Express is 60 kmph, if the halts at various stations is excluded then the average speed is 80kmph. What is the average halt time per hour of DT express?
   (a) 0.25 hours (b) 0.5 hours (c) 0.33 hours (d) 0.20 hours

3. How many natural numbers x exist such that, $x^2 + 2x + 33$ is divisible by x + 3?
   (a) 4 (b) 7 (c) 6 (d) 5

4. 50 students attempted the midterm tests of class 5th, the midterm consists of 4 subjects English, Hindi, Maths and Science. The number of students passed in these subjects is 35, 45, 25 and 30. What is the maximum number of students who have passed in exactly one subject?

5. The prime number a is such that $\frac{1}{a} + \frac{1}{8} + \frac{-7}{8a} = \frac{3}{n}$, where n is a natural number. What is the number of possible values of n?

6. Two workers Arun and Bimal were assigned to paint a wall. Arun alone would take 6 days working 10 hours a day to complete the wall. Arun started working 4hrs a day for first five days then Bimal joined him and they both completed the work in another 2.5 days by working 4 hrs per day. What is the ratio of efficiency of Arun and Bimal.
   (a) 1: 3 (b) 3 :1 (c) 1: 5 (d) 2 : 1

7. In an equilateral triangle ABC a point p is selected inside the triangle, the three altitudes from point P to the sides AB, BC and CA of the triangles are 5 cm, 3 cm and 6cm, what is the area of the triangle?
   (a) $\frac{196}{\sqrt{3}} sq\ cm$ (b) $\frac{98}{\sqrt{3}} sq\ cm$ (c) $\frac{256}{\sqrt{3}} sq\ cm$ (d) $\frac{49}{\sqrt{3}} sq\ cm$

8. A field is in the shape of a right triangle and its corners are named A, B and C. The angle ABC is 90° and angle ACB is 30°. A point D is present on AC such that BD is perpendicular to AC. Now, a pole is erected on B and its top is P. If the length of PB is 30m and angle PDB is 30°, then find the area of ABC(in cm^2).
   (a) $600\sqrt{3}cm^2$ (b) $300\sqrt{3}cm^2$ (c) $1800\sqrt{3}cm^2$ (d) $750\sqrt{3}cm^2$

9. Instead of a meter scale, a cloth merchant uses a 110cm scale while buying 100cm yarn but uses an 80cm scale while selling the same yarn. A customer paid Rs 8800 for the entire yarn sold. If the merchant sold the yarn at the cost price, what is the profit he received?
   (a) Rs 1200 (b) Rs 2000 (c) Rs 1600 (d) Rs 2400

10. On an island, the male population is 25% more than the female population. The food is limited and enough for only 20 days for the given population. After 10 days, 20% of men leave and 25% more women join and the food lasts for 12 more days. Had all the male population left at the beginning and no one joined in the middle, how many days would the food have lasted? Assume that the daily food consumption of all the men is the same. Same is the case for all the women.
    (a) 240 (b) 300 (c) 250 (d) 270

11. X is the smallest number which leaves a remainder of 3 when divided by 7 and a remainder of 2 when divided by 19. What is the remainder when X is divided by 23?

12. How many 3-digit numbers have 5 as at least one of their digits?
(a) 252 (b) 260 (c) 234 (d) 256

13. Let $\log_4 C = 9$, $\log_2 A = 27$ and $\log_{64} B = x$, If C,A and B are in GP, what can be the value of x?
(a) 9 (b) 5 (c) 4 (d) 6

14. Physics book was sold by a dealer to a shopkeeper at 25% profit, which was sold by the shopkeeper to a customer at a further profit of 25%. Whereas, Chemistry book was sold by the dealer at 25% loss, which was sold by the shopkeeper to the customer at the further loss of 25%. The shopkeeper sold two books for Rs. 225 each, what is the difference in the original cost price of the two books?
(a) Rs 244 (b) Rs 356 (c) Rs 256 (d) Rs 200

15. A triangle ABC of perimeter 70 cm is circumscribed by a circle of radius 15 cm such that AB is the diameter. Find the area of the triangle(in cm^2).
(a) 175 (b) 125 (c) 150 (d) 225

16. A sheep is left to graze in a farm which is of dimension 6m x 15m. If it is tied to the center of the field and the length of the rope to which it is tied is 6m, What is the ungrazed area in the farm?
(a) $120-12\pi-9\sqrt{3}$ (b) $90-12\pi-3\sqrt{3}$
(c) $90-12\pi-18\sqrt{3}$ (d) $90-9\pi-9\sqrt{3}$

17. Compound interest earned at 20% per annum compounded semi-annually is how much percentage more/less than the simple interest earnedat 10% per annum over a 2 year period on same principal?(round off the answer to nearest integer)

18. If the r^{th} term, $(r+1)^{th}$ term and $(r+2)^{th}$ term of the expansion of $(1+x)^{14}$ are in AP. Find the largest possible value of r

19. The difference between the maximum possible distance and minimum possible distance between the point P(8, 10) and a point on the circle $x^2 + y^2 = 25$ is

20. A deck of cards is shuffled, four cards are picked in random and all of them turned out to be red. What is the probability that two of the cards are kings?
(a) $\frac{6}{325}$ (b) $\frac{3}{375}$ (c) $\frac{9}{325}$ (d) $\frac{6}{375}$

21. What is the area of the figure bound by the lines $|x| = 3$, $|y| = 1$ and $|x+y| = 2$?
(a) 8 (b) 6 (c) 10 (d) 4

22. What is the value of the function $(x - 1)(x - 2)^2$ at its minima?
(a) 0 (b) 4/27 (c) 3/27 (d) 4

Mock 2

1. There are 100 bottles of a Pepsi, out of which only one bottle is poisoned. Anyone who tastes the Pepsi from the poisoned bottle would die in 1 hour. However, there is no harm if the Pepsi from

other bottles is tasted. A test is to be conducted using rabbit to identify the poisoned bottle. What is the minimum number of rabbits needed for the test if the poisoned bottle is to be identified in exactly 1 hour time? Assume that the time taken by the rabbit to drink the contents of the bottle is negligible and that rabbit can drink the contents of as many bottles as we make them to drink..

(a) 4 (b) 5 (c) 6 (d) 7

2. Number of sets of 2 or more consecutive integers which exist, such that the sum is 1000?

(a) 5 (b) 7 (c) 9 (d) 11

3. Arun purchased a coffee machine from Varun and sold it to Barun. The amount of profit realised by both Arun and Varun are equal. Arun offered a discount of 6.25% and realised a profit of 20%. If Barun paid Rs. 150 to purchase the coffee machine, then what is the difference between the cost price of Varun and the discount offered by Arun?

4. Two business people, Peyush and Ashneer walk up a moving up escalator at constant speeds. For every 6 steps that Peyush takes Ashneer takes 5 steps. How many steps would each have to climb when the escalator is turned off, given that Peyush takes 60 and Ashneer takes 55 steps to climb up the moving up escalator respectively?

(a) 80 (b) 90 (c) 100 (d) 110

5. An entrepreneur takes a loan of Rs 384000 from a bank, that is to be returned in three years at a rate of 15.25% p.a. compound interest. He returns Rs 73360 and Rs 62303 after first and second year. How much money will he have to return after third year to settle the loan?

6. Rabin marked a scooter at 50% above his cost price. What is the maximum number of successive discounts each being 5%, he can give such that he does not make a loss?

7. The number of integral values of m for which the line, $6x + 8y = m$ intersects the circle, $x^2 + y^2 + 6x - 8y + 6 = 0$ at two distinct points is _____.

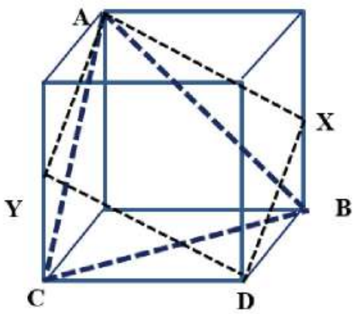
8. Dipika & Elena participated in an archery competition. There is circular target as shown in the diagram. The radii of the concentric circles are 1cm, 2cm, 3 cm, 4 cm & 5 cm. The rule of this archery is different from normal archery games. The first person to hit anywhere in the highlighted ring wins. The game continues until either of them wins. It is given that both Deepika & Elena hits within the 5 cm circular targets as they are top seeded players. If Deepika starts the game, what is Elena's probability of winning the game?

(a) $\frac{1}{2}$ (b) $\frac{2}{5}$ (c) $\frac{3}{5}$ (d) $\frac{4}{9}$

9. The digits 1, 2, 3, 4 and 5 are arranged to form a 9-digit number in such a way that 8! /21 is the product of all digits. Let the number can be formed in 786×6^k ways. If a function f (x) is such that, f (x+ y) - f (xy) = 0, where x, y are integers and f (k) = 5, then what is the value of f(8!/21)?

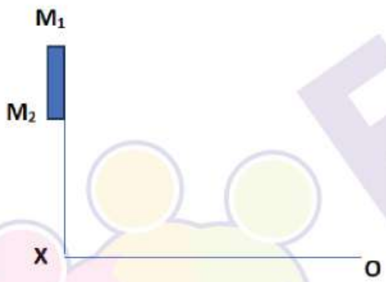
10. Tap X can fill 4/5th of a tank in 20 hours. Efficiency of tap Y is 30% more than that of tap X. Both taps X and Y are started together and but get defected after ten hours. Tap Z filled the remaining tank in 4 hours. Efficiency of tap Z is what percent more/less than that of tap X?
(a) 25% less (b) 50% more (c) 25% more (d) 50% less

11. In the diagram a quadrilateral AXDY is formed where X & Y are the midpoint of the respective sides. If the area of AXDY is A_1 and that of ABC is A_2. Then find $\left(\frac{A_1}{A_2}\right)^2$



12. Ravi started a business with Rs.45,000. Bharat joined him 3 months later with Rs. 32,000. After 3 months Ravi withdrew Rs.5,000 of his capital and 2 more months later, Bharat brought in Rs.13,000 more. At the end of the year, what will be the ratio in which they share the profits if Ravi receives 20% of profits as commission?
(a) 3:2 (b) 5:4 (c) 5:17 (d)17:8

13. A mirror M_1M_2 is hanging on a wall as shown in the figure. M_1M_2 = 50 cm and XM_2 = 40 cm. If an observer is at O, then find out the distance OX so that the angle created by M_1M_2 at O is the highest.



(a) 50 cm (b) 60cm (c) 72cm (d) 90cm

14. The two sets A and B are 2P and P consecutive integers. The sum of the integers in set A is P and the sum of the integers in set B is 2P. The difference of the greatest integers in the sets A and B is 316. Then, find the value of P is:
(a) 633 (b) 635 (c) 626 (d) 628

15. In an army training camp, a soldier is trying to climb up a flag pole. He is ordered to touch the flag at the Top. He ascends 12 meters and slides down 5 meters in every alternate hour. If the flag is at the height of 60 meters from the ground, how much time will he take to reach the flag?
(a) 14 hours 20 minutes (b) 14 hours 55 minutes
(c) 15 hours 35 minutes (d) 16 hours 45 minutes

16. In a bag, there are some number of marbles of three colors - black, red, and green. Total number of black marbles are 36 and total number of red and green marbles together are 4 more than the total number of black marbles. The average weight of black marbles is 2.5 gm that of red is 2 gm and that of green is 1.2 gm. If the average weight of all marbles is 1.9 gm, then find the difference between the number of red and green marbles.
(a) 26 (b) 24 (c) 28 (d) 22

17. The sum of the solutions to the equation $|x-1| + |x-2| + |x-3| = 10$ is

(a) $\frac{16}{3}$ (b) 4 (c) $\frac{7}{3}$ (d) None of these

18. A and B take part in a duel. A can strike with an accuracy of 0.6. B can strike with an accuracy of 0.8. A has the first shot, post which they strike alternately. What is the probability that A wins the duel?

(a) $\frac{7}{10}$ (b) $\frac{15}{23}$ (c) $\frac{2}{3}$ (d) $\frac{11}{17}$

19. While walking down the pavements of Delhi city, I notice that every 60 minutes there is a city bus coming in the opposite direction and every 70 minutes there is a city bus overtaking me from behind. What is the approx. time gap between one city bus passing a stationary point known as Local Bus Stop beside the bus route and the immediately next city bus in the same direction passing the stationary point?

(a) 68 min (b) 65 min (c) 60 min (d) Can't be determined

20. A cube's outside surface takes 18 minutes to paint. This cube is divided into 216 identical smaller cubes. All these 216 smaller cubes are split into three groups such that in each group, all the cubes can be put together to form an individual larger cube. How much time in total (in minutes) will it take to paint the outer surface of all the three new cubes?

(a) 20 (b) 27 (c) 30 (d) 25

21. Let three friends Susmita, Sahev and Sahev are walking along a circular path. The equation of the circle is $x^2+y^2=9$. Let P $(3\sqrt{2}, 0)$ be any point outside the circular path and there are two tangents PA and PB, where A, B are the point of contacts. All of them have started walking from point A, but Sahev in clockwise and Susmita in anti-clockwise. Their friend Sounak also has started walking from point A, but he is walking along the tangent, from the point A to P and then point P to B. If all of them reach to B at the same time, then what is the ratio of speeds of Sounak, Sahev and Susmita?

(a) $2: 3\pi: \pi$ (b) $3: \pi: \pi$ (c) $4: \pi: 3\pi$ (d) $6: 2\pi: \pi$

22. The roots of a quadratic equations α, β are reciprocals of the maximum & minimum values respectively that can be assumed by f(x) where $f(x)= (x^2+3x-6)/(x^2-2x+4)$

If $a_n = (\alpha^n-\beta^n)$ for all natural number $n\geq1$ then find $10(a_1 + a_2 + a_3 + \ldots)$

(a) 16 (b) 20 (c) 24 (d) 18

Mock 3

1. Let's say n is a 3-digit number abc where a, b, c are digits in hundred's place, ten's place & unit's place respectively. F(n) is defined as

$F(n) = a+b+c$ if $(a+b+c) <10$

$= F(a+b+c)$ if $(a+b+c) \geq 10$

G(n) is defined as the remainder when the number n is divided by 9

Find out the number of 3 digit numbers for which F(n) + G(n) is a perfect square.

2. A number when successively divided by 9, 5 and 4 leaves remainders 5, 3 and 3 respectively. Find the sum of the respective remainders when the order of the divisors is reversed.

3. A man travelled a total distance of 172 km in 18 hours. He took a bicycle and a car at a speed of 13 km/hr and 7 km/hr respectively for the first half of the distance and he took a bike and train at a speed of 8 km/hr and 9 km/hr respectively. If he travelled the first half of the distance in 8 hours and the second half of the distance in 10 hours. Find the ratio of the distance travelled by him on the bike to the ratio of the distance travelled by car.
(a) 12 : 25 (b) 18 : 29 (c) 21 : 32 (d) 22 : 35

4. To complete a piece of work Rishi & Nupur are deployed. Rishi alone worked on the project and completed $1/5^{th}$ of it and then passed it to Nupur who finished the remaining job. The total time taken in this process was 12 days. If Nupur started the work and completed $1/5^{th}$ of it and then passed it to Rishi to finish the remaining part, then 13 days were needed to finish the work. In how many days Rishi can finish the work alone?
(a) 13.33 days (b) 15 days (c) 16.66 days (d) 14.18 days

5. Obama bought a number of shirts. He gave 60% of the total shirts to Johnson and the rest of the shirts to Biden. Next day, he buys 20% more shirts than the previous day. If he gave 5% more shirts to Johnson than the previous day, then the number of shirts given to Biden is what percent more than the previous day?
(a) 40.5 (b) 42.5 (c) 44.5 (d) 46.5

6. In a herd of cattle with 7 cows, the average length of the 6 shortest cows is 70 inches, Average length of the 6 highest cows is 75 inches. What is the overall difference between the maximum and minimum possible average length of cows in the nearest integer?
(a) 3 (b) 4 (c) 5 (d) 6

7. Two varieties of poppy seeds costing $28 per kg and $18 per kg are mixed in a certain ratio to form varieties A and B. A and B are mixed in the ratio 1: 2 to form variety C which is sold for $30 per kg at 20% profit. If A costs $20 per kg, how much poppy seeds costing $18 is present in 10 kg of variety B?
(a) 2 kg (b) 5 kg (c) 200 g (d) 500 g

8. A smartphone has a printed price of Rs. 8800. Ramcharan wanted to buy it online at a 20% discount, but due to connectivity issues, he failed to place an order. Later he buys it at Rs. 4560 after getting two successive discounts. Then, the second discount in nearest integer was:(approximately)
(a) 40 (b) 35 (c) 30 (d) 25

9. A bank offers two schemes of interest on a fixed deposit of Rs. 10,000 for 3 years. Scheme A pays simple interest at 12% per annum for the first year, 15% per annum for the second year, and 18% per annum for the third year, with interest calculated only on the principal amount. Scheme B pays compound interest at 10% per annum, compounded annually. However, both schemes deduct 10% of the interest earned as tax at the end of the tenure. What is the difference between the final amounts received from the two schemes?

10. Find the minimum value of the expression $\frac{49x^4e^{4x}+64}{x^2e^{2x}}$.
(a) 56 (b) 112 (c) 28 (d) 100

11. A sunglass company bears an expense of Rs. 240 for producing every sunglass. Also, they have to pay an additional fixed cost of Rs. 25,000, which does not depend on the number of sunglasses produced. If they are able to sell a sunglass to customers during the summer season, they sell it for Rs. 340. If they fail to do so, they have to sell each sunglass for Rs. 200 to scrap collection companies. If they are able to sell only 1,400 out of 1,700 sunglasses, they have made in the summer season, then they have made a profit of Rs. ______:

12. For an India vs Pakistan T20 match tickets are getting distributed from the ticket counter in front of Eden Garden. People started queuing up from 4 AM for the tickets and 100 people join the que in every minute from 4 AM till 4 PM. After 4 PM no one is allowed to line up in the que. The counter which distributes tickets opens at 11:30 AM closes by 5:30 PM. In the ticket counter there are some BCCI officials who distribute tickets to the people who are in the line. Each official can distribute 2 tickets per minute. How many BCCI officials need to be stationed to make sure that all the people who are in the line get tickets?

(a) 60 (b) 80 (c) 100 (d) 120

13. If 4.5 times the perimeter of a square is 12 cm less than $11\sqrt{2}$ times its length of the diagonal, then the side length of the square is S. What is the perimeter of the square whose side length is $1 + 2/S + 3/S^2 + 4/S^3 + \dots$ for $1/|S| < 1$?

(a) 11 (b) 10 (c) 9 (d) 8

14. A tower is mounted on top of a building. A man standing on the ground, $4\sqrt{3}$m away from the base of the building, can see the top and base of the tower at two different angles of elevation, which are complementary. If the building is 6m high, the height of the pole is h. What is the value of $(3 \tan\alpha - 2 \cos\alpha)$, where $\sin\alpha = 1/h$?

(a) 1 (b) 0 (c) 2 (d) 3

15. Let $f: R - \left\{\frac{3}{2}\right\} \to R, f_1(x) = \frac{3x+5}{2x-3}$ and $f_2(x) = f_1(f_1(x)), f_3(x) = f_1(f_2(x)) \dots$
$f_n(x) = f_1(f_{n-1}(x))$. Then the value of $S = \sum_{i=1}^{1011} P_i$ where
$P_i = \left||f_i(1)| + |f_{(2023-i)}(1)|\right|$

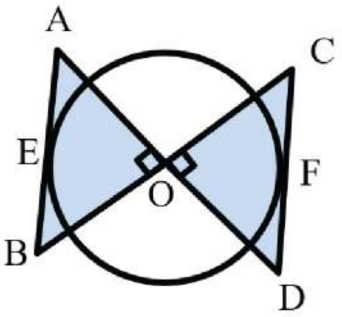
16. Leaving from his laboratory at the same time, Prof stark reaches home at 9:05 pm if he travels at 6 km/h, and at 8:50 pm if he travels at 15 km/h. Leaving his laboratory at 8:20 pm, at which speed (in km/h) must he travel so that he reaches home exactly at 9:10 pm?

17. The external dimensions of a plastic box closed at both ends are 36 cm, 25 cm, and 8 cm respectively and the thickness of the plastic is 5 mm. If the empty box weighs 9 kg, then find the approximate weight of 1 cubic cm of plastic?

(a) 15.4 gm (b) 6.8 gm (c) 10.9 gm (d) 8.25 gm

18. Rajnikant gives 30% of his monthly income to his sister, and 60% of his remaining income he invests in business and health insurance policies in the ratio of 7: 5. If the difference between the money he gave to his sister and the money he spent on the health insurance policy is Rs. 1750, then find the difference between the money he gave to his sister and the money he spent in business.

19. What is the area of the white portion in the following figure if the radius of the O centric circle is r?



(a) $r^2 \times (1 - \pi/4)$ (b) $\pi/2 \times r^2$ (c) $r^2 \times (1 - \pi/2)$ (d) $0.2r^2$

20. A bartender mixes a 60 litre mixture of syrup and soda in the ratio of 7:3 with 'a' litre of a mixture of syrup and soda in the ratio 1:4. If the overall mixture should contain between 30% - 50% syrup, what is the range of values 'a' can take?
(a) 75 litres to 250 litres (b) 40 litres to 240 litres
(c) 60 litres to 180 litres (d) 50 litres to 200 litres

21. Find the number of distinct real numbers so that the below expression is equal to 0.
$[(x-5)(x-3)+2][(x-2)(x-6)+4]$

22. If α, β are the roots of the equation $x^2 + 2x + 2 = 0$ and γ, δ be the roots of the equation $x^2 - 2x + 2 = 0$, then find the value of $(\alpha^4 + \beta^4)(\gamma^6 + \delta^6)$
(a) 2^3 (b) 0 (c) 2 (d) 2^5

Mock 4

1. Simmy has a collection of 10 different Comic cards arranged in a stack. She selects 3 Comic cards out of these 10 Comic cards. What is the probability that no 2 Comic cards selected are adjacent to each other?
(a) 1/2 (b) 1/3 (c) 2/5 (d) 7/15

2. A regular octagon has a side length of 4 meters. What is the approximate integer value of the area ?

3. Two buses start from the stoppage X and Y heading towards each other. The bus from stoppage X starts at 10 p.m. and reaches stoppage Y at 2 p.m. next day. The Bus from the stoppage Y starts at 9 p.m. the same day on which the bus starts from stoppage X and reaches to the stoppage X at 7 a.m. the next day. At what time (approximately) will they cross each other?
(a) 4 a.m. (b) 3:32 a.m. (c) 2:51 a.m. (d) 3.51 a.m.

4. In Bschool, during the 1st year of MBA, ratio of boys to girls in a batch was 3:1, however due to highly competitive environment, n number of boys dropped out of college in 2nd year and 2n number of girls came into batch through special quota, after which the ratio of boys and girls became 5:4. Also, the total number of students increased to 135 after this action. If the increase in the total number of students was a%, what is the value of 4a (in percentage)? (Enter '0' if the answer cannot be determined)

5. Vinit works in R&D of a Sanitizer Company. He wants to revolutionize the sanitizer spray by making it 100% safe for children, currently they mix 3 varieties of elements costing Rs. 20/kg, Rs. 17/kg, and Rs. 18/kg in the ratio of x:y:z respectively. y is the geometric mean of x and y and x is less than y. The company marks up the price of the sanitizer by 66.67% and then provides a discount of 20%, earning a profit of Rs.6 on every kg of the sanitizer sold. One day, Vinit figured out that if they mix these three elements in the ratio z:x:y (instead of x:y:z) it will have no harmful impact on children. The company sells the new sanitizer at the usual selling price as previous one. What is the profit in Rs. per kg of the mixture sold?
(a) 5 (b) 6 (c) 10 (d) 12

6. If x and y are non-negative real numbers such that $3x + 2y = 12$, then the average of the maximum and minimum possible values of $(x + 2y)$ is:
(a) 8 (b) 10 (c) 12 (d) 15

7. In a tank full of plastic balls of 4 different colors, 18% of the total number of balls is Red, 4/9 of total number of balls is Blue, and 8% of the total number of balls is Green. If there are 133 yellow balls then find the difference between the number of red balls and number of green balls in the tank?

(a) 45 (b) 90 (c) 30 (d) 60

8. A private bank offers two types of investment schemes: Scheme A with a simple interest rate of 12% per annum, and Scheme B with a compound interest rate of 10% per annum compounded annually. If a person invests $10,000 in each scheme for 2 years, how much more interest (in $) will he earn from Scheme A than Scheme B at the end of the period?

9. If $0 \leq \theta \leq \pi$, then what is the minimum value of the following expression?

$$\frac{(3sin^2\theta+sin\theta+3)(4cos^2\theta+cos\theta+4)}{sin\theta cos\theta}$$

(a) 54 (b) 45 (c) 63 (d) 72

10. A well-known EdTech company ABC buys 6 sets of DILR, 16 sets of VARC and 8 sets of Quant sectional mock test papers of CAT from a vendor where the cost of 5 sets of DILR is the same as that of 20 sets of VARC or 7 sets of Quant. They mix all the three sectional mock test papers and marks a price for the mixture in order to make a profit of $1695. They sell 6 combined papers at this marked price and the remaining at a 16.66% discount on the marked price, thus making a total profit of $1117. Then the amount, in rupees, that they had spent in buying DILR sectional mock test papers is:

11. At a certain shopping mall, the cost of each jacket is 3 times the cost of each shirt. Kartik bought 18 jackets and a certain number of shirts. If he bought as many jackets as the number of shirts that he bought and vice versa, his total expenditure on the two items would have been 1/17 times less. How many shirts did he buy? [Approximate to the nearest integer]

(a) 20 (b) 16 (c) 18 (d) 22

12. Two circular paths intersect each other at two distinct points A & B. The area of the right circle is 200% more than that of the left one and the centres of the two circles are at a distance twice the radius of the smaller circle. Ramesh & Suresh start their morning walk from the point A where Ramesh walks along the periphery of the left circle in the counter-clock-wise direction and Suresh walks along the periphery of the right circle in the clock-wise direction. If they meet for the very first time while crossing B for the first time after 10 seconds from the start then when they will meet at point B for the 3rd time? (in seconds)

13. The base of a vertical pillar with uniform cross section is a trapezium whose parallel sides are of lengths 10 cm and 20 cm while the other two sides are of equal length. The perpendicular distance between the parallel sides of the trapezium is 12 cm. If the height of the pillar is 20 cm, then the total area, in sq cm, of all six surfaces of the pillar is

(a) 1300 (b) 1340 (c) 1480 (d) 1520

14. The digits 1, 2, 3, 4 and 5 are arranged to form a 9-digit number in such a way that 8! /21 is the product of all digits. Let the number be formed in 786 × 6k ways. If a function f (x) is such that, f (x+ y) - f (xy) = 0, where x, y are integers and f (k) = 5, then what is the value of f(8!/21)?

15. Dr Strange's lab is 90 km apart from his house. He used to travel to his lab by cycle. One day, on his way to the lab, he collided with another cycle and became late by 4 hours. So, to reach his lab on time, he rented a car whose speed is 6 km/hr more than his usual cycling speed. What is the speed (km/hr) of the car?

(a) 17.5 (b) 10 (c) 15 (d) 20

16. Two cars are on perpendicular roads. Initially, the black car is 26 km away from the intersection and the red car is 24 km away from the intersection. The black car is traveling towards the intersection at 70 km/hr. The red car is going away from the intersection at 55 km/hr. How many kilometres apart are they after 12 minutes?
(a) 35 (b) 36 (c) 37 (d) 38

17. Mr. Richard and Mr. Nadar invest $6000 and $7000, respectively in a business. Mr. Richard received $95 per month out of the profit as a remuneration for running the business and the rest of the profit is divided in proportion to the investments. If in a year, Mr. Richard totally receives $3054, what does Mr. Nadar receive (in $)?

18. There are a total of 9 bus stops from Arambagh to Tarakeswar. The number of types of bus tickets required in order that it may be possible to book a passenger from every stoppage to every other is M.
(a) 210 (b) 110 (c) 72 (d) 36

19. Let ±m be the roots of the equation $12x^3-kx^2-432x+144 = 0$. Then if ${}^nP_k = 1680$, what is the value of n?

20. What is the least integer value of $3\log_2 x - \log_x 0.25$, x> 0?
(a) 2 (b) 3 (c) 5 (d) 7

21. PQR Company has launched a Multi-Level-Marketing (MLM) scheme in which one person can sell products for the company and can also keep many people under him as a distributor who can again sell the products of PQR Company and can keep people (different from the ones already included in the MLM Scheme) under them. This branching can happen infinitely. For selling a product the seller gets 30% commission on the MRP. If a person A who is just above B on the chain and B directly reports to him, gets 10% commission of whatever B earns from either selling or commissions from the immediate lower layer. This way of income is common for every person in the MLM branch. If the company PQR produces a product at ₹160 cost whose MRP is ₹300, then what can be the minimum profit margin of the company (in %)? [Assume that all the products are sold at MRP and no discounts are given by the sellers on MRP.]
(a) 45 (b) 30 (c) 25 (d) 35

22. What is the minimum possible value of $\frac{y^2-10y+26}{5-y}$, for y < 5?
(a) 5 (b) 3 (c) 2 (d) 7

Mock 5

1. In a 200 m race, Abhay beats Chetan by 40m and Chetan beats Kundan by 20 m. If Abhay and Kundan were to run a 500 m race, then by what distance will Abhay beat Kundan?
(a) 80 m (b) 120 m (c) 140m (d) 60 m

2. Sunita and Danish are playing a dice game where each of them rolled a fair dice thrice. Whatever numbers come while rolling the dice thrice, Sunita used to multiply the outcomes and write all the natural numbers which are less than or equal to it without any repetition in an ascending manner. Danish then removed all the numbers which will have a common factor greater than 1 to the largest number in the sequence. Let N be the count of the number of terms in the sequence thus formed after Danish's editing. Then which of the following cannot be the value of N?
I. 5
II. 42

III. 100
IV. 120
(a) I & II (b) II & III (c) III & IV (d) I, II & IV

3. Delhi and Kanpur are 880 km apart. A train called Banaras Express starts from Delhi at 6:30 am and travels towards Kanpur at a speed of 50 km/hr. Another train, Shatabdi express, starts from Delhi at 9 am and travels towards Kanpur at the speed of 40 km/hr. A train called Rajdhaani express starts from Kanpur at 1:30 pm on the same day and travels towards Delhi at 60 km/hr. At what time will Shatabdi and Rajdhaani express be equidistant from Banaras express?
(a) 6:45 pm (b) 4:30 pm (c) 5 pm (d) 6:15 pm

4. Tap A alone can completely fill an empty pool in 16 hours and efficiency of tap B in filling is 4 times the efficiency of A. Initially, the pool was empty and taps A and B were opened together simultaneously for two hours after which both taps were closed. Remaining part of pool was then filled by tap C alone in 12 hours. Find the time (in hours) required by tap C alone to completely fill the empty pool.

5. There are three beakers A, B, and C with nitric acid concentrations of 18%, 16%, and 21%, respectively. Himani combined 120 ml of A with 160 ml of B. If he needs the final solution's concentration to be between 17 and 19 percent, what is the sum of the maximum and minimum amounts of C (in ml) that he can add to the solution of A and B?

6. If the average weight of the class VI, VII, and VIII is 48.75 kg, and Class VII contains 20 students of average weight 45 kg, class VIII contains (X + 1) students of average weight 60 kg and class VI contains (X - 9) students of average weight 36 kg, then what is the total number of students in class VI, VII, and VIII together?

7. A joint venture was started by Elara and Johnson with a total capital of Rs. 90000 invested in 5:7 ratio. After 5 months, Elara and Johnson withdrew 25% and 20% of their investment respectively and Elara left the venture and took all his money off 3 months before completion of the time-period such that profit is divided between Elara and Johnson in 725: 1372 ratio. Find the total time-period (in months) of the venture.

8. A shopkeeper sells Apples. He buys 100 kg of Apples and sells them in packages of 1 kg and 3 kg. He offers 2 packets of 1 kg of Apple free to customers who buys the 3 kg packet. He marks up the price of the Apples by 30% and ends up realizing a profit percentage of 17%. What percentage of the total quantity of Apples sold is sold in 3 kg packets?

9. Adani won Rs. 65000, $1/5^{th}$ of which he deposits in Swiss bank and gets it compounded annually for 2 years while he partnered with QIA in a business, with investment of Rs. 4000 less than the remaining money. After 5 months, QIA withdrew Rs. 4800, 2 months after which Adani increased his investment by 10% and the share of profit of Adani after 1 year is Rs. 40,625 which is 625/88 times of the interest received from Swiss bank. Find the amount invested by QIA, if the total profit from the business is Rs. 87,100. Also find the rate of interest given by the Swiss bank.
(a) Rs. 60,000, 20% (b) Rs. 65,000, 15%
(c) Rs. 65,500, 20% (d) Rs. 55,000, 12%

10. Trevor and Adani have less than 125 shares together. If Adani gives Trevor a certain number of shares, then Trevor would have 5 times as many shares as Adani. Instead, if Trevor gives the same number of shares to Adani, then Trevor would have 4 times as many shares as Adani. If the minimum number of shares Trevor and Adani have together is more than 70, what can be the number of shares together with them?

11. A Buyer buys items at the rate of Rs. 30 per item for his shop. But the selling price is linked to the number of items available. Thus, the selling price of the first item is Rs. 1, second one for Rs. 3, third for Rs. 5...and so on. The wholesaler wants to make an overall profit of at least 35%, what is the least number of items he should sell?

12. If $2^{(2x+2)} + 2^{(x+2)} = 24$, then find the value of $(x^{2023} + x^{2022} + x^{2021})$.
(a) $x^2 + 1$ (b) $x^2 + 1$ (c) $x + 2$ (d) Both option B & C

13. In a park, a group of 3 children A, B, and C sit in three corners 4 cm, 5 cm and 7 cm apart from each other. Now if a girl runs around them in such a way that she is always at a distance of 1 cm from the imaginary lines joining each of the two children, then the distance travelled by her is given by:
(a) 16 (b) 20 (c) 16+ 2π (d) 16+ 3π

14. Let $(b \sin\theta - \sqrt{3})^2 + (b \cos\theta - 1)^2 = 0$, then if $x^{\frac{5}{6}}k\left(\frac{x}{k}+\frac{k}{x}\right) = b^2x^{-\frac{1}{6}}$, what is the maximum value of x?

15. The film Pathan which had a budget of \$1 Million was launched on 25th January. The price of tickets for the first week is \$10 which reduces by \$1 in every 10 days. The per day tickets sold is 5000 which reduces by 500 in every 10 days. On which date Pathan will recover all of its cost?
(a) 14th February (b) 15th February (c) 16th February (d) 18th February

16. A boat can travel 120 km downstream in 2 hours. If the speed of the current is 1/3rd of the speed of the boat downstream, then how much time (in hrs) will the boat take to travel 240 km upstream?

17. Area of the rhombus is 147 cm^2. Ratio of volume of sphere to the volume of a cylinder is 9: 5, where radius of the sphere is equal to the shorter diagonal of the rhombus and base radius of cylinder is equal to the longer diagonal of the rhombus. Base radius of the cylinder is 40% of its height, then what is the difference between the length of both the diagonals of the rhombus?
(a) 7 (b) 41 (c) 21 (d) 28

18. A rectangle is cut from a semi-circular metal sheet of radius r. What is the minimum area left in the semi-circular sheet?
(a) $r^2(\pi/2 - 0.8)$ (b) $r^2(\pi/2 - 1)$ (c) $r^2(\pi/2 - 0.5)$ (d) $r^2(\pi/2 - 1.2)$

19. $\sum_{x=1}^{M}\left[\frac{2}{3}+\frac{x}{9}\right] = 21$, where [x] be the largest Integer less than or equal to x. Then, what is the value of M?

20. If α, β are the real roots of the quadratic equation $(px^2 - 4px + 2p + 1) = 0$ where $p \le ½$. Then find the roots of the below quadratic equation-
$(\alpha/\beta)^{2023}x^2 - (\alpha+\beta)p^2x - (\alpha/p)^2 - (\beta/p) = 0$
(a) 5, 4 (b) 4, -5 (c) -4, -5 (d) 5, -4

21. If $\log_{256}(16\log_2(1 + \log_6(3 + 3\log_3 x))) = 1/2$, then find the value of x.
(a) 3 (b) 4 (c) 5 (d) 6

22. Let the solution of $\frac{2x^2+x-5}{(2x^2+x-3)(2x^2+x-1)} \ge 1$ is $x \in (-a-1, -1) \cup (a, 1)$, then what is the value of $\log_{2048}[3a/(1+a)]$?

Mock 6

1. A square grid contains 36 points arranged in the form of rows and columns. Distance between any of the 2 consecutive points is the same. The total number of rectangles that can be formed by using the points of the grid as vertices is:

2. If the sum of the last two digits of 67^{1668} is p, then for how many values of x satisfying $\sqrt{\ } > p - 2x$, 4x is an integer?

3. Akal and Bakal start running on a circular track from the same point in the same direction with speeds a m/s and b m/s. Which of the following cannot be the values of a and b, if the point at which they meet for the fourth time is the starting point?
(a) 3m/sec and 4m/sec (b) 36m/sec and 28m/sec
(c) 35m/sec and 15m/sec (d) 28m/sec and 7m/sec

4. Heart beat gallery employs male and female workers to create designer flowerpots for their stores. 5 males and 3 females can create as many flowerpots in 4 days as 3 males and 3 females in 5 days. If one man and one woman work together and complete an assignment of creating 400 flowerpots in 50 days, then how many flowerpots can be created by 6 males and 2 females in 7 days?

5. Two tanks of similar volume are full of a mixture of oil and water. In the first, the ratio of oil and water is 2:5 and in the second, it is 6:11. If both these tanks are poured in a larger tank, what would be the resultant ratio of oil and water?
(a) 7 : 81 (b) 7 : 27 (c) 38 : 81 (d) 37 : 81

6. here are 2 classes X and Y in a college. The average weight of the students in class X and class Y combined is 75 kg. The average weight of students in class X is 45 kg more than the average weight of students in class Y. Which of the following cannot be the ratio of the number of students in classes X and Y, if it is known that tshe average weights of both the classes are integers?
(a) 8 : 1 (b) 1 : 2 (c) 1 : 5 (d) 2 : 1

7. A dishonest shopkeeper while purchasing rice uses a faulty weighing machine M1 which shows 80% reading of the actual weight. While selling he uses another faulty weighing machine M2 which shows 120% reading of an actual weight. He purchased rice R1 at 50 INR/kg. Before selling he mixes a lowquality rice R2 purchased using M1 at 30 INR/kg. If he mixes R1 & R2 in the ratio of 3:1 and sells it at a profit of 50% then what should be the % discount that he should give on the marked-up price of 50 INR/kg?
(a) 0 % (b) 10 % (c) 20 % (d) 25%

8. Three friends Abir, Babar, Cantor took loans of Rs. 4800, Rs. 6400 and Rs. 3600 respectively from a cooperative bank on the condition that they would not have to pay interest, if they would repay their loan within two years. They invested the money to purchase 2 Electric Vehicles. After two years they made a profit of Rs. 35,150 excluding all the expenses. They divide the profit among themselves in the ratio of their capitals and repaid back their individual loans amount to the bank. Then, the difference of amount of shares between Abir and Cantor is:

9. Rajav bought x kg of coffee that cost Rs.1500 per kg and 20 kg of coffee at Rs. 2000 per kg for the restaurant. Find the total weight of coffee purchased in kilograms, if the average cost per kg of both types together is Rs.1700.

10. Aman, Rohit, and Samson went to buy some pens, erasers, and rulers. Aman bought some pens and erasers in the ratio 5:3, Rohit bought some rulers and erasers in ratio 3:2 and Samson bought

some pens and rulers in ratio 3:5. If together they bought more pens than rulers and more rulers than erasers, then what is the minimum number of items bought by the three friends?
(a) 29 (b) 21 (c) 34 (d) 26

11. From a wholesaler, the shopkeeper bought 4 items A, B, C and D at price of p, q, r and s respectively. He sells the four items at profit of 15%, 25%, 35% and 45% respectively. The net profit on the sale of these four items is 40%. Which of the following options cannot be the value of the ratio p: q: r: s?
(a) 1: 2: 3: 14 (b) 2: 1: 4: 17 (c) 1: 3: 2: 16 (d) 2: 2: 1: 18

12. A virus, CORONA, has a property to split into 15 viruses of the next generation. But due to environmental haphazard, only 60% of one generation can produce the next generation and the remaining 40% don't survive. If the number of viruses in the seventh generation is 531441 million, then what was the number (in millions) of viruses in the first generation?

13. p, q, r are the sides of the triangle PQR which satisfies the inequation $\left(1+\frac{q-r}{p}\right)^p \times \left(1+\frac{r-p}{q}\right)^q \times \left(1+\frac{p-q}{r}\right)^r \geq 1$. If the inradius of the triangle is 1 cm, then find the circumradius of the triangle PQR (in cm).

14. The medians of a triangle are in the ratio of $\sqrt{592} : \sqrt{505} : \sqrt{673}$. The sides of the triangle are all coprime integers. Then find the inradius of the triangle.

15. In a work-shop there are four different tools Hammer, Screwdriver, Plier and Drill. It is known that, there are 191 tools except Hammers, 178 tools except Screwdrivers, 169 tools except Pliers and 161 tools except Drills. What is the total number of tools in the work-shop?

16. Paul is carrying his friend Sam from home on a bicycle towards the capital city which is far from his home by 10 km. Paul is riding the bicycle at 5kmph and his other friend Nuanc started from his home simultaneously but on foot at 2 kmph. After reaching the capital city Paul drop Sam and come back to take walking Nuanc to again return for the capital city. Find the total time taken by Paul to drop both of his friend from his home. (Assume no time is lost in picking or dropping and the path followed is same for any case)
(a) 25/7 hours (b) 26/7 hours (c) 27/7 hours (d) None of these

17. If the graphs of the lines 3x - 4y + 5 = 0 and 8x - 6y + 11 = 0 intersect at the point P(a, b), then the value of $16(a^3 + b^3 + a(b - 5))$ is:

18. Age of Smith is 13/11 of the age of his younger brother Robert and Johnson is 8 years younger to Robert. If the ratio of age of their father and mother is 10 : 9 and father is 46 years older to Johnson. What is the average age of the father and mother if the average age of the five-member family is 35.2 years?

19. There are two boxes A and B. A contains 3 White balls and 4 Yellow balls and B contains 5 Yellow balls. One ball is transferred from the box A to the box B without seeing the colour. Now, two balls are drawn, one from each box. What is the probability of both the balls that are drawn are Yellow?
(a) 18/19 (b) 17/9 (c) 11/21 (d) None of these

20. If α, β are the roots of the equation $x^2 + 2x + 2 = 0$, then find the equation whose co-efficient of x^2 is 1 and whose roots are α^{2024} & β^{2024}.
(a) $(x^2 - 2^{1013}x + 2^{2023}) = 0$ (b) $(x^2 + 2^{2023}) = 0$
(c) $(x^2 + 8x + 2^{2023}) = 0$ (d) $(x^2 + 4x + 2^{2023}) = 0$

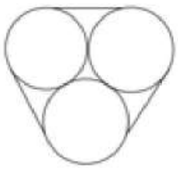
21. Find the maximum value of x where x is a natural number so that [1+[2] +[4] +...+ x ≤ 1000 where [.] represents box function.

22. What is the value of the sum 2/60 + 1/170 + 2/816 + 1/744 + ... 2/9636 ?
(a) 13/219 (b) 10/219 (c) 10/221 (d) 11/219

Mock 7

1. A group of 10 men can plough a whole stadium in 20 days. This group starts the work and after every 2 days, 2 extra men join the group. The efficiency of each man is the same. On which day men finish ploughing the stadium?

2. The diagram below represents three circular Paint cans, each of radius 0.5m. The three cans are touching as shown. Find the tight minimum possible perimeter of the tight string encompassing three cans.



(a) $\pi + 3$ (b) $\pi + 6$ (c) $2\pi + 3$ (d) $2\pi + 6$

3. In a right-angle triangle having circumradius 2.5 cm and the smallest side of 3 cm following 3 figures were drawn-
R_1 : R_1 is the largest possible rectangle inside the triangle having one side on the hypotenuses.
R_2 : R_2 is the largest possible rectangle inside the triangle having one side on the smallest side
C_1 : The largest possible circle inside the triangle
Let the area of R_1, R_2 & C_1 are A_1, A_2 & A_3 respectively. A is the area of the right-angle triangle. Then which is/are the right statement(s) about A_1, A_2, A_3-
   1. $A_1 < A_2 < A_3$
   2. $A_1 = A_2 < A_3$
   3. $A_1 : A_2 : A_3 = 3:3:\pi$
   4. $A_1 : A_2 : A_3 = 1:\sqrt{2}:\pi$
   5. $A_1 : A = 1:2$

(a) 1 & 3 are true (b) 1, 3 & 5 are true (c) 2 & 3 are true (d) 2,3 & 5 are true

4. In a cricket bag there are 2 pink balls and n white balls. The balls are drawn out of the bag at random one by one. Two people A & B are betting on the colour of the balls coming out of the bag. A wins as soon as 2 balls are pink. B wins as soon as 2 balls are white. The game continues until one of them wins. A(n) & B(n) are the probabilities of A's & B's win respectively.
Find B(2)*B(3)*B(4)*B(5)……
(a) 1/4 (b) 1/8 (c) 1/10 (d) 1/12

5. There are 100 coins numbered from 1 to 100. In how many ways can two coins be drawn, such that, the sum of the numbers on the two coins is greater than 100?

6. The total salary of Rajesh, Deepak and Pankaj is Rs. 1136. If they spend 84%, 82% and 75% of their salaries respectively, their savings are 8 : 10.8 : 8. Then, find the salary of Rajesh and Deepak are:

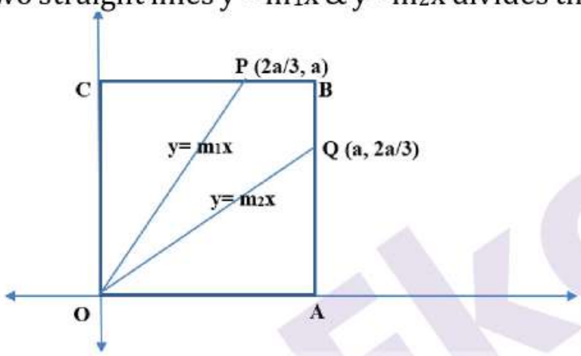
(a) Rs. 507, Rs. 323 (b) Rs. 270, Rs. 507 (c) Rs. 423, Rs. 270 (d) Rs. 400, Rs. 480

7. Starting at the same time from Howrah and Solapur station, two trains T_1 and T_2 are coming towards each other at speeds of 45 kmph and 55 kmph respectively. At the time of their meeting, the second train has travelled 130 km more than the first one. What is the distance between Howrah and Solapur stations in km?

8. In an election three candidates A, B, and C are the representatives, A wins the election where A gets 40% more votes than B and also beats C by 10800 votes. If B gets 10% more votes than C, then find the total number of voters if it is known that only 80% of the voters on the list had cast their votes.
(a) 728000 (b) 91000 (c) 99000 (d) 80800

9. A regular polygon, with the number of diagonals equal to 9, is inscribed inside a circle, which in turn is inscribed inside a square of area 100 square units. Find the ratio of the circumference of the polygon, circle, and square.
(a) $4 : 2\pi : 3\sqrt{6}$ (b) $3 : \pi : 4$ (c) $2 : \pi : 4$ (d) $20 : 5\pi : 24\sqrt{6}$

10. $L_1 \equiv 0 \le y \le a$
$L_2 \equiv 0 \le x \le a$
Two straight lines $y = m_1x$ & $y= m_2x$ divides this region into 3 equal areas. Find the value of $m_1 * m_2$



11. If $T = 3/5 + 6/5^2 + 11/5^3 + 18/5^4 + 27/5^5 + 38/5^6 + \ldots$ What is the value of $(1 + T + T^2 + T^3 + T^4 + \ldots)$?
(a) 32 (b) 128 (c) 64 (d) 16

12. The real root of the equation $5^{4x} - 3.5^{2x+1} - 54 = 0$ is:
(a) $(\log_5 18)/3$ (b) $(\log_5 18)/2$ (c) $(\log_5 9)/2$ (d) $(\log_5 21)/4$

13. In an annual function event, each group's overall points are calculated by $\frac{s}{n^2} + n$, where s is the total sum of the score they received in each event and n be the number of events. Group A and group B had total scores 32 and 36. Find the total number of events that A and B participated in, if A and B had their overall points in ratio 6:7 and the product of the number of events participated by A and B is 12.
(a) 8 (b) 13 (c) 7 (d) 9

14. If f(x) = f(x-1) + f(x+1) and f(25) + f(26) = 9. Also, f(47) = -5, then what is the value of f(1) + f(2) + f(3)…………+ f(99)?
(a) 10 (b) 12 (c) 9 (d) 16

15. A function f(p,q), where p > q is defined as below
f(p,q) = |p-q| if q = |p-q|
= f(|p-q|, q) if |p-q|>q
= f(q, |p-q|) if |p-q|<q

Here, min [p, q] refers to the minimum value between p and q. Which of the following will have the Maximum value?

(a) f (500, 350) (b) f (1000, 700) (c) f (2000, 1950) (d) f (4000, 3950)

16. In a class, 40% of the students opted for Maths, 60% for science and 25% for English. What is the maximum percentage of students who could have opted for all the three subjects if each student opted for at least one subject?

(a) 14% (b) 12.5 5 (c) 20% (d) None of these

17. If A(3,5) and B(9,7) are two end points of diameter AB of a circle and two tangents AC and BD are drawn to the circle touching it at points A and B. It is known that AC = 2BD = 6cm, then what is the area (in cm^2) enclosed by the figure ABCD?

(a) $18\sqrt{10}$ (b) $12\sqrt{10}$ (c) $9\sqrt{10}$ (d) $16\sqrt{10}$

18. Aisha can do a work in 30 days, while Piranha can do the same work in 45 days. Aisha started the work and was joined by Piranha after 5 days. At the end of 10th day, they had an argument and Aisha quit. How many more days did Piranha take to complete the work? (Both worked at 100% efficiency on all days they worked.)

(a) 22 (b) 25 (c) 24 (d) 26

19. Ramu mixes a certain quantity of milk with 12 litres of water. After selling one-fourth of this mixture he replenishes it with an equal quantity of water. He then sold one-third of the resultant mixture and once again replenished it with an equal quantity of water. How many litres of the milk solution does he have right now if 35% of the solution is milk?

20. Bipin went from his home to coaching centre on his cycle at a speed of 16 kmph. While returning, his cycle got punctured in the midway and his speed reduced to half. What is his average speed?

(a) 10.80 kmph (b) 12.80 kmph (c) 12 kmph (d) 14 kmph

21. Kiran & Johal can complete a task together in 21 days, while Kiran alone can complete it in 15.75 days. They start working together but Johal leaves 10.5 days before the completion of the work. For how many days did Kiran and Johal work together?

(a) 17.5 (b) 10.5 (c) 8 (d) 7

22. There are seven subjects in the Engineering Test. For each subject, the maximum and passing marks are 100 and 35, respectively. Raj received 40% overall, with the average of his marks in A, B, and C being 48, and the highest mark among these three subjects being 64. What is (M-m) if M and m are the maximum and minimum number of subjects in which Raj could have failed?

Mock 8

1. What will be the difference between y_{min} and y_{max}, if x is a natural number such that $x \leq 100$ and $y = |x - 1| + |x - 2| + \ldots + |x - 100|$?

2. Ram spends money in an interesting fashion, he spends exactly ₹k on every k^{th} day of the month if the dates of that month are odd, and on every even day he spends half the money as compared to the previous day. If he starts this spending pattern from October, then the number of days in which the daily spending is less than the average spending of the month is.

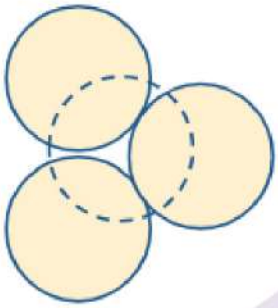
(a) 12 (b) 15 (c) 17 (d) 19

3. Find the number of integer solutions of the function: $3^x - 2^x + 12^x - 18^x = 0$
(a) 0 (b) 1 (c) 12 (d) 3

4. A is the area bound by the following curves-
$L_1 \equiv |y| \leq \sqrt{3}$
$L_2 \equiv \sqrt{3}|x|+|y| \leq 2\sqrt{3}$
$x = \alpha$ divides A into 2 parts in the ratio of 1:2.
Find the respective areas of the two parts.
(a) $3\sqrt{3}, 6\sqrt{3}$ (b) $\sqrt{3}, 2\sqrt{3}$ (c) $5\sqrt{3}, 10\sqrt{3}$ (d) $2\sqrt{3}, 4\sqrt{3}$

5. a, b, c and d are the roots of the equation x4 – x3 – x2 – 1 = 0. If f(x) = x6 – x5 – x4 – x2– x, f(a) + f(b) + f(c) + f(d) is equal to:
(a) -1 (b) 0 (c) 1 (d) 2

6. Prof. Tom invented a molecule having formula X_4. 4 atoms of X elements touch each other and form a symmetrical tetrahedron. The diagram shows below the top view of the molecule. The base of the element is XY plane (same as the plane of the paper). The 3 atoms who form the base of the tetrahedron are called base atoms. The 4th atom is called summit atom. The surface area of each of the spherical atoms are 6π sq unit



Find the height of the center of the summit atom and the base plane (in unit)

7. A solid metal sphere is melted and smaller spheres, all with the same radius, are formed. 20% of the material is lost in this process. The radius of each smaller sphere is 1/8 the radius of the original sphere. If 20 liters of paint was needed to paint the original sphere, then how many liters of paint would be required to paint all the smaller spheres?
(a) 90 (b) 108 (c) 128 (d) 256

8. Let three friends Susmita and Sahev are walking along a circular path. The equation of the circle is $x^2+y^2=9$. Let P $(3\sqrt{2}, 0)$ be any point outside the circular path and there are two tangents PA and PB, where A, B are the points of contact. Both of them have started walking from point A, but Sahev in clockwise and Shusmita in anti-clockwise. Their friend Sounak also has started walking from point A, but he is walking along the tangent, from the point A to P and then point P to B. If all of them reach to B at the same time, then what is the ratio of speeds of Sounak, Sahev and Susmita?
(a) $2: 3\pi: \pi$ (b) $3: \pi: \pi$ (c) $4: \pi: 3\pi$ (d) $6: 2\pi: \pi$

9. In a factory three types of products P, Q and R are manufactured. All workers employed in the factory are equally efficient. In one hour, 100 workers can produce 80 P's, 160 Q's, 120 R's. In two hours, 75 workers can produce 125 P's, 140 Q's and 180 R's. In three hours, 150 workers can produce 150 P's, 'X' Q's and 540 R's. What is the value of 'X'?

10. A started a business with \$2000. He further invested the same amount of money in the 2nd and 3rd month as well. B invested \$4000 in the beginning of the 7th, 8th and 9th months. C invested

\$6000 each at the end of the 10^{th} and 11^{th} month. D joined in the at sometime in the year investing \$12000. As A has been actively involved with the business, he got 10% of the profit as his salary. The remaining amount is then shared between A, B & C. If A received profit of \$1500 and B received \$1000 at the end of the year, then what is D's profit share?

(a) \$1000 (b) \$1200 (c) \$500 (d) \$1500

11. If α, β are the roots of the equation $x^2 + 2x + 2 = 0$ then find the equation whose roots are reciprocals of α, β having co-efficicent of x^2 as 2.

(a) $2x^2 + 2x + 1$ (b) $2x^2 + x + 1$ (c) $x^2 + 2x + 1$ (d) $x^2 + x + 1$

12. In a shop, cost of 5 pen, 7 chocolates and 9 ice creams is ₹ 65 and 8 pen, 11 chocolates and 14 ice creams cost ₹ 103. Then how much does one 1 pen, 1 chocolate and 1 ice cream cost ?

(a) ₹ 13 (b) ₹ 10 (c) ₹ 17 (d) ₹ 11

13. If $x^3 =1$ but x is not equal to 1, then the value of log $(x^{2015} + 1/x^{2015} + x^{2016} + 1/x^{2016})$ is

(a) 3 (b) 2 (c) 1 (d) 0

14. When Anuj substitutes x = 1 into the expression ax3 – 2x + c its value is – 5. When he substitutes x = 4, the expression has value 52. One of the values of x that makes the expression equal to zero is

15. The sum of the roots of the equation $2|e^{3x}|-4|e^{2x}|-46|e^{x}|+120=0$ is $ln\, k$. Then, what is the number of divisors of k?

16. If a, b, c are positive real numbers, then find the minimum value of $(a^4+b^4+c^2)/abc$.

(a) $4\sqrt{2}$ (b) 2 (c) $\sqrt{2}$ (d) $2\sqrt{2}$

17. The distance between Dakhhineshwar and Babughat is 90 km. A boat while going downstream takes 3 hours. Rekha a passenger in a boat dropped a polythene when she was at Dakhhineshwar. After reaching Babughat, she realized that the polythene was dropped. She soon took the boat and started going upstream. After how much time, she will be able to find the plastic if the speed of the boat is 20 kmph in still water.

18. Mixture of petrol and diesel contains 40% petrol in it. 30 L of this mixture is taken out and 10 L petrol is added to the mixture. Now, quantity of petrol and diesel in the mixture becomes equal, then find the difference between initial quantity of petrol and diesel in the mixture (in L)

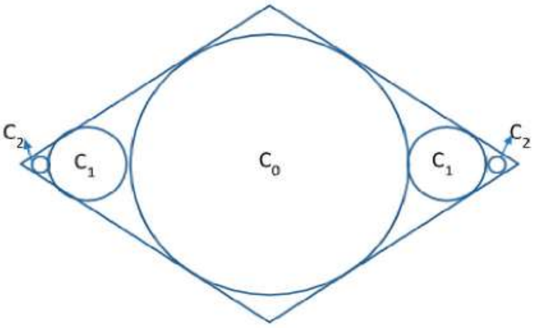
19. 27 kg of red pulses which costs Rs. 80 per kg was mixed with a certain quantity of yellow pulses, which costs Rs. 60 per kg. If a shopkeeper sold the mixture at Rs. 97.5 per kg and earned a profit of 25%, then what was the quantity of yellow pulses mixed in the mixture (in kg)?

20. Ram, Rahim and Shyam invest money in the ratio of 3: 5: 7 in fixed deposits having respective annual rates in the ratio of 8: 9: 10. What is their total interest income (in Rupees) after a year if Rahim's interest income exceeds Ram's by Rs. 4,200?

21. The length of the medians of a triangle ABC are 5 cm, $2\sqrt{13}$ cm and $\sqrt{73}$ cm. Find the perimeter of the triangle.

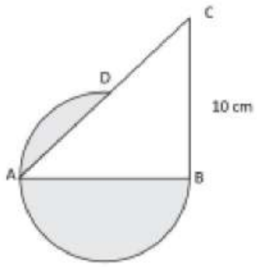
(a) 32 (b) 16 (c) 12 (d) 24

22. In a Rhombus of side length of 8 cm and area $32\sqrt{3}$ cm^2 circular holes are punched as shown in the diagram below. C_0 is the largest possible circle inside the Rhombus. C_1 circles are tangent to 2 sides of the Rhombus and C_0. C_2 are circles are tangent to one of the C_1 circles and 2 sides of the rhombus and so on. Find out the remaining area of the Rhombus which is left after punching these infinite circles.



Mock 9

1. In the following diagram, AB is the diameter of the circle and is perpendicular to BC. Point D is the midpoint of AC and the length of BC is 10 cm. Which of the following option represents the area of the shaded region?



(a) $(75\pi - 50)/4$ (b) $(100\pi - 75)/4$ (c) $(50\pi - 75)/4$ (d) $(75\pi - 25)/4$

2. The point (-1,7) is one of the vertices of a rectangle. If the diagonals of the rectangle are represented by the equations $x - 3 = 0$ and $y - 7 = 0$, then the area of the rectangle (in square units) is

3. Sum of length, breadth and depth of a cuboid is 17 cm. and length of longest diagonal is 11 cm. find the total surface area of cuboid.
(a) 168 (b) 172 (c) 158 (d) 160

4. Pipe P, Q & R can fill water in a tank in 20 min, 30 min and 60 min respectively. Pipe A, B & C can empty the tank in 30 min, 40 min and 120 min. The inlet pipes and the outlet pipes are put in "On" and "Off" mode in every alternate minute. In the first minute pipe P, Q & R are opened and in the second minute A, B & C are opened when pipes P, Q & R are closed. Again, on the 3rd minute P, Q, R are opened and A, B & C are closed. This went on till the tank is filled with water completely. There is also a hole H at the bottom of the tank which can drain the entire water out of the full tank in 120 min. The hole drained out water throughout. When (in minutes) the tank will be filled? [Write the closest integer if the answer is in fraction]

5. Find the domain of $f(x) = \log_2 (\log_3 (x^2 + 5x + 7))$.
(a) $(-\infty, 1) \cup (2, 4)$ (b) $(-\infty, -3) \cup (-2, \infty)$
(c) $(-4, -1) \cup (1, \infty)$ (d) $(-4, -1) \cup (0, 4)$

6. Two trains simultaneously start towards each other at speeds of 50 km/hr and 60 km/hr respectively. A bird is perched on the engine of one train. The moment the trains start, the bird

starts flying towards the second train. Immediately on reaching the second train, the bird heads back towards the first train. Immediately on reaching the first train, the bird reverses the direction and starts flying towards the second train. This process continues till the two trains meet. If the distance between the trains is 220 km and the speed of the bird is 80 km/hr, what is the total distance travelled by the bird in the forward direction (i.e., in the direction towards the second train)?

(a) 100 km (b) 160 km (c) 130 km (d) 80 km

7. Rohan, who has $19 with him, is planning to watch the movie Avengers with his friend Ratul. Rohan and Ratul took a cab and reached the cinema hall where they purchased 2 tickets and 2 popcorns. Rohan also purchased 4 chocolates for his nephew. If the cab fare, price of each ticket, chocolate and price of each popcorn are positive distinct integers then find what will be the minimum total cost that Reshma will incur who purchased 3 tickets and 3 popcorns and 1 chocolate.

(a) 15 (b) 16 (c) 17 (d) 19

8. A metro line that runs between Gurgaon and Anand Vihar stops at different stations along the way. How many different ways can it halt at three of the 'n' stations so that no two are consecutive, consider the value of n to be 10.

9. 2 friends Taran and Karan start from 2 cities A and B towards each other. They meet for the first time when they both of them are at a distance of 60 km from A. After meeting, Taran continues towards B and Karan continues towards A. On reaching B and A, Taran and Karan return towards the city they started from. They meet for the second time when they are at a distance of 80 km from B. The ratio of the speeds of Taran and Karan can be expressed as p : q, where p and q are relatively prime. Enter the value of p + q.

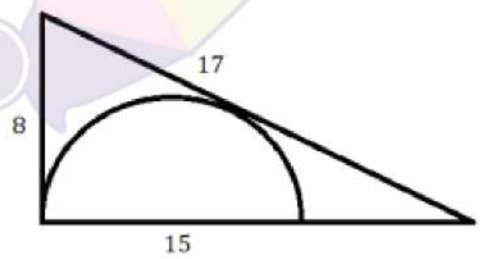
10. If one of the roots of the quadratic equation $(ax2 + bx + c) = 0$ is $5+2\sqrt{6}$ then find the value of $(b + c)/a$ where a, b & c are natural numbers.

(a) 9 (b) -9 (c) 11 (d) -11

11. If one of the roots of the quadratic equation $(ax2 + bx + c) = 0$ is $(5+2\sqrt{6})$ where a, b & c are natural numbers, then find the value of p so that $(cx2 + px + a) = 0$ whose one root is $(3 + 2\sqrt{2})$

(a) 3b/5 (b) -6c (c) 6c (d) Both option a & b are correct

12. Find the radius of Semicircle in Right angle triangle



(a) 3.6 (b) 4.8 (c) 6.0 (d) 7.2

13. Ashwani purchased a 60-seater Roller coaster loop. He provides his services in large fairs. His profit (P) from the Roller coaster depends upon the number of riders over a certain minimum number of riders 'n' and upon the number of rounds moved by the Roller coaster. His profit is Rs. 2700 with 30 riders in the Roller coaster for 42 rounds and Rs. 5400 with 45 riders in the Roller coaster for 48 rounds. What is the minimum number of riders are required so that he will not suffer any loss?

14. A started a business investing some amount. B entered into the business 3 months after A by investing $4000. C joined the business exactly 3 months after B's investment and invested an

amount equal to what A invested. As A worked in the business actively he takes 10% of the profit as his salary. The remaining profit was then distributed between A, B & C. If ratio of A's & B's profit is 5 : 3 then what will be the C's share of profit if the total profit is $1000?
(a) $100 (b) $300 (c) $450 (d) $200

15. Rahul, who is Sumit's elder brother, found that the sum of thrice of his age and twice of Sumit's age is a prime number. If both Rahul and Sumit's age are prime numbers and none of them greater than 10 and less than 2 years then find Rahul's age.
(a) 5 (b) 7
(c) Both option A & B are possible (d) None of them

16. Fresh grapes contain 80% water by weight while dried grapes contain 30% water by weight. What is the weight of dry grapes available from 40 kg of fresh grapes? (nearest integer)

17. In an election between two candidates A and B, 80% of the voters cast their votes, out of which 5% of the votes were declared invalid. Candidate A got 7296 votes which were 80% of the valid votes. Find the total number of the voters.
(a) 12000 (b) 14000 (c) 12500 (d) 15000

18. If $x^4+x^3+x^2+x+1= 0$, then $x^{2050} + x^{2021} + x^{2022}$ equals which of the following:
(a) $x^2 + 1$ (b) x^2 (c) $-x^2$ (d) $-x^3(1+x)$

19. If $a=1+\frac{1}{2}+\frac{1}{4}+\frac{1}{8}+\frac{1}{16}+....and$ $b=1+\frac{1}{4}+\frac{1}{16}+...$ Then how many of the following expressions will be greater than 0:
10a-14b
8a-12b
6a-10b
4a-8b
2a-8b
(a) 4 (b) 3 (c) 2 (d) 1

20. Given that, $a+ b+ c=45$, $a^2+b^2+c^2= 693$, $a 3+b^3+c^3= 10935$, and $ab+ bc +ca = 666$. Then what is the value of abc?

21. If x is non negative integer, then find the maximum value of $\frac{x+2}{2x^2+8x+8}$
(a) 1/2 (b) 1/3 (c) 1/4 (d) 1/12

22. 6 Ram deposited a certain sum of money in a company at 13.5% per annum simple interest for 5 years and deposited an equal amount in fixed deposit in a bank for 3 years at 18% per annum simple interest. If the difference in the interest from two sources is Rs. 621, then the sum deposited in each case is
(a) 5700 (b) 4600 (c) 6500 (d) 3600

Mock 10

1. A world-famous Chinese martial arts competition was organized for 4 weeks. The number of seats covered in the 2nd week, decreased by 12%, but increased by 14% in the 3rd work week and again decreased by 20% in the 4^{th} week. Find the number of seats covered in the third week if in the last week 80256 seats were covered.
(a) 100320 (b) 10032 (c) 100000 (d) 80256

2. Find the last two digits of 1152^{651}.

3. A faulty escalator moves 12 steps upward in the first 1 min and 7 steps downward in second minute. If Rohit has to go from ground floor to first floor taking the escalator only, then find the time taken by him to reach to the first floor. It is given that there are 60 steps between the ground and the first floor.
(a) 16 Min 20 Sec (b) 20 Min 40 Sec (c) 24 Min 55 Sec (d) 20 Min 50 Sec

4. 28 men can do a work in 90 days while working 3 hours a day. 36 men can do the same work in (3X+6) days while working 5 hours a day. In how many days will X men complete the whole work while working 4 hours a day?
(a) 143.5 days (b) 161.5 days (c) 157.5 days (d) 139.5 days

5. In an oil refinery, an oil tank with a capacity of 50,000 gallons has an oil supply inlet, which pours oil at the rate of 800 gallons per hour. This oil inlet starts automatically when the oil goes below the level of 25000-gallon mark. If there is a hole formed at the bottom of the tank when the oil tank is full, how long will it take for the whole tank to be emptied if the oil goes out of the hole at the rate of 1000 gallons per hour?

6. Two friends are drinking in the bar. One of the friends is being challenged to drink a glass when a tail appears after tossing a coin. If they played eight rounds, what is the probability that he drinks 5 times?
(a) 7/32 (b) 21/25 (c) 35/128 (d) Cannot be determined

7. 42 litre of Nitric acid is mixed with 168 litre HCL. x litre of total mixture is taken out and 25 litre Nitric acid and 42 litre HCL are added in the mixture. The final mixture contains 25% Nitric acid. How much amount (in litres) of the mixture is taken out?

8. Shopkeeper mixed two qualities of rice and sold them to the customers. The first type of rice costs Rs.35 per kg and the second type of rice costs Rs.45 per kg. The cost price of the mixture is Rs.38 per kg. What is the quantity of the first type of rice if the quantity of second type of rice is 42 kg?

9. Surya has to pay back the total loan plus interest, where the interest is of Rs. 441 earned at the rate of 10% compounded annually in 2 years, on the loan. Had Surya decided to pay it in two equal installments at same rate of interest then he would have saved Rs. x. Find the value of x.
(a) 121 (b) 210 (c) 41 (d) 110

10. Let $f(x) = x^3$ and $g(x) = 3^x$, for all real x. Then the value of $f(f(g(x)) + g(f(x)))$ at x = 1 is:
(a) 2700 (b) 27000 (c) 90000 (d) 9000

11. Three persons X, Y and Z, as per their agreement, are to share their three-day tour expanses such as X's share is two-thirds of Y share and Z's share is 33.33 % more than Y's share. On the first day, X pays the bill which amounts to Rs. 3310. The second day's bill amounting to Rs. 5220 was

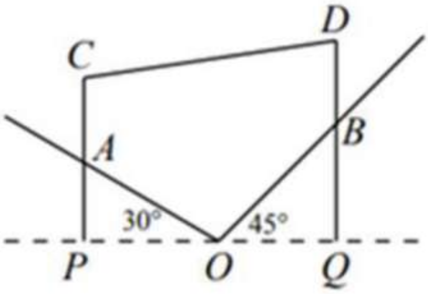
cleared by Y while Z clears the last day's bill for Rs. 6230. During the final settlement of their accounts, which of the following happens??

(a) Z pays Rs. 30 to X and Rs. 300 to Y
(b) X pays Rs. 300 to Y
(c) Y pays Rs. 240 to X and Rs. 90 to Z
(d) Z pays Rs. 60 to X and Rs. 270 to Y

12. There are 2 clocks X and Y in a laboratory. X is a correct clock but clock Y gains 16 minutes every 10 hours. Both the clocks were set right at 5 PM today. Find the angle between the hands of the clock X when clock Y shows 7 AM tomorrow.

(a) 59.5° (b) 63° (c) 48.5° (d) 30°

13. In commando training, the personnel has to cross a V shaped valley. One part of the valley makes a 30° angle with the horizontal and the other part of the valley makes a 45° angle with the horizontal. Two points A and B, each 20 meters apart from the vertex of the valley. On the slope of the valley where two Indian flags AC and BD are to be mounted. Both the flag's pole is connected with a straight rod CD as shown in the diagram. If Flag 1 (AC) = 6 m, what is the length of the Second flag's pole (BD) for which the connecting rod (CD) is as short as possible?



(a) 16 - √2 m (b) 16 - 8√2 m (c) 16 - 10√2 m (d) 18 - 10√2 m

14. Two sides of a triangle are x - 2y = 0 and 2x - y = 6. Let the coordinates of the centroid of it is (2, 3). Then the equation of the perpendicular on its third side, which passes through the centroid is:

(a) 14x+13y+67=0 (b) 13x-14y+67=0 (c) 14x+13y-67=0 (d) 13x+14y-67=0

15. A function f(x,p) is defined as-
$f(x,p) = [x/p]+[x/p^2]+[x/p^3]+....$
[.] is the greatest integer function
Where x is any natural number and p is a prime number

$G(x) = \sum_{p=2}^{\infty} f(x,p)$

If $G(12) = \sum_{x=0}^{n} G(x)$

What is the minimum possible of value of n?

16. AB is a diameter of a circle and C is any point on the circumference of the circle. Then,
(a) The area of triangle ABC is maximum when it is isosceles.
(b) The area of triangle ABC is minimum when it is isosceles
(c) The perimeter of triangle ABC is minimum when it is isosceles
(d) None of these

17. XYZ is right angle triangle, right angled at Y. If the triangle is rotated about XY, the three dimensional figure so formed will have a volume of 6400π. However, it is rotated about YZ, then the three dimensional figure so formed as a volume of 15360π. The length of XZ is:

(a) 52 (b) 53 (c) 54 (d) None of these

18. Two types of rice grains X and Y are mixed and then sold at Rs. 50 per kg. The profit is 12% if X and Y are mixed in the ratio 5 : 3, and 6% if this ratio is 3 : 5. The cost prices per kg of X and Y are in the ratio

(a) 121 : 25 (b) 121 : 25 (c) 121 : 51 (d) 121 : 51

19. $(x-2)(x-4)(x-8) \leq 0$, where x is a positive integer. If $a \leq (x+2) \leq b$, then $(a + b) = ?$

20. How many values can natural number N take, if N! is a multiple of 2^{26} but not 3^{26}?

(a) 24 (b) 23 (c) 22 (d) 18

21. a, b and c are all distinct positive integers less than 1000 such that
$|a - b| + |b - c| - |c - a| = 0$.
Then find the difference between the maximum and minimum value of b.

(a) 996 (b) 997 (c) 998 (d) 995

22. Let the number of integers greater than 70000 that can be formed by using the digits 1, 2, 5, 6, 8 and 9 if digits are not repeated is n. Then what is the real root of $7^{4x} - 7.7^{2x+1} - n = 0$?

(a) $(\log_7 64)/3$ (b) $(\log_7 64)/2$ (c) $(\log_7 8)/2$ (d) $(\log_7 32)/2$

Mock 11

1. Let's say n is 3 digit number abc where a, b, c are digits in hundred's place, ten's place & unit's place respectively. F(n) is defined as
F(n) = a+b+c if (a+b+c) <10
= F(a+b+c) if (a+b+c) ≥ 10
G(n) is defined as the remainder when the number n is divided by 9
Find out the number of 3 digit numbers for which F(n) + G(n) is a perfect square. [TITA]

2. Obama bought some number of shirts. He gave 60% of total shirts to Johnson and rest of the shirts to Biden. Next day, he buys 20% more shirts than the previous day. If he gave 5% more shirts to Johnson than the previous day, then the number of shirts given to Biden is what percent more than the previous day?

(a) 40.5 (b) 42.5 (c) 44.5 (d) 46.5

3. Kohli wants to invest money in Mutual funds. He selected three schemes A, B, and C. The investment made in scheme A is four times that of scheme B, whereas the investment in scheme B is ¾ times of scheme C. At the end of the year, Kohli will get ₹ 57000 as a profit. Calculate the profit made by scheme B (in Rs.). [TITA]

4. The price of 37 pens and 17 pencils and 5 erasers is $150. If the price of each of the pen, pencil and eraser are positive integers and the price of a pen is more than that of an eraser, then find the combined price of 1 pen, 1 pencil and 1 eraser.

5. Trayvon and Ferdinand start running simultaneously but in the opposite direction on a circular track of length 140 m from the same position on the track with speed 6 m/s and 4m/s respectively. Every time they meet they exchange their respective speeds. Find the distance from the starting point (anti-clockwise) of their 25th meeting if it is known that Trayvon moving in an anti-clockwise direction. [TITA]

6. A bartender mixes 60 litre mixture of syrup and soda which is in the ratio of 7:3 with 'a' litre of a mixture of syrup and soda which is in the ratio 1:4. If the overall mixture should contain between 30% - 50% syrup, what is the range of values 'a' can take?

(a) 75 litres to 240 litres (b) 40 litres and 240 litres
(c) 60 litres to 180 litres (d) 50 litres and 200 litres

7. Consider the two equations:

$5(x^2 - xy - x) = 17\sqrt{870 + \sqrt{870 + \sqrt{870 + \cdots \ldots \ldots \infty}}}$ and

$y^2 - xy + y = \sqrt{870 + \sqrt{870 + \sqrt{870 + \cdots \ldots \ldots \infty}}}$.

If x > y, then x - y equals:
(a) 15 (b) 14 (c) 13 (d) 12

8. Which of the following would be the minimum value of $x^2 + y^2 + 5xy$, If $|x + y| + |x - y| = 6$?
(a) -27 (b) -15 (c) 0 (d) 10

9. Subham has an initial capital of Rs. 25,000. Out of this, she invests Rs. 10,000 at 7.5% in the ABI bank, Rs. 4,000 at 4.5% in the BBI bank and the remaining amount at x% in DBI bank, each rate being simple interest per annum. Her combined annual interest income from these investments is equal to 6% of the initial capital. If he had placed his full initial cash in the DBI bank, her yearly interest income would have been (in Rs.): [TITA]

10. A hockey team of 16 players won a cash prize, in an inter-school hockey tournament, which they settled as follows:
I. 10% of the cash was donated to Sai orphanage.
II. From the remaining, 5% of the cash was given to the school sports club.
III. Rs.100 was spent on food.

Of what remained, the 17th part was equally distributed between captain and vice-captain. The remaining money was then equally distributed among all the players. If everybody got only Rs 100 notes, the total cash prize could have been:
(a) 18000 (b) 19000 (c) 20000 (d) 12000

11. $N = 100^2 + 99^2 - 98^2 - 97^2 + 96^2 + 95^2 \ldots\ldots + 3^2 - 2^2 - 1^2$ (The plus and minus signs are in pairs appearing alternatively). What is the value of N / 100? [TITA]

12. From the three terms a, b, c of a Geometric Progression (GP), having common ratio greater than 1, when consecutive perfect squares starting from 1 are subtracted from the terms starting from first, the three terms of Geometric Progression (GP) change to Arithmetic Progression (AP). If a = ½, what is the value of the 20th term of the AP so formed?
a) 77/2 (b) 75/2 (c) -77/2 (d) -75/2

13. What is the value of 'x' that satisfies the following equation: [TITA]
$\log_3\log_7 (\sqrt{(x+7)} + \sqrt{x}) = 0$

14. If the sum of the 20th, 30th and 40th terms of an arithmetic progression is equal to the 88th term, what is the ratio of the sum of the 20th, 30th and 40th terms to the sum of the 5th, 10th and 15th terms?
(a) 23:9 (b) 26:9 (c) 29:9 (d) 29:9

15. Consider the set S = {1, 2, 3, ..., 721}. How many arithmetic progressions can be formed from the elements of S that start with 1 and end with 721 and have at least 6 elements? [TITA]

16. A snail starts from a point & moves in a straight-line path. It moves mere 1cm in 1 minute, half of that distance in next minute & so on. How long will it take for the snail to reach a point 2.4 cm away from the starting point?
(a) 2 minutes

(b) 2.4 minutes
(c) 4.8 minutes
(d) Snail will never reach a point 2.4 cm away from starting point.

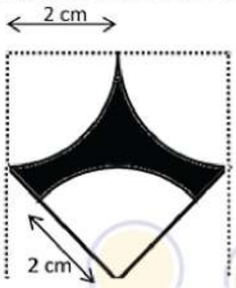
17. A baby plant grows 1.53 cm in its first week. Each week it grows by 3% more than it did the week before. By how much does it grow in nine weeks, including the first week (approx.)?
(a) 15.54 (b) 18.23 (c) 11.66 (d) 13.25

18. The angle of elevation of the top of the tower at a point A on the ground is 45° .On walking towards the tower, the angle of elevation become 60°. The height of tower is equal to 240 m. Find the distance walked by him.
(a) $80(3 + \sqrt{3})$ m (b) $60(3 - \sqrt{3})$ m (c) $80(3 - \sqrt{3})$ m (d) $60(3 + \sqrt{3})$ m

19. The angle of depression of an airport from a plane flying at a certain path is 60°. The airport is located 8 km due North of the plane's current position. The control tower radios the plane and changes the landing location to another airport due East of the plane's current position which has an angle of depression of 45° from the plane. What is the distance between both airports?
(a) 18 km (b) 16 km (c) 12 km (d) 10 km

20. A ladder is placed against a wall making an angle of 45° with the ground. If the point where the ladder touches the ground, shifts a distance of 12 units, and now the ladder makes an angle of 30° with the ground, then the length of the ladder is?
(a) $24(\sqrt{3} + \sqrt{2})$ (b) $12(\sqrt{3} + \sqrt{2})$ (c) $24(\sqrt{3} - \sqrt{2})$ (d) $12(\sqrt{3} - \sqrt{2})$

21. Find the area of the shaded region inside the given square.



22. P, Q and R together complete a work. The ratio of the number of days taken by Q to R is 3:5. The ratio of the efficiency of P to R is 3:2. R takes 10 days more than P, when P and R complete the work individually. P, Q and R started the work. After 4 days, P and R left. What is the number of days taken by Q to complete the remaining work?

Mock 12

1. Three-person P, Q, and R started to travel simultaneously from point A and reach point B at the same time. Each of them can walk at a speed of 10 km/h. They also have a two-seater scooter and only two persons can travel on a scooter at any time. What is the minimum time taken to travel from point A and B, if the distance between the point A and B is 240 km and average speed of scooter is 40 km/h?
(a) $10\frac{5}{9}$ h (b) $11\frac{1}{7}$ h (c) $10\frac{1}{7}$ h (d) $11\frac{5}{9}$ h

2. What is the total number of integers value can 'k' take if the equation, $x^2 + 10x + |k| = 0$ has real and distinct roots?
(a) 32 (b) 49 (c) 25 (d) 48

3. The sum of two numbers x and y is 234 and their LCM is 756. Which of the following is the value of x or y?
(a) 72 (b) 108 (c) 126 (d) Can't be determined.

4. A student spends a definite sum 'm' each month to buy 8 magazines and 12 notebooks. The price of a magazine is 20 % of a notebook. If the price of a notebook is increased by 20 %, then what will be the percentage decrease in the number of notebooks after increased price so that the total monthly expenditure 'm' remains the same?
(a) 20% (b) $12\frac{4}{3}$ % (c) $33\frac{1}{3}$ % (d) $16\frac{2}{3}$ %

5. When you reverse the digits of the number 13, the number increases by 18. How many other two-digit numbers increase by 18 when their digits are reversed?
(a) 5 (b) 6 (c) 7 (d) 8

6. If $(250\sqrt{2}x^3 + 24\sqrt{3}y^3) \div (5\sqrt{2}\,x + 2\sqrt{3}\,y) = (Ax^2 + By^2 - C\sqrt{6}\,xy)$, then the value of $(\frac{A}{10} + \frac{B^2}{8} + C)$ is
(a) 33 (b) 66 (c) 20 (d) 23

7. The ratio of the area of the circumcircle and incircle of an equilateral triangle is:
(a) 1: 4 (b) 9 : 1 (c) 4 : 1 (d) 1 : 9

8. A cinema hall owner made a revenue of ₹ 2400 per day if the number of tickets sold was 50 per day. The revenue becomes ₹ 3200 per day as the number of tickets sold reaches 60 per day. What will be the minimum number of tickets to be sold per day, so that he will not suffer any loss?
Remark: revenue is directly proportional to the number of tickets sold over a certain minimum number of tickets sold.
(a) 10 (b) 24 (c) 16 (d) 20

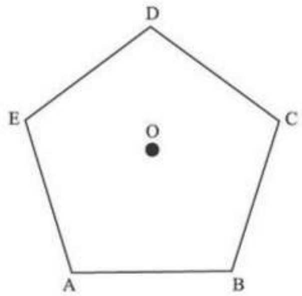
9. 10 men and 20 women working together can complete a piece of work in 22 days. Men works 8 hour per day while women work 6 hours per day. Per hour efficiency of a woman is $\frac{1}{3}rd$ of a man per hour efficiency. In how many days 8 men and 12 women complete the same piece of work?
(a) 30 days (b) 36 days (c) 32 days (d) 24 days

10. What is the maximum value of $(a-4)(b+2)(c-1)$, where a, b and c are distinct positive integers and $a+b+c=15$?

11. How many numbers are between 200 and 700 which when divided by 13 and 7 leave a remainder of 9 and 5, respectively?
(a) 4 (b) 6 (c) 13 (d) 11

12. Each student in a class enjoys at least one of the five activities: playing, singing, drawing, dancing, and reading. Students enjoy 80 percent of the time playing, 70 percent of the time singing, 90 percent of the time drawing, 80 percent of the time dancing, and 90 percent of the time reading. What is the highest percentage of pupils who enjoy four activities equally?
(a) 70 (b) 80 (c) 90 (d) 60

13. ABCDE is a regular pentagon. O is a point inside the pentagon such that AOB is an equilateral triangle. What is ∠OEA?



(a) 48° (b) 54° (c) 72° (d) 66°

14. The number of ordered pairs of natural numbers (a, b) satisfying the equation 2a + 3b = 100 is:
(a) 16 (b) 15 (c) 14 (d) 13

15. Every year, a person's salary declines by 50%. Every quarter, his expenses climb by 100%. At the moment, the salary-to-expense ratio is x: 1. What will be the worth of x if his pay equals his costs after two years?
(a) 256 (b) 324 (c) 556 (d) 1024

16. In a city 60% are male and remaining are females. Out of total males, 25% of the male are government employees. Out of the remaining male's ratio between private employees to unemployed the male is 4 : 5. Out of total female, 60% of females are in government jobs and out of the remaining females 60% of female work for private firms and remaining are unemployed. If the difference between male and female who are unemployed is 6510 then find the total number of male and female who are government employees?
(a) 18000 (b) 8000 (c) 10000 (d) 13650

17. A right-angle triangle $\Delta ABC, \angle A = 90^{\circ}$, AB = 9 cm, BC = 15 cm and AC = 12 cm. The internal bisector of $\angle C$ passes through the incentre (O) of the ΔABC and meet AB at D. What will be the value of OD: OC?
(a) 1: 3 (b) 1: 2 (c) 2: 3 (d) 2: 4

18. What will be the remainder when $(1!)^1 = 1, (2!)^2 = 4, (3!)^3 = 6, (5!)^5 = 1$ is divided by 5?

19. The population of a village is decreased by a certain rate of interest (compounded annually) as the villagers trying to move to the city. If the current population is 20577 and the ratio of the decreased population for the start of second year and start of third year is 20:19. What was the population of the village three years ago?
(a) 32000 (b) 24000 (c) 36000 (d) 28000

20. If $\log 2X + \log 4X = \log 0.25\sqrt{6}$ and $x > 0$, then x is
(a) $6^{-1/6}$ (b) $6^{1/6}$ (c) $3^{-1/3}$ (d) $6^{1/3}$

21. Two glasses filled with solutions of milk and water in the proportion of 2 : 1 and 1 : 1 respectively are emptied into a third glass. What is the proportion of milk and water in the third glass?
(a) 1: 2 (b) 1: 3 (c) 7: 5 (d) Cannot be determined

22. a is x % of b, b is x% more than a. Find x.
(a) 50% (b) 75% (c) 62% (d) 37%

Mock 13

1. How many digits are required to number a book containing 200 pages?
(a) 256 (b) 616 (c) 492 (d) 372

2. Place O is located between the place P and place Q. The distance between the places P and O is half of the distance between the places O and Q. A biker starts from place P and riding towards Q. Simultaneously, another biker starts from place Q and riding towards P. The second biker reaches to the place O, 30 minutes after the first biker reaches place O. If speed of the first biker is twice the speed of second biker, then find the time (in minutes), taken by the second biker to reach place O from place Q.

3. If the ratio of areas of two squares is 9 : 1, then the ratio of their perimeters will be
(a) 9 : 1 (b) 3 : 4 (c) 1 : 3 (d) 3 : 1

4. When two types of tea, X and Y are mixed in 3:2 ratio and sold at Rs. 60 per kg then a seller earns a profit of 20% and when X and Y are mixed in 2:3 ratio and sold at the Rs. 40 per kg then the seller faces a loss of 10%. Find the ratio of cost prices per kg, of X and Y
(a) 12:7 (b) 13:6 (c) 11:5 (d) 11:6

5. In how many ways can 45 men be allotted to 3 different districts, if the districts are to be covered by 10, 15 and 20 men?
(a) $\frac{45!}{10!\times 15!\times 20!}$ (b) ${}^{45}p_3$ (c) $\frac{3!\times (45)!}{10!\times 15!\times 20!}$ (d) None of these

6. For all positive integer , if $f(x+4)=f(x)+f(x+2)$ and if $f(13)=45, f(21)=471$, then what is the value of f(11)?
(a) 72 (b) 82 (c) 92 (d) 102

7. A square cuboid with a height of 15 m is placed inside a right circular cylinder having a height of 20 m and a radius of 6 m in such a manner that the corners of the square cuboid touches the circular wall of the cylinder. If a liquid is poured into the cylinder until it reaches the upper level of the cylinder, then find the volume (in m^3) of the liquid?
(a) $360(3\pi-2)$ (b) $360(2\pi-3)$ (c) $180(3\pi-2)$ (d) $180(2\pi-3)$

8. If $f(x)=\max|2x^2, 102-5x|$, where x is any positive real number, then find the minimum possible value of the function f(x) .
(a) 72 (b) 64 (c) 80 (d) 54

9. If one root of the quadratic equation $x^2+px+48=0$ is 12 and the roots of the quadratic equation $x^2+px+q=0$ are equal, then find the value of q ?
(a) 16 (b) 32 (c) 48 (d) 64

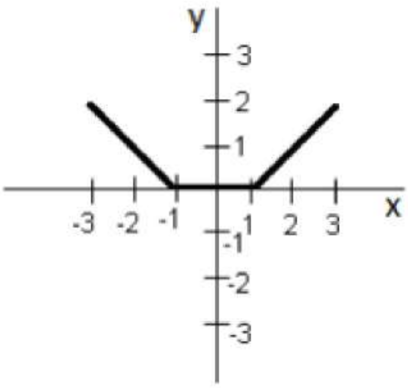
10. If the LCM of two natural numbers x and y is $3^4 4^5 13^{12}$, then find the number of ordered pairs (x,y)?
(a) 1915 (b) 1920 (c) 4275 (d) 1390

11. In September, the price of LPG per litre increases by 15% from the month of August. A person decided to reduce his LPG consumption to retain his monthly expanse for LPG same as that of the previous year. In what percentage the person has to reduce its LPG consumption in the month of September?

(a) 13.04% (b) 13.54% (c) 13.84% (d) 13.94%

12. Ramesh bought 4 dozen oranges at a rate of Rs. 12 per dozen. He had to spend Rs. 32 to transport the oranges. Approximately in what percentage he has to mark the price of oranges up so that after giving 5% discount he can earn a profit of 4%?
(a) 7.5% (b) 82.45% (c) 8.5% (d) 75.5%

13. Given below is a graph made up of line segments shown as thick lines. Which of the following options is correct?



(a) f(x) + f(-x) = 0 (b) f(x) - f(-x) = 0 (c) f(x) + 3f(-x) = 0 (d) None of these

14. Three friends A, B and C promised to complete a work for Rs. 2400. A can complete the work in 6 days, B can complete the work in 8 days and C can complete the work in 12 days. They completed the work with the help of another friend D in 2 days. What was D paid for his work (in Rupees)?
(a) 600 (b) 400 (c) 800 (d) 500

15. A man is standing on a corner of a square field having length of each side be 36 m. There is a tree in the opposite corner of the man. If the angle of elevation from the position of the man to the top of the tree is 30 degree then find how tall is the tree?
(a) $6\sqrt{6}m$ (b) $6\sqrt{3}m$ (c) $12\sqrt{3}m$ (d) $12\sqrt{6}m$

16. If x is real number, then find the minimum value of $\frac{(9x^2-12)}{(3x^2+8)}$.
(a) -3 (b) -3/2 (c) -5/2 (d) 0

17. Alphonso, on his death bed, keeps half his property for his wife and divides the rest equally among his three sons Ben, Carl and Dave. Some years later, Ben dies leaving half his property to his wife and half to his brothers Carl and Dave, to be shared equally. When Carl makes his will, he keeps half his property for his wife and the rest he bequeaths to his younger brother Dave. When Dave dies some years later, he keeps half his property for his wife and the remaining for his mother. The mother now has Rs. 1,575,000.
What was the ratio of the property owned by the wives of the three sons, in the end?
(a) 7 : 9 : 13 (b) 8 : 10 : 15 (c) 5 : 7 : 9 (d) 9 : 12 : 13

18. The internal angles of a convex polygon are in arithmetic progression. The common difference of the progression is 6 degrees. If the smallest angle is 105 degrees and the number of sides of the polygon is less than 10, then find the number of the sides of the polygon.

19. If $\log_3(7+\log_2 x)=2$ and $\log_7(67+72+\log_x y)=3$, then find the value of $\left(\sqrt[6]{y}\right)^{\sqrt{x}}-x$.

20. The owner of a renowned jewellery shop recruited 3 security guards for better security. Still a thief managed to still some diamonds from the shop. On the way returning, the thief met each guards, one at a time. To save himself, he gave ½ of the diamonds he had and then 1 more besides. At last, if he managed to escape with only one diamond, then how many diamond did the thief actually steel?
(a) 22 (b) 24 (c) 26 (d) 28

21. A fish is divided into three parts viz. head, tail and body. The length of the head is 15 cm. The tail of the fish is as long as its head and one third of its body. If its body is half of its total length in cm, then find the length of the fish.
(a) 50 (b) 70 (c) 90 (d) 110

22. An enterprise got a bonus and decided to share it in equal parts between the workers. Three more workers joined the enterprise. Hence, each of them got 4 rupees less. The administration had found the possibility to increase the total sum of the bonus by 90 rupees and as a result, each worker including the three new workers got 25 rupees. How many total workers are there now?
(a) 9 (b) 18 (c) 8 (d) 16

Mock 14

1. A milkman has two containers A and B of same capacity. Container A contains pure milk, and container B contains the mixture of milk and water, fully filled. The milkman replaces 8 litres of pure milk from container A with water. He attempts this process thrice such that the ratio of the milk and water in the final mixture becomes 512:217 in the container A. If the ratio of milk to water in container B is 5:4, then find the quantity of water in container B.
(a) 54 litres (b) 36 litres (c) 45 litres (d) 32 litres

2. Rihaan has a sum of Rs. 5x with him. He invested 40% of the sum at 30% p.a. simple interest for 5 years. He then invested half of the interest received by him along with the remaining sum at 20% p.a. compound interest for 2 years, compounded annually and received Rs. 9720 as the amount. The amount received at simple interest on Rs. 5x for 2 years at 20% p.a. will be:
I. Rs. (x + 9000)
II. Rs. {(3x/5 + 9600)
III. Rs. (3x + 3000)
(a) Only I and II (b) Only III (c) All I, II and III (d) Only I

3. Let N, x and y be positive integers such that N = x + y, 2 < x < 10 and 14 < y < 23. If N > 25, then how many distinct values are possible for N?

4. Rana invested Rs. 'X' in a scheme offering a compound interest of 12% p.a. compounded annually and 60% of 'X' in scheme 'B' offering simple interest of 32% p.a. If difference between interests earned from scheme 'A' and 'B' after 2 years is Rs. 648, then find the value of 'X'.
(a) Rs. 6000 (b) Rs. 8000 (c) Rs. 7500 (d) None of these

5. A' while working 40% more efficiently can complete a piece of work in 25 days and 'B' while working 25% more efficiently can complete the same work in 21 days. While working with their original efficiencies 'A' and 'B' together worked for 9 days, then find the time taken by 'A' alone
to complete the remaining work with his original efficiency.
(a) 7 days (b) 14 days (c) 12 days (d) 6 days

6. Find the sum of the last two digits of $61^{118} \times 69$?

7. 'A' and 'B' started moving towards each other at same time with speeds of 72 km/hr and 90 km/hr, respectively. If both met after 8 seconds, then find the total time taken by 'B' to reach the point from where 'A' started.
(a) 15.6 seconds (b) 12 seconds (c) 14.4 seconds (d) 9.6 seconds

8. There are two villages 'A' and 'B'. Number of males in village 'B' is 50% more than that in village 'A' and number of females in village 'B' is 432 more than that in village 'A'. If number of males in village 'B is increased by 20% and number of females in village 'A' is increased by 40%, then total population of village 'B' and 'A' will become 2832 and 2144, respectively. Find the original number of males in village 'B'.
(a) 1200 (b) 1440 (c) 1394 (d) 960

9. Pam brought certain number of fruits at the rate of 32 fruits for Rs.24 and the same number of fruits at the rate of 48 fruits for Rs.40. He sold all of them at the rate of 60 fruits for Rs.60. What will be his gain and loss percentage? (type the integer part only)

10. A rat and a tortoise exchange their homes. The tortoise starts for its new home at 1 : 30 PM and the rat starts for its new home 3 : 06 PM. They meet at 4 : 00 PM and from there they take the same time to complete their remaining journeys. Both of them travel along the same route. At what time do they complete their journeys?
(a) 4 : 45 PM (b) 6 : 15 PM (c) 5: 30 PM (d) 6 : 00 PM

11. If $a = \frac{x}{log}$ and $6^{a} \frac{x}{log_8 6} = 2$, what will be the value of z if $x = \log_8 (\log_8 z)$.
(a) 36 (b) 49 (c) 64 (d) 512

12. 760 ml of mixture 'A' contains milk and water in the ratio of 12:7, respectively, while 500 ml of mixture 'B' contains milk and water in the ratio of 13:12, respectively. If 60% of mixture 'A' is mixed with 40% of mixture 'B' in a jar, then find the ratio of milk to water in the jar.
(a) 49 : 33 (b) 29 : 13 (c) 39: 23 (d) 59 : 33

13. Four numbers are in G.P., such that the sum of the numbers is 85, and the product is 4096. What is the sum of the smallest and largest of the 4 numbers?

14. For a quadratic equation with roots α and β, the sum and the product of the roots is 4 and -3 respectively. Which of the following can be the sum of the roots of the quadratic equation whose product of the roots is given by $\alpha^2 (1 - \beta) + 2\alpha\beta + \beta^2(1 - \alpha)$? [Both the roots of the quadratic equation are positive integers.]
(a) 11 (b) 7 (c) 4 (d) 9

15. A quadrilateral PQRS is inscribed inside a circle such that PQ is the diameter of the circle and vertex S and R lie on the circumference of the circle. It is given that $\angle RPS = 30°$ and $\angle RQP = 70°$. Find the measure of $\angle PRS$.
(a) 45° (b) 35° (c) 30° (d) 40°

16. Ramesh and Gautam are among 22 students who write an examination. Ramesh scores 82.5. The average score of the 21 students other than Gautam is 62. The average score of all the 22 students is one more than the average score of the 21 students other than Ramesh. The score of Gautam is
(a) 53 (b) 51 (c) 48 (d) 49

17. A boat is being rowed away in still water, from a 420 m high cliff at the speed of 6 km/h, what is the approximate time taken for the angle of depression of the cliff of the boat to change from 60º to 45º? (Take $\sqrt{3} = 1.732$)

(a) 2 minutes (b) 5 minutes (c) 8 minutes (d) 12 minutes

18. Production of pens, pencils and books in a company is 10%, 30% and 60% of the total production of all three together, respectively and percentage of the defective pens, defective pencils and defective books is 20%, 40% and 60% of their respective production. If the production of pens is 200 then find the difference between number of non-defective pencils and non-defective books.
(a) 100 (b) 120 (c) 140 (d) 160

19. 12 points lie on the circumference of a circle. The difference between the number of triangles and the number of quadrilaterals that can be formed by connecting these points is

20. Train 'A' crosses train 'B' in 18 seconds when travelling in opposite direction. Train 'A' crosses a pole in 18 seconds. If the ratio of length of train 'A' and train 'B' is 9:8, respectively then find the ratio of speeds of train 'A' to train 'B'.
(a) 1: 3 (b) 3 : 5 (c) 7: 11 (d) 9: 8

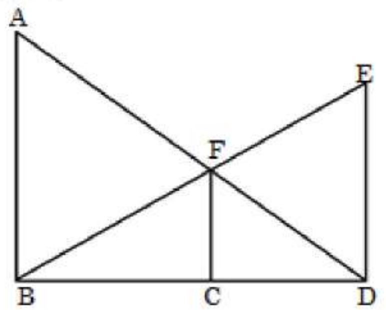
21. Two regular polygons are such that the ratio of their number of sides is 1:2, respectively and the ratio of the measure of their interior angles is 3:4, respectively. Find the number of sides of two polygons.
(a) 5 and 10 (b) 4 and 8 (c) 3 and 6 (d) 6 and 12

22. arbitrary point P lies inside an equilateral triangle such that the distances of P from all the three sides are x, y and z. Find the value of xy + yz + zx, if it is given that the side of the triangle is $2\sqrt{3}$ and $x^2 + y^2 + z^2 = 3$.
(a) 3 (b) $2\sqrt{3}$ (c) 4 (d) $3\sqrt{2}$

Mock 15

1. There are three boxes of fruits A, B and C. In box A, there are 3 Apples and 1 Banana, in box B there are (x + 2) Apples and x Banana, whereas in box C, there are 1 Apple and 2 Banana. One fruit is selected at random from each box. Find the value of x, if the probability of selecting 2 Apples and 1 Banana is 17/36.
(a) 4 (b) 1 (c) 3 (d) 2

2. In the figure given below, BD = 18 cm, AB = 15 cm and ED = 9 cm. ΔABD and ΔEDB are right-angle triangles right angled at 'B' and 'D', respectively. If FC is perpendicular to BD, then find the length of FC.



(a) 5.625 cm (b) 6.25 cm (c) 7.125 cm (d) 5.25 cm

3. A solid cone of maximum possible volume is inserted in a cubical room of volume 512 cm³. What is approximate percentage of the volume of the room which is not occupied by the cone?

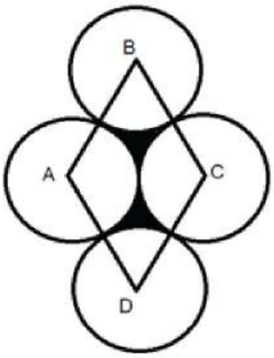
(a) 68% (b) 64% (c) 74% (d) 40%

4. B' is twice as efficient as 'A' and 'C' are together. If 'B' and 'C' together take 5 days to finish some work whereas 'A' alone takes 40 days to finish the same work, then find the percentage of work completed by 'A' and 'C' together in 12 days.

5. If '23a84b0' is a seven-digit number which is divisible by 11 and $2 \le b < a < 9$, then which of the following can be the product of 'a' and 'b'.
(a) 6 (b) 24 (c) 27 (d) 36

6. Find the value of (x × y) given that $x = \frac{1}{5\times6} + \frac{1}{6\times7} + ... +$ upto 18 terms and $y = \frac{1}{2\times3} + \frac{1}{3\times4} + ... +$ upto 20 terms.
(a) (75/558) (b) (18/253) (c) (57/805) (d) (63/492)

7. In the given figure 'A', 'B', 'C' and 'D' are the centres of the given four identical circles. All the four circles touch each other externally. If radius of each of the given circle is 2 cm, then find the area of shaded portion. [Take π = 3.14]



(a) 1.72 cm² (b) 1.20 cm² (c) 1.28 cm² (d) 1.32 cm²

8. The ratio of milk to water in the first mixture is 'B : (A + 1)', and the ratio of milk to water in the second mixture is '(A + B): 1'. If these two mixtures are mixed in the ratio (A + B) : (A – B) to form a third mixture, then the ratio of milk to water in the final mixture becomes C : (C + 2). What is the profit percent earned after selling the third mixture at the cost of pure milk?
I : $\frac{50C}{A+B+1}$
II : $\frac{100(A+B+2)}{(A+B)}$
III : $\frac{100C}{C+1}$
(a) All I, II and III (b) Only III and IV (c) Only I and IV (d) Only II

9. If $||x-2|-1| < 7$ and $||y-1|-2| < 9$, where x and y are integers, then which of the following is a not a possible value of (x – 2y).
(a) 26 (b) -21 (c) 21 (d) -28

10. Three years ago, Vimal had ₹15 crore. He purchased a few acres of land with two-fifth of total amount, a mansion with 3/10th of total amount, a car for ₹1 crore, Jewellery with 22% of total amount. He donated the remaining amount to charity trust. If today, the price of car and Jewellery remains the same, he sells off the land, the mansion, the car and the Jewellery at certain percentage of their original value, the total gain in his assets is 15%. what is the approximate percentage increase in the value of the land, the mansion from their original value?
(a) 9% (b) 6% (c) 23% (d) 23%

11. There are two articles A and B and the sum of the cost prices of the articles A and B is 3136. Article A is sold at 20% profit and article B is sold at 25% profit and the ratio of the marked price of article A to article B is 4:5. The discount given on article A and article B is d% and (d + 16)% respectively and the selling prices of both the articles A and B are same.
Which of the following can be determined by using the above given data?
(i) Discount percentage given on article B.
(ii) Total profit earned on article A and article B together.
(iii) Marked price of article A is _____% more than the cost price of article A.
(iv) Difference between the cost prices of articles A and B.
(a) Only (i), (iii) and (iv) (b) Only (i) and (ii)
(c) Only (i) (d) All (i), (ii), (iii) and (iv)

12. If N is the least four - digit numbers having 36 factors, how many factors will N+1 have?

13. If there are four given lines which form a rectangle and d is the distance between intersection of diagonals to any of the four vertices, what is the value of [d] where [ ] is the greatest integer function.
L_1: x + y = 7
L_2: x+ y = 17
L_3: x - y = 10
L_4: x - y = 25
(a) 6 (b) 7 (c) 8 (d) No unique answer exists

14. A secret women force is having different rules for dressing while going to a secret mission.
Rule 1: Either a saree or T-shirt with jeans must be worn.
Rule 2: Cap or hat must be worn.
Rule 3: Shoes or Snickers must be worn.
A woman of the force is having 5 sarees, 3 shirts, 5 jeans, 1 cap, 2 hats, 1 pair of shoes and 3 pairs of snickers.
In how many ways can she select her outfit?

15. In a business school 50 students were asked about the sport they follow. Among them, 40 follow Cricket, 35 follow Basketball, 45 follow Football and 42 follow Table tennis. What can be the minimum number of students who follow all four sports?

16. The angle of elevations to the top of a building from the top and bottom of a pole is 'a^o' and 'b^o', respectively. If the height of the pole is 'h' metres, then find the height of the building is:
(a) cota/(cota + cotb) (b) cota/(cota – cotb)
(c) (hcota)/(cota + cotb) (d) (hcota)/(cota – cotb)

17. If $(7x^2 + 2y^2) = 15xy$, and a=x/y then find the integer value of "a".

18. If $f(x-3) = 2x^3 + a - bx$ & $f(x^2 - 4) = x^2 + 6a - 8b$, then what is the value of (a - b + 10)?.
(a) -10 (b) 0 (c) 20 (d) 10

19. Two different principal amounts are invested at 9% p.a. simple interest and 11% p.a. compound interest for 3 and 2 years respectively and the interest obtained on the second principal during the 2 years is kept aside and the principal is invested at 12% p.a. simple interest for one more year. If the sum of the two principals is ₹54000 and the difference between the interests obtained by the two principals is ₹4083, find the difference between the two principals?
(a) ₹8000 (b) ₹7500 (c) ₹6000 (d) ₹9000

20. Ram and Shyam started running to and fro on a straight track AB from point A at the same time, each of them running with a constant speed throughout. Their first meet took place at a point P located at 960 m from A and their second meet took place at a point Q located at 720 m from B. They were going in opposite directions when they met for the second time. Find the distance of the point from B where they meet for the sixth time.

21. If $f(z)$ is a real value function such that $3f(z) = f(z+1) + 2f(x-1)$ for all $z \geq 1$ and $f(0) = 1, f(1) = 2$ and then $f(7)$ is equal to:
(a) 128 (b) 256 (c) 253 (d) 129

22. If $N = (log_2 x)^2 - 6(log_2 x) + 12$, then the number of distinct values of x for $x^N = 256$ is-
(a) More than 3 (b) 3 (c) 2 (d) 1

23. Rakesh went to buy some apples and oranges. The cost of 1 apple is Rs. 10 and the cost of 1 orange is Rs.15. He bought x apples and y oranges. Had he bought $1.5y$ apples and $\frac{4}{3}x$ oranges, he would have spent 40% more than he did. Which of the following can be the amount of money he spent?
(a) Rs. 2870 (b) Rs. 2950 (c) Rs. 3000 (d) Rs. 2880

Mock 16

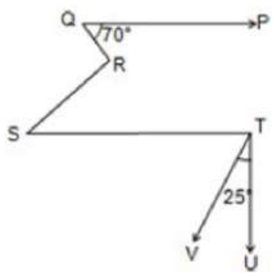
1. Ronit has a collection of 10 different stamps arranged in a stack. She selects 3 stamps out of these 10 stamps. What is the probability that no 2 stamps selected are adjacent to each other?
(a) $\frac{1}{2}$ (b) $\frac{1}{3}$ (c) $\frac{2}{5}$ (d) $\frac{7}{15}$

2. If a + b + c = 7, also a, b, c are positive numbers, then find the maximum value of $a^3b^2c^4$.
(a) $(7/9)^9 \times 3 \times 2^8$ (b) $(7/9)^9 \times 3^3 \times 2^{10}$
(c) $(7/9)^9 \times 3^5 \times 2^7$ (d) $(9/7)^9 \times 3^2 \times 2^8$

3. The arithmetic mean of x and y is 30 and that of y and z is 25. It is known that x, y, z are positive integers and x > y > z. What is the range (i.e., the difference between the maximum and the minimum possible value) of x?

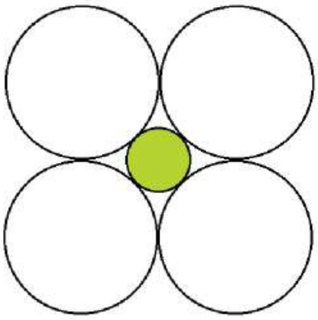
4. Each of six classmate Rahul, Rakul, Ramya, Ratan, Ritu and Rio can complete their science project in a, b, c, d, e and f days respectively, when working alone. The six classmates were scheduled to work in such a way that exactly two of the six classmates work on any day, with no group of the same two classmates working on more than one day. Working in this method, they could finish only 1/p th of the work by the time all the possible pairs of classmates had worked once. Now, if p = 12/7, then find the approximate (nearest integer) number of days in which the entire work was completed, given that all the six classmates worked together on the remaining part of the work.

5. In the given figure, PQ || ST, TV || RS and $TU \perp ST$. Find angle QRS.



(a) 100° (b) 130° (c) 135° (d) 145°

6. Find the area of the shaded circle, if the radius of all 4 larger circles is 10cm.



(a) 45 (b) 54 (c) 60 (d) 63

7. In a circular track, Abhik, Bibek & Chandan are running at a speed of 12 m/s, 15 m/s & 20 m/s respectively. If they move in the same directions, they will meet with each other for the first time in 60 Seconds. Had they run in directions which are not all the same along the circular track, then when they will meet for the 3rd time in the starting point (in sec)?

8. In Desert Cooler Mocktail, there are only three ingredients: apple juice, pineapple juice, and cranberry juice in the ratio of 3 : 4 : 2. If 20 ml of pineapple juice and 10 ml of apple juice are added to the mocktail, then the new ratio of these ingredients becomes 7:11:3. How much cranberry juice must now be added so that 24% of the total mocktail consists of cranberry juice?
(a) 10.74 ml (b) 9.32 ml (c) 12 ml (d) 8.16 ml

9. An expensive gem worth Rs. 10368 fell and broke into three pieces, the weights of which are proportional to 1: 2: 3. The value of each gem is directly proportional to the square of its weight. Determine the loss occurred due to the breaking.
(a) 4224 INR (b) 3113 INR (c) 6336 INR (d) 7500 INR

10. S = 1+11+111+....20 terms. What will be the sum of the digits of S?
(a) 37 (b) 60 (c) 75 (d) 11

11. Find the value of $\frac{13abc}{a^3+b^3+c^3}$, if a+b+c=0
(a) 0 (b) 13 (c) 13/3 (d) 13/2

12. Abhisekh travelled from Bhopal to Mumbai via Indore on his bike. The distance between Bhopal to Indore is 5/8 times the distance between Indore and Mumbai. The average speed of his bike from Bhopal to Indore is half that of average speed between Indore and Mumbai. If the average speed of his entire journey is 39km/hr, then the average speed of his bike between Indore and Mumbai is;
(a)27 (b) 24.5 (c) 54 (d) None of these

13. Suresh and Mukesh are walking up on an upward-moving escalator. It took 60 steps for Suresh to reach the top, whereas Mukesh took 64 steps. While moving up, Mukesh took 4 steps for every 3 steps Suresh took. What was the total number of steps in that escalator?
(a) 60 (b) 80 (c) 100 (d) 120

14. Find the remainder when the arithmetic mean of all the distinct numbers that can be obtained by rearranging the digits in 3423, including itself, is divided by 11

15. log (132) -log (4) = log(x-y) + log (21+ xy) such that x and y are positive integers. What is the value of 5xy – 9y?

16. Let $x_1, x_2, x_3, \ldots$ are in harmonic progression (H.P.) such that $g(\lambda) = \sum_{k=1}^{n} x_k - x_\lambda$, then $\frac{x_1}{g(1)}, \frac{x_2}{g(2)}, \frac{x_3}{g(3)}, \cdots, \frac{x_n}{g(n)}$ are in
(a) A.P. (b) G.P. (c) H.P. (d) None of the above.

17. Mr Ambani and Mrs Ambani have invited 5 of their friends and their wives for a party at their own hotel Antlia. They stand for a group photograph. If Mr Ambani never stands next to Mrs Ambani (during the photo shoot only), how many ways the group can be arranged in a row for the photograph?
(a) 19 × 18! (b) 18 × 19! (c) 14 × 15! (d) 10 × 11!

18. Given $F(x) = 2025^x/(2025^x+45)$
Find F(1/2021) + F(2/2021) +F(3/2021) +...+F(2020/2021)
(a) 2021 (b) 2020 (c) 1010 (d) 1011

19. If p(x)=p(x+1).p(x-1), then for what value of 'k' will $p(x).p(x+k).p(x-1)^{-1}=1$ hold true?
(a) 5 (b) 4 (c) 6 (d) 3

20. Let a solid is formed by placing a right circular cone on top of a right circular cylinder. The height of the cone is 11 inch and the slant height is 14 inch. The total volume of the solid is 2276.5 $inch^3$.Then the height of the solid is _______ inches.

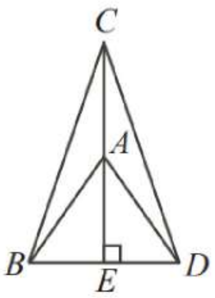
21. Prerna started a business by investing 0.75 lakh. Mansee joins the business by investing 1 lakh after a few months. After how many months Mansee joined the business if at the end of the year profit was divided between Mansee and Prerna in the ratio of 13: 18?
(a) 5 (b) 5.5 (c) 6 (d) 6.5

22. Two workers Arjun and Karan can complete a piece of work in 40 days if they work alternately starting with Arjun and followed by Karan. Arjun takes 'p' days to complete the same work working alone while Karan takes 'q' days to complete the same work working alone. If p and q are integers, then how many ordered pairs of (p,q) are possible?
(a) 7 (b) 8 (c) 13 (d) 15

Mock 17

1. Two printing machines of different efficiency can complete a set of flex printing in 8 minutes if they work together. If the first machine works alone for 6 minutes and then the second machine works alone for 8 minutes, 1/5 of the whole printing works still remains unfinished. How many minutes would it take the faster machine to complete the whole set of flex printing alone (in min)?

2. In the diagram, AB = AC = AD = BD and CAE is a straight line segment that is perpendicular to BD. What is the measure of ∠CDB?



(a) 75° (b) 85° (c) 60° (d) 45°

3. The ratio of sum till n^{th} term of two AP series is (6n + 4):(2n + 1), then find the ratio of their 11^{th} term.
(a) 43:130 (b) 79:87 (c) 130:43 (d) 12:140

4. A function f(x,y) is defined as $f(x, y) = x^2 + y^2 + 5x^3y^2$, where x and y are natural numbers. If it is known that the value of f(x, y) is odd, what is the probability that x is odd?
(a) 1/2 (b) 1/3 (c) 1/4 (d) 2/3

5. Shraboni and Bhavna are at Gandhi Ghat & Babu Ghat respectively. River Hooghly flows between these two places. They left for Babu Ghat & Gandhi Ghat respectively at the same time by taking boats having the same speed on still water. After meeting with each other, Shraboni reached her destination in 8 hours and Bhavna reached in 2 hours. In a rainy day when the stream speed is 50% more than the normal days, Shraboni remains 18 km away from Babu Ghat in the same time in which she previously used to reach Babu Ghat. Then find the distance between Gandhi Ghat & Babu Ghat.

6. Trisha and Bhavna jog in a circular track of length 40m every day with a speed greater than 0. They started from the same starting point at the same time and met for the first time after 20 seconds. Even if they jog for all day long, they will meet with each other in the same exact point. Bhavna's speed is 20% more than that of Trisha.
Find the amount of time taken by Trisha to complete 1 round of the track (in sec).

7. Find the number of trailing zeros in : $\frac{100!}{80!} - \frac{60!}{50!}$

8. Two men Sonu and Titu works on a royal car painting garage. If Titu worked alone, he would need 10 hours more to finish the car painting than if they both worked together. Now if Sonu worked alone, it would need 7.5 hours more to complete the painting than they both working together. How much time would Sonu require to finish the painting if he would not take any help from Titu?
(a) 10.5 (b) 12.5 (c) 14.5 (d) 16.5

9. $(1+\log_4 x)\,[1+(\log_4 x)^2 + (\log_4 x)^4 + ...] = 2$. Find x, given $(1/4 < x < 4)$.
(a) 3/2 (b) 1/4 (c) 1/2 (d) 2

10. Using only 3, 4, 5, 7 and 9 as digits, how many distinct natural numbers, can be made if the last digit is a perfect square and the first digit is a prime number? Here all digits may not be used but no digit can be repeat again.

11. If $P = (1^1 + 2^2 + 3^3 + ... + 2020^{2020} + 2021^{2021} + 2022^{2022})$; the unit's digit of $(P^P)^P$

12. Find out the smallest four-digit number which when divided by 5,7,13 gives a remainder of 1, 4, 9 respectively.

13. Find the 7th power of the integer which will not satisfy the equation $(3x^2 - 7x + 4) \geq 2$ is

14. A shopkeeper purchased two items at Rs.1500 each. He sold both the items at 60% profit each, but he calculated profit of one on the selling price and the other on the cost price. What is the difference between the selling price of both the items (in Rs.)?

15. A person standing on the ground at a point A saw a bird at point B on the ground at a distance of 100 m. The bird then started flying towards him at an angle of 30º with the ground, then how much distance the man should move towards bird that the distance between the bird and the person is minimum possible, if the ratio of speed of the person to the speed of bird is 1:1

(a) $\frac{200}{2-\sqrt{3}}$ (b) $\frac{200}{2+\sqrt{3}}$ (c) $\frac{200}{2-3\sqrt{3}}$ (d) $\frac{200}{2+3\sqrt{3}}$

16. In a triangle ABC, the length of three medians is 15, 18 and 21, then find the area of the triangle.

(a) $56\sqrt{3}$ (b) $72\sqrt{6}$ (c) $72\sqrt{3}$ (d) $54\sqrt{6}$

17. In a right circular cone, the sum of radius and the slant height is 8 times the difference between twice the radius and slant height. If the total surface area of the cone is 3456π cm^2, then the volume of the cone when divided by 8 is?

(a) 3456π cm^3 (b) 2592π cm^3 (c) 3240π cm^3 (d) 4372π cm^3

18. A cube's outside surface takes 18 minutes to paint. This cube is divided into 216 identical smaller cubes. All these 216 smaller cubes are split into three groups such that in each group, all the cubes can be put together to form an individual larger cube. How much time in total (in minutes) will it take to paint the outer surface of all the three new cubes?

(a) 20 (b) 27 (c) 30 (d) 25

19. A south Indian dish is made using two ingredients, Jaggery and Orange peels in the proportion 2: 5. The price of the jaggery is three times the price of the orange peels. The overall cost of production of a bottle of the dish is Rs. 520 including Rs.80 as labour charges. What is the value of jaggery used in a bottle of the dish?

20. Captain Damera with his boat is sailing in the river with the upstream speed of 18 km/hr against the flow of the river which is flowing at 6 km/hr. If it takes 1.6 hr to reach back on its starting point then find the distance (in km) between the starting and ending point of one-time journey by Captain Damera's boat.

21. Find the number of solutions of the quadratic equation $x^2 + [x] - 5x + 4 = 0$, where $[\cdot]$ is representing the greatest integer function.

(a) 0 (b) 1 (c) 2 (d) None of these

22. Suppose that A be the set of all non-zero real numbers k so that the quadratic equation $kx^2 - 8x + 4k = 0$ has two distinct real roots r_1 and r_2 satisfying the inequality $|r_1 - r_2| < 2$. Then, the subset of A is

(a) $\left(-\frac{4}{\sqrt{3}}, -2\right)$ (b) $\left(-\frac{4}{\sqrt{3}}, 0\right)$ (c) $\left(\frac{4}{\sqrt{3}}, 2\right)$ (d) ϕ

Mock 18

1. The monthly income of Rik and Nik is Rs. 'X' and Rs. 'Y', respectively. They spend 80% and 70% of their income on food, respectively. Rik spends 10% of his expenditure on food on entertainment, and he saves Rs. 12,000. Nik spends Rs. 8000 on entertainment while he saves 20% of his income.
If in the next year, the monthly income of Rik and Nik increased by 10% and 20%, respectively, but they both still save the same amount as earlier, then what is the ratio of the difference between their expenditures in the next year and that in the present year?
(a) 3: 4 (b) 7: 6 (c) 1: 1 (d) 11:16

2. A number when successively divided by 2, 5 and 7 leaves respective remainders of 1, 4 and 6. What will be the remainders when the least number is divided successively by 4, 2 and 8?
(a) 1,1,0 (b) 2,1,1 (c) 3,1,4 (d) 1,0,3

3. In a circular track of length 30 m, Amar, Akbar & Anthony started running with unequal speeds not more than 20 m/s. They all complete one complete circle in integral seconds. All of them met for the first time at the starting point after 15 seconds. Amar is faster than Akbar and Anthony is the slowest. Had they participated in a 300 m race, then minimum how much head start (in integral meters) needs to be given to Akbar if Akbar finishes first?

4. The following question is followed by three statements. Determine the statements that are sufficient to answer the question.
Question:
In how many days will 10 men, 10 women and 20 boys build a road of length 180km?
I. All of them work 9 hours a day.
II. The amount of work done by a man, a woman and a boy in the same time is in the ratio 4 : 2 : 1.
III. 5 men, 20 women and 40 boys can build a road of 60 km in 120 days, working 6 hours a day.
(a) Both I and II (b) Either I and II or, I and III
(c) I,II and III (d) Both II and III

5. A bank has $\frac{200}{9}$% of its staff is female. 45% of these female staffs are married and $\frac{100}{3}$% of married female staffs have children. $77\frac{1}{7}$% of the male staff are married and $\frac{250}{9}$ % of married male staffs have children. If no two staffs are married to each other, what fraction of the staffs do not have children?
(a) 72/90 (b) 62/80 (c) 52/70 (d) 42/60

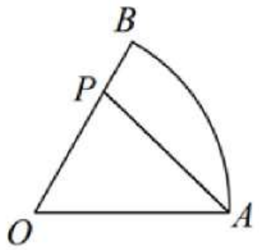
6. There are 3 ways from a town A to reach town B, 4 ways from town B to reach town C, and 2 ways from town A to reach town C directly. In how many ways can a person go from town A to town C and then return to A, if he does not take the way already taken?
(a) 48 (b) 96 (c) 144 (d) 122

7. If selling price of 45 kg apples for a shopkeeper is equal to the cost price of 54 kg of apples for him, then find the profit percent earned by the shopkeeper. [TITA]

8. There are two canisters of the same capacity. $1/3^{rd}$ of the first canister is filled with honey and $1/3^{rd}$ of the second canister is filled with tea. $1/3^{rd}$ of the content of the first canister is transferred to the second canister, and then the $1/3^{rd}$ of this mixture is transferred back to the first canister. Next, $1/3^{rd}$ of the content of the first canister is transferred back to the second canister. Then the ratio of honey and tea in the second canister is:

(a) 12:25 (b) 16:21 (c) 14:25 (d) 13:21

9. Given in the diagram OAB is a slice of pizza, and the whole pizza has 6 slices. The radius of the OA = OB = 18. The pizza loaf is cut into two regions with a single straight cut through A and point P on OB so that the areas of the two regions are equal. Find the length of OP.



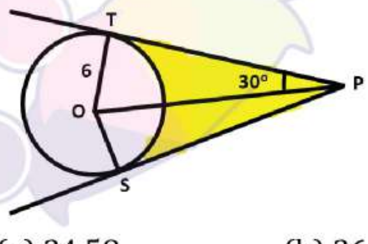
(a) $2\sqrt{2}\pi$ (b) $2\sqrt{3}\pi$ (c) $3\sqrt{2}\pi$ (d) $3\sqrt{3}\pi$

10. Messi invests Rs 18000 at 9% interest, compounded annually, and Rs 11875 at 8% interest, compounded semi-annually, both investments being for one year. Mbappe invests his money at 6% simple interest for one year. If Messi and Mbappe get the same amount of interest, then the amount, in Rupees, invested by Mbappe is: [TITA]

11. A cylinder of radius 10.5 cm and height 22cm standing on its base is vertically cut into two equal parts. What is the percentage increase in the total surface area of the cylinder :
(a) 42% (b) 43% (c) 43.08% (d) 42.09%

12. If x is a real number, then $\frac{1}{\sqrt{log_e \frac{9x-x^2}{14}}}$ is a real number if and only if
(a) $2 \le x \le 7$ (b) $1<x \le 2$ (c) $-1 \le x<7$ (d) $2<x<7$

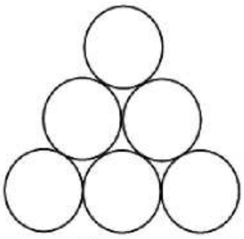
13. What is the area (in cm^2) of the yellow portion in the following figure ?
[Assume $\sqrt{3}$ = 1.73, π = 22/7]



(a) 24.58 (b) 26 (c) 27.54 (d) 29.36

14. Let the maximum value of $\log_{13}(5p+12q) = n$, where $p^2+q^2=169$. Then, what is the area of region bounded by the equation $|x - 7| + |y + 11| = n^2$?
(a) 16 (b) 32 (c) 48 (d) 60

15. Six circles, each of radius r feet, are placed as shown in the figure below. If A is the area bounded by but not included in the circles (in square feet), and B is the height of the stack (in feet), then find the value of A + Br.



(a) $2\sqrt{12} - 2\pi r^2$ (b) $2r + \sqrt{12}r$
(c) $2r + \sqrt{12}r + 2\sqrt{12}\, r^2$ (d) $r^2(2 + 3\sqrt{12} - 2\pi)$

16. If S= 3^(sin²p+sin⁴p+sin⁶p+…∞), 0<p<1 satisfies the quadratic equation $x^2-6x-27=0$. Then, what is the value of (2sinp-5cosp)/(4cosp-5sinp)?
(a) $\sqrt{2}$ (b) $2-\sqrt{3}$ (c) $1/\sqrt{2}$ (d) $\sqrt{3}/2$

17. Two roots of a quadratic equation are $\sqrt{6\sqrt{6\sqrt{6\ldots\infty}}}$ and $\sqrt{6+\sqrt{6+\sqrt{6+\cdots\infty}}}$. Find the minimum value of the quadratic expression whose zeroes are 2 more than the above two roots if the co-efficient of x^2 in the new equation is 1.
(a) -9/4 (b) 5/4 (c) -8/3 (d) 4/3

18. Raghu distributes 100 sweets to his three children. If each child gets at least one sweet and no two children get the same number of sweets, then the number of ways in which Raghu can distribute the sweets is:

19. In an examination, Musk's score was one-third of the sum of the scores of Depp and Dwayne. After a review, the score of each of them increased by 8. The revised scores of Dwayne, Depp, and Musk were in the ratio 13:12:9. Then Dwayne's score exceeded Musk's score by [TITA]

20. What is the last digit of $981^{8789}(782^{54} + 8762^{6759}) + 564^{5641}(987^{453} + 1)$?

21. An entrepreneur imports some cheap headphones at a cost of $7 each from China. To make the headphones branded and customized, he hires an engineer at a fixed wage. Then, he sells 100 of these headphones at $11 each. If the remaining headphones are sold at $10 each, then he makes a net profit of $200, and he makes a net loss of $200 if the remaining headphones are sold at $8 each. The wage of the engineer, (in $), is: [TITA]

22. Let f be a function such that f(xy) = f(x) f(y) for every natural numbers x and y. If f(i)'s are natural numbers for i = 1, 2, 3; f(1) < f(2), and f(48) = 162, then f(36) equals: [TITA]

Mock 19

1. Let ABC be a triangle with AB = 3 cm & AC = 5 cm. If AD is a median drawn from the vertex A to the side BC, then which one of the following is correct for the value of AD?
(a) always less than 4 cm (b) always greater than 2 cm
(c) always greater than 3 cm (d) always less than 6 cm

2. In a 1 km race if 'X' can give 'Y' a head start of 50 m and 'Y' can give 'Z' a head start of 40 m so that all of them reach the finish line at the same time. By how many meter 'X' can give 'Z' a head start?

3. Australian cricket team of 11 players having at least 4 batsmen, exactly one wicket keeper and at least 3 bowlers are to be selected from a group of 8 batsmen, 7 bowlers and 3 wicketkeepers. Indian cricket team of 11 players having at least 5 batsmen, exactly one wicket keeper and at least 4 bowlers is to be selected from a group of 9 batsmen, 6 bowlers and 2 wicketkeepers. What is the difference between the number of ways in which Australian team and Indian team is selected?
(a) 4476 ways (b) 4546 ways (c) 4746 ways (d) 4976 ways

4. A mixture (acetone and water) contains 120 litres acetone and rest water. If the mixture contains 25% water, then how much water should be added to the mixture to make the ratio of acetone to water 4:3, respectively?
(a) 50 liters (b) 30 liters (c) 20 liters (d) None of these

5. Two chords of lengths 'a' metre and 'b' metre respectively subtend angles 60^o and 90^o at the centre of the circle respectively. Which of the following is true?
(a) $b^2 = \sqrt{2}a$ (b) $b = \sqrt{3}a$ (c) $b^2 = \sqrt{3}a$ (d) $b^2 = \sqrt{3}a$

6. If $(x + 1/x)^2 = 3$ then find the value of $x^{206} + x^{200} + x^{90} + x^{84} + x^{18} + x^{12} + x^6 + 1$.
(a) 1 (b) 0 (c) -3 (d) -1

7. A man covers a certain distance from point 'A' to point 'B' at a speed of 60 km/hr. While returning, half the distance is covered by the speed of 37.5 km/hr and then he took a bypass which increases the distance to point 'A' by 15 km and the speed during the bypass is 60 km/hr. If it took him 96 minutes more while returning, then find the direct distance (not through bypass) between point 'A' and 'B'.

8. If 20 men or 25 women or 36 boys can do a piece of work in 15 days, working 9 hours a day, how many men must be associated with 10 women and 18 boys to do same work in 10 days working 10 hours in a day?
(a) 12 men (b) 10 men (c) 9 men (d) 8 men

9. A man lent Rs.28750 at 12% p.a. compound interest, compounded annually for two years. After two years, the total amount earned by the man is again lent for 2 years at 20% p.a. simple interest. What is the total interest earned by the man in 4 years? (Approximately integer)

10. A bag contains 4 red ball, 3 yellow ball, and 5 green ball. Three balls are drawn randomly from the bag. Find the probability that out of three balls at least 2 balls are yellow.
(a) 3/44 (b) 9/22 (c) 8/45 (d) 7/55

11. Container A contains mixture of water and milk in the ratio 9:11, respectively and container B contains mixture of water and milk in the ratio 7:13, respectively. 120 litres of mixtures from each container is transferred into another container C in which water and milk is present initially in the ratio 5:9, respectively. After transferring, ratio of milk and water in container C becomes 11:7, respectively. Find the amount of mixture present in the container C initially.

12. A hemisphere of radius 7 cm divided into 4 similar pieces. Find the flat surface area of each piece. (Take $\pi = 22/7$)
(a) 462 cm^2 (b) 120 cm^2 (c) 115.5 cm^2 (d) 136.8 cm^2

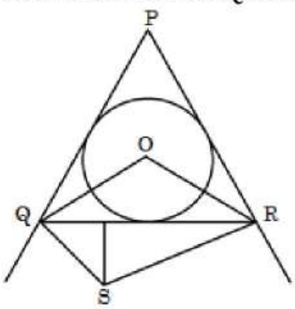
13. In a farm, there are 40 sheds. Each shed has 24 rows and each row consist of 15 cows. If the farm has to re-structured such that in each shed there are 24 rows and each row consist of 20 cows, then find the percentage decrease in number of sheds required to accommodate all the cows.

14. 'A' sold an article to 'B' at 30% profit, 'B' sold that article to 'C' at 10% loss and 'C' sold that article to 'D' at 20% profit. If the difference between the amounts at which 'A' and 'D' bought the article was Rs.202, then find the price at which 'B' bought the article.
(a) Rs. 520 (b) Rs. 480 (c) Rs. 480 (d) Rs. 650

15. Ramesh alone can do a work in 36 days while Suresh can do 40% of same work in 16 days. Suresh starts the work alone and leaves the work after 10 days. If remaining work is completed by Ramesh and Mahesh together in 12 days, then find the time taken by Suresh and Mahesh together to do the same.(Multiply the answer with 43)

16. A man rows to a place 126 km away and back to initial place in 8 hours. He found that he could row 9 km with the stream in the same time as he can row 7 km against the stream. Find the distance travelled by the boat in still water in 7 hours and 30 minutes.
(a) 240 Km (b) 120 Km (c) 360 Km (d) 180 Km

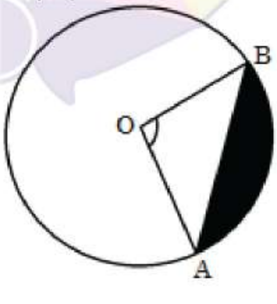
17. In the figure given below, $\angle QOR = 125^o$ and 'O' is in-centre. Find $\angle QSR$ if QS and RS are bisectors of $\angle SRQ$ and $\angle SQR$, respectively.



(a) 75^o (b) 55^o (c) 55^o (d) 70^o

18. In a group (boys + girls), the ratio of the number of boys and girls is 5:3, respectively. If the average age of group is 'x' years and the average age of girls is (x+4) years, then find the average age of boys
(a) (x + 1.4) years (b) (2x - 5) years
(c) (x + 3.2) years (d) (x – 2.4) years

19. Circumference of the circle in the given figure is 39.6 cm. If 'O' is the centre of the circle and $\angle AOB$ is 60^o, then find the area of the shaded region. (Correct up to 2 decimal places), Take (π = 22/7)

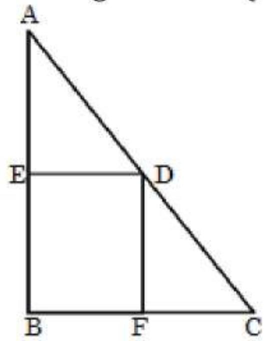


(a) 2.24 cm^2 (b) 2.98 cm^2 (c) 1.92 cm^2 (d) 3.61 cm^2

20. If 'x' is a positive acute angle and $16(\sin^2x - \cos^2x) = 8$, then find the value of (tanx + cosecx).
a) $(1/\sqrt{3})$ (b) $(5\sqrt{3}/3)$ (c) $(2\sqrt{3}/5)$ (d) $(3\sqrt{3}/2)$

21. A man observed that 'x' workers can finish some work in 16 days, however if he hired 30 more workers, the work would be finished in 10 days. Find the time required by one worker to finish the work alone.

22. In the figure given below, ABC is a right-angled triangle with $\angle ABC = 90^{o}$ and BEDF is a rectangle. If ED = (1/3) × BC, AC = 45 cm and BC = 27 cm, then find the area of triangle DFC.



(a) 196 cm^2 (b) 216 cm^2 (c) 144 cm^2 (d) 256 cm^2

Mock 20

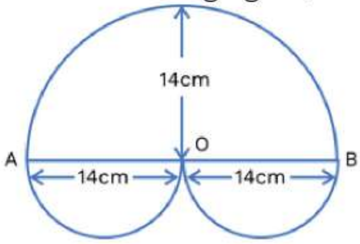
1. Anil, Aman and Anuj work in a factory and can complete a work in 30, 25 and 20 days respectively. They started working together but after 'm-5' days Anil met with an accident and broke his hands and couldn't work. 'm' days before completion of the work Aman left due to illness. The whole work is completed in 15 days. What is the value of 'm'?
(a) $26>m>27$ (b) $m>27$ (c) $20>m>26$ (d) $m<20$

2. Find the maximum value of p if $5\sin x - 7\cos x + p \geq 0$.
(a) $\sqrt{74}$ (b) $\sqrt{37}$ (c) 5 (d) 7

3. An airplane is flying at an altitude of 20 kms above point P on the ground and its elevation from point R on the ground is 45°. It is flying horizontally away from point R and after 5 seconds it is directly above a point Q on ground and the elevation of the airplane is now reduced by 15°. The speed of the airplane (in m/s) is:
(a) $4000\sqrt{3}$
(b) $8000(\sqrt{3}-2)$
(c) $4000(\sqrt{3}-1)$
(d) $8000(\sqrt{3}-\sqrt{2}$

4. A man visited Dubai and saw Burj Khalifa. He was amazed to see the world's tallest building and decided to calculate its height. He finds the angle of elevation of the top of the building to be 45° from where he was standing. On walking 450 metre towards the building, he finds the corresponding angle of elevation to be 60°. Then, what is the height of the building?
(a) $125(3+\sqrt{3})$ m
(b) $220(3+\sqrt{3})$ m
(c) $225(3+\sqrt{3})$ m
(d) $275(3+\sqrt{3})$ m

5. In the following figure, the area in (cm^2) is:



6. A cube of iron, each edge of which measures 10 cm, weighs 60 kg. What is the length of each edge of a cube of the same metal which weighs 180 kg?

(a) $12\sqrt[3]{3}$ cm (b) $10\sqrt[3]{3}$ cm (c) $15\sqrt[3]{3}$ cm (d) $16\sqrt[3]{3}$ cm

7. From the given options choose the one which would be sufficient to answer the following question using the minimum number of statements. Mark your answer as 'data inadequate' if the data given in all the statements together is insufficient to answer the question.

What is the surface area of the largest sphere that can be fit into the cube?

I: Length of longest diagonal of the cube is $6\sqrt{3}$ cm.

II: The inner surface area of the cube is 216 cm^2.

III: Sphere touches all the faces of the cube.

(a) Either I or II (b) Either II or III

(c) III and either I or II (d) All the three statements I,II and III

8. A cube having volume 343 m3 is painted green on all faces and then cut horizontally and vertically to form identical small cubes of side 1 m. Find the total number of cubes that have at least one of the faces painted.

(a) 216 (b) 125 (c) 218 (d) 64

9. A dice of side 12 cm is dropped into a rectangular jar of length 9 cm, breadth 16 cm and height x cm which is filled with water. When the dice is completely submerged into the water, then some amount of water (in cm^3) will be overflown. If initially, the jar was partially filled with water, then the rise of the water level would be (in cm):

(a) 10 cm (b) 12 cm (c) 15 cm (d) 16 cm

10. To make 48 parts, Aisha alone takes 36 days and Disha alone takes 72 days. They started the work of making 48 parts together, but Aisha left after 6 days while Disha continued to make the parts alone. If Aisha returns when only 12 parts are left to be made, for how many days did Disha have to work alone?

11. Pipe P, Q & R can fill water in a tank in 20 min, 30 min and 60 min respectively. Pipe A, B & C can empty the tank in 30 min, 40 min and 120 min. The inlet pipes and the outlet pipes are put in "On" and "Off" mode in every alternate minute. In the first minute pipe P, Q & R are opened and in the second minute A, B & C are opened when pipes P, Q & R are closed. Again, on the 3rd minute P, Q, R are opened and A, B & C are closed. This went on till the tank is filled with water completely. When (in minutes) the tank will be filled? [Write the closest integer if the answer is in fraction]

12. Mohan and Sohan climb up or down at the same speed. Mohan takes 8 seconds to go up a certain escalator that is going up, while Sohan takes 12 seconds to go down the same escalator. If Sohan takes 3 steps for every 2 steps that Mohan takes, how long would Sohan take to go up the same escalator?

(a) 2.4 seconds (b) 4 seconds (c) 4.8 seconds (d) 6 seconds

13. Let three friends Susmita, Sounak and Sahev are walking along a circular path. The equation of the circle is $x^2+y^2=9$. Let P $(3\sqrt{2}, 0)$ be any point outside the circular path and there are two tangents PA and PB, where A, B are the point of contacts. Both of them have started walking from point A, but Sahev in clockwise and Susmita in anti-clockwise. Their friend Sounak also has started walking from point A, but he is walking along the tangent, from the point A to P and

then point P to B. If all of them reach to B at the same time, then what is the ratio of speeds of Sounak, Sahev and Susmita?

(a) 2: 3π: π (b) 3: π: π (c) 3: π: π (d) 6:2π:π

14. Sunita is the owner of a chocolate factory which produces only one type of chocolate. She incurs to types of costs - fixed cost and variable cost. Fixed cost is constant and does not get impacted by the number of chocolates produced. Variable cost varies proportionately with number of chocolates produced. She has produced 1000 chocolates and 2000 chocolates in two consecutive days and the sold them for $6/chocolate. Her % profit for the chocolates produced on first day is 50% and that of second day is 100%. Find out the number of chocolates she needs to produce at least so that she does not incur any loss while selling the chocolates at $6/pc. [TITA]

15. The Cost Incurred by RIB company (CRIB) per employee for an organization varies with the number of employees in the organization. Himanshu, the HR Associate computed the maximum total CRIB that could be possible in the main branch. He found out that the average CRIB per employee in the main branch is (32 – x) thousand rupees when the number of employees is (3x + 24). What is the average CRIB per employee when the maximum possible total CRIB for the organization is observed at the main branch? [TITA]

16. A merchant bought 50 books at Rs. 100 each. He sold 'n' books out of these at a profit of (2n) % and the remaining books at a profit of (100 – 2n) %. What are the values of the minimum and maximum profit made by the merchant?

(a) Minimum: Rs. 625, Maximum: Rs. 1250
(b) Minimum: Rs. 2500, Maximum: Rs. 5000
(c) Minimum: Rs. 1500, Maximum: Rs. 3000
(d) Minimum: Rs. 2000, Maximum: Rs. 4000

17. Three persons Asmita, Sushmita and Gourav, as per their agreement, are to share their three-day tour expanses such as Asmita's share is two-thirds of Sushmita share and Gourav's share is $33\frac{1}{3}$% more than Sushmita's share. On the first day, Asmita pays the bill which amounts to Rs. 3310. The second day's bill amounting to Rs. 5220 was cleared by Sushmita while Gourav clears the last day's bill for Rs. 6230. During the final settlement of their accounts, which of the following happens?

(a) Gourav pays Rs. 30 to Asmita and Rs. 300 to Sushmita
(b) Asmita pays Rs. 300 to Sushmita
(c) Sushmita pays Rs. 240 to Asmita and Rs. 90 to Gourav
(d) Gourav pays Rs. 60 to Asmita and Rs. 270 to Sushmita

18. Monika went to the market to purchase three stationary items namely – eraser, sharpener and compass. She purchased more erasers than sharpeners and more sharpeners than compasses. The total number of articles purchased by her is 31 and she purchased at least 8 of each type. If she purchased less than 12 sharpeners then the number of compasses purchased by her is:

(a) Exactly 8 (b) Exactly 9
(c) Either 8 or 9 (d) Either 8 or 9 or 10

19. The average of 8 numbers in an arithmetic progression is 16. The sum of first 3 numbers and the average of next three numbers each equals 18. Also, the last number in the arithmetic progression is 2 more the average of last two numbers. Calculate the seventh number of the arithmetic progression. [TITA]

20. One day Niraj went to the theatre to watch a movie named "JAY HO". He is a huge fan of Salman Khan so he decided to write a thank you letter to his five friends. He told each one of them to copy the letter and sent to five different people with instruction that they move the chain similarly. Assuming that the chain is not broken and it cost 20 paise to send 1 letter. Find the amount (in Rs.) spent on the postage before 8^{th} set of the letter is sent. [TITA]

21. There are 10 people weighing 600 kg in all in elevator A of a building and 16 people weighing 800 kg in all in elevator B of a building. The weights of all people in the elevators are integers. The 10 people in elevator A have their weights in AP and the 16 people in elevator B also have their weights in AP. Both the APs have the least possible positive integer value of common difference. What is the average of the weights of the lightest person in elevator A and heaviest person in elevator B? [TITA]

22. If the sum of the possible values of y satisfying the equation, $(\log_{10} y)^2 + 1 = (\log_{10} 2)^2 - \log_{10} y^2$ is K, then what is the value of 16K? [TITA]

SOLUTION

Mock 1

1. (b)

$f(n) = [\frac{2^n}{3}] + [\frac{2^{n+1}}{3}]$

Let us try to find the pattern of the numbers,

$f(1) = [\frac{2^1}{3}] + [\frac{2^{1+1}}{3}]$

$= 0 + 1 = 1$

$f(2) = [\frac{2^2}{3}] + [\frac{2^{2+1}}{3}]$

$= 1 + 2 = 3$

$f(3) = [\frac{2^3}{3}] + [\frac{2^{3+1}}{3}]$

$= 2 + 5 = 7$

$f(4) = [\frac{2^4}{3}] + [\frac{2^{4+1}}{3}]$

$= 5 + 10 = 15$

Series 1, 3, 7,.......

$= 2 - 1, 2 * 2 - 1, 2 * 2 * 2 - 1,$ ....$2^n - 1$

The value of $f(50) = 2^{50} - 1$

B is the correct answer.

2. (a)

In one hour, DT express covers 80 km.

When the halt time is included, then the express covers 60 km

Because of the halts, the train lost covering 20 km

In hour the train stops for $60 * = \frac{20}{80}$ 15 minutes

A is the correct answer.

3. (c)

We have,

$x^2 + 2x + 33 = x^2 + 3x - x - 3 + 3 + 33 = x(x + 3) - 1(x + 3) + 3 + 33$

$= (x + 3)(x - 1) + 36$

Now, first term $(x + 3)(x - 1)$ is always divisible by $(x + 3)$

Hence, if 36 is divisible by x + 3, then the whole

value will be divisible by x + 3

So, factors of 36 are 1, 2, 3, 4, 6, 9, 12, 18 and 36

(9 values)

x + 3 will be equal to these values.

x + 3 = 1, x + 3 = 2 and x + 3 = 3 will be rejected because the values are not positive.

Hence, the total number of remaining values = 9 – 3 = 6

4. 20.

Number of times students passed = 35 + 45 + 25 + 30 = 135

I + II + III + IV = 50

I + 2 * II + 3 * II + 4 * IV = 135

so, II + 2 * III + 3 * IV = 85

to maximize I i.e. the number of students passed in exactly one subject we have to maximize IV, but maximum value of IV can be 25

∴II + 2 * III =10 now maximize III, the maximum value of III = 5.

So, IV = 25, III = 5, II = 0

I = 50 – 5 – 25 = 20

∴The maximum number of students who have passed in exactly one subject = 20 students.

5. 6.

$$\frac{1}{a}+\frac{1}{8}+\frac{-7}{8a}=\frac{3}{n}$$

$$\Rightarrow \frac{1}{8a}+\frac{1}{8}=\frac{3}{n}$$

since a is positive

$$\frac{1}{8}<\frac{3}{n}\Rightarrow n<24$$

=> 1/a + 1 = 24/n

$$\Rightarrow \frac{(1+a)}{a}=\frac{24}{n}$$

factors of 24 are 1,2,3,4,6,8,12,24

For, a = 2,3,5,7,11,23 the value of n is integer and less than 24.

so, possible values of n = 6.

6. (a)

Let the rate at which Arun work = a units/ hr

The rate at which Bimal work = b units/ hr

Let the work = W units

W = 6 * 10a = 60a

W = 4*5*a + (a+b)*4*2.5 = 30a + 10b

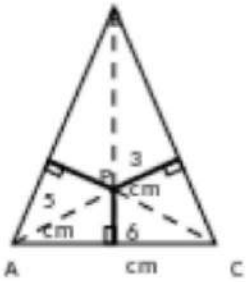
60a = 30a + 10b

b = 3a

∴Efficiencies of Arun : Bimal = 1:3

7. (a)

We can draw the following diagram.



Area of triangle ABC = Area of triangle APC + Area of triangle PBC + Area of triangle ABP

$\frac{1}{2}*a*h = \frac{1}{2}a*3 + \frac{1}{2}a*6$

h = 14cm

altitude of an equilateral triangle = 3a

where a is the length of the side of the triangle.

$a = 28/\sqrt{3}$

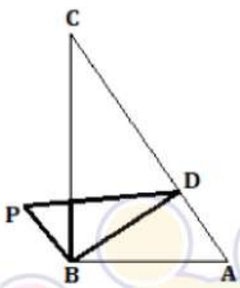
Area $= \frac{\sqrt{3}}{4}a^2$

$= \frac{196}{\sqrt{3}}$

8. (c)

$\therefore \text{Area} = \frac{1}{2}*60*60\sqrt{3} = 1800\sqrt{3}$

Consider the following figure



Here, right triangle PBD lie is a plane which is perpendicular to the plane of ABC.

Now, in PBD, tan30 is $\frac{PB}{BD}$

$=> \frac{30}{BD} = \frac{1}{\sqrt{3}}$

$=> BD = 30\sqrt{3}$

Now, in right triangle $\triangle$ BDA, $\triangle$ sin BAD = sin 60 = $\frac{BD}{AB}$

$=> AB = \frac{BD}{\sin 60} = \frac{30\sqrt{3}}{\frac{\sqrt{3}}{2}} = 60 \text{ cm}$

Now, in ABC, tan (60) = $\frac{BC}{AB}$ => BC = AB * $\sqrt{3} = 60\sqrt{3}$

$\therefore \text{Area} = \frac{1}{2} * 60 * 60\sqrt{3} = 1800\sqrt{3}$

9. (d)

Suppose he bought 1000m of cloth according to the meter scale. Then actually he received 1.1 * 1000 - 1100m of cloth.
He sold 80 cm while selling 1 m of yarn.
Thus the length of yarn he sold to the customer (effective)
= 1100 / 0.8 = 1375m
Selling price = Rs 8800
Cost price = 8800 * (1000/1375) = 6400
Profit = 8800 – 6400 – 2400

10. (d)
Assume a male consumes m units of food per day and a female consumes w units of food per day.

Assume, the female population is 4x, then the male population will be $4 \text{ x } \left(1+\frac{25}{100}\right) = 5x$

Now, the total amount of food = (5 x m + 4 x w)*20
After 10 more days, food left = (20 - 10) = 10 days of food
= 10(5 x m + 4 x w)

20% men leave and 25% women join. So the new population of men = $5 \text{ x } \left(1-\frac{20}{100}\right) = 4x$

New population of women = $4x \left(1+\frac{25}{100}\right) = 5x$

Hence, 10(5 x m + 4 x w) = 12(4 x m + 5 x w)
=> 2 x m = 20 x w => m = 10w
So the total amount of food in the beginning
= (5 x m + 4 x w)*20 = 20(50 x w + 4 x w) = 1080 x w

Had all the male population left in the beginning, food would have lasted for $\frac{1080xw}{4xw} = 270$ days

11. 13.
X on division by 7 leaves a remainder of 3.
So X is of the form7k +3
Same number on division by 19 leaves a remainder of 2,
So X is also of the form 19m + 2
Thus
7k + 3 = 19 m + 2
If we put m = 3, we get a number which is of the form 7k + 3. Thus the smallest number which f1ts the given criteria is19*3+2 = 59
When 59 is divided by 23, the remainder would be 13.

12. (a)
Total number of 3 digit numbers having at least one of their digits as 5 = (Total numbers of three-digit numbers) – (Total number of 3 digit numbers in which 5 does not appear at all)
= (9 × 10 × 10) – (8 × 9 × 9)
= 900 – 648
= 252
Option A

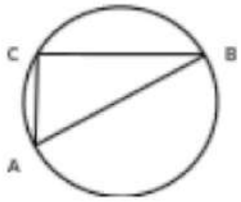
13. (d)

$C = 4^9 = 2^{18}$

$A = 2^{27}$
$B = 64^x = 2^{6x}$
$A^2 = C * B$ or $C^2 = B * A$ or $B^2 = A * C$
$27 * 2 = 18 + 6x$ or $36 = 27 + 6x$ or $12x = 45$
x = 6 or 1.5 or 3.75
Since only 6 is there in option, Answer is option D

14. (c)
Let the cost price of Physics book = P
P * 1.25 * 1.25 = 225
P = 144
Let the cost price of Chemistry book = C
C * 0.75 * 0.75 = 225
C = 400
P – C = 256
Option C

15. (a)
Consider the following figure:

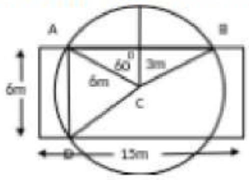


ACB will be a right angle. (Angle in the semicircle)
Now, AB + BC + AC = 70
Now, AB = 15*2 = 30 cm
=> BC + AC = 70 - 30 = 40 cm ......(1)
Also, $BC^2+AC^2 = 30^2$ (Using pythagoras)...(2)
Squaring the first equation and subtracting the second equation from it, we get 2BC * AC = 40 * 40 – 30 *30 = 700 .....(3)
Area of triangle ACB = BC AC = 700/4 = 175 cm2 (dividing equation 3 by 4)

16. (c)

Area of the rectangular field = 6 * 15 = 90 m^2

We can make the following diagram:



Area where sheep can graze = πr^2 - Area outside the farm.
The area outside the field = 2 * [(120/360) πr^2 - Area of the triangle ABC]
= 2{1/3 πr^2 - 1/2 (6$\sqrt{3}$)(3)}
= 2/3 πr^2 - 18$\sqrt{3}$
Area where sheep can graze = πr^2 - 2/3 πr^2 + 18$\sqrt{3}$
=1/3 πr^2 +18$\sqrt{3}$
= 12π + 18$\sqrt{3}$

Ungrazed area = 90 - 12π - 18$\sqrt{3}$
Option C

17. 132.
Let's say the principle= Rs 100.
Semi- annual interest rate r = 20% / 2 = 10%
T = 4 semi- annual time periods.

The amount from compound interest = P * (1 + $\frac{r}{10}$)T = 100(1.1)4

=146.41
So, Compound Interest=146.41-100=46.41
Simple interest =100*10*2/100=20
So,the Compound interest is greater than than the simple interest by (46.41-20)*100/20=26.41*5=132.05≈132

18. 9.
Coefficient of $(r + 2)^{th}$ term in the expansion of $(1 +x)^{14}$ is $^{14}C_{r+1}$.
Given the coefficient of r^{th}, $(r + 1)^{th}$ and $(r + 2)^{th}$ terms in the expansion of (1 + x)14 are in A.P.
Rewriting the equation.

$\Rightarrow 2\left({}^{14}C_r\right) = {}^{14}C_{r-1} + {}^{14}C_{r+1}$

Rewriting the equation.

$\Rightarrow \dfrac{{}^{14}C_{r-1}}{{}^{14}C_r} + \dfrac{{}^{14}C_{r+1}}{{}^{14}C_r} = 2.$

We know that $\dfrac{{}^{n}C_r}{{}^{n}C_{r-1}} = \dfrac{n-r+1}{r}$

$$\Rightarrow \frac{r}{14-r+1} + \frac{14-r}{r+1} = 2$$
$$\Rightarrow \frac{r^2 + r + (15-r)(14-r)}{(15-r)(r+1)} = 2$$

$$\Rightarrow 2r^2 - 28r + 210 - 2(15-r)(r+1) = 0$$
$$\Rightarrow 4r^2 - 56r + 180 = 0$$
$$\Rightarrow (r-5)(r-9) = 0$$
$$\Rightarrow r = 5 \text{ or } r = 9$$

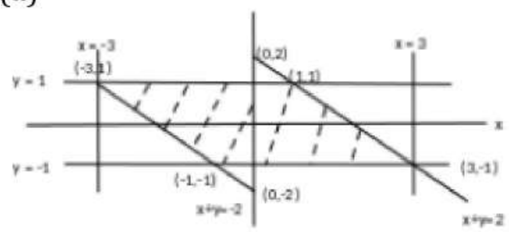
The required value of r is 5 or 9.

So, largest possible value of r is 9.

19. 10.
From the general equation of a circle we can observe that centre and radius of the circle is (0,0) and 5
Let the centre of the circle be C which is located on (0.0) and its radius is r= 5
The maximum possible distance from P to a point on the circle is=PC+r
The minimum possible distance from P to a point on the circle is=PC-r
So the difference is =(PC+r)-(PC-r)=2r=2(5)=10

20. (a)
A deck of cards is shuffled, four cards are picked in random and all of them turned out to be red.
The number of ways 4 red cards are selected = ${}^{26}C_4$ ways.
If two cards are Kings, then the remaining two cards can be selected in ${}^{24}C_2$ ways
The probability that two of the cards are kings
$= {}^{24}C_2 / {}^{26}C_4$
$= \dfrac{6}{325}$
Option A

21. (a)



The required area is the area of the shaded region = area of the parallelogram = bh=4*2=8.

22. (a)

Given f (x) = (x − 1) $(x - 2)^2$

f (x) = (x − 1) $(x^2 + 4 - 4x)$;

f (x) = $(x^3 - 5x^2 + 8x - 4)$

Now $f'(x) = 3x^2 - 10x + 8$, $f'(x) = 0$

$3x^2 - 10x + 8 = 0$

(3x − 4) (x − 2) = 0

x = 4 / 3 or 2

Now $f''(x) = 6x - 10$

$f''(4/3) = 6 \times [4/3] - 10 < 0$

$f''(2) = 12 - 10 > 0$

Hence, at x = 2 the function will occupy minimum value.

∴Minimum value = f (2) = 0

Mock 2

1. (c)

If we look at the binary representation of the bottles numbered 1 to 100, all numbers till 100 can be represented using 7 digits.

Now, let us arrange the 7 rabbits in a row and number them 1 to 7. A rabbit is to take a sip from a bottle if the digit corresponding to its poison is 1.

For example, is a number is 1011010, rabbit numbered 1, 3, 4 and 6 will take a sip from this bottle. This way we will be able to identify the combination of 1s for the bottle that contains poison. So, in general the no. of rabbit needed to identify a poisoned bottle would be n such that the number of bottles ≤ 2^n & n is the least such integer.

As $100 < 2^7$, n = 7

Therefore, the required answer is 7.

Thus, option (3) is correct.

2. (b)

If the sum of any set of, say n, consecutive integers is equal to 1000, then we can apply the formula for the sum of the first n terms of an A.P.

In this case, the common difference between consecutive terms of the A.P. is 1.

Hence, we have (n/2)(2a + n − 1) = 1000, where a is the first term in the set.

Therefore, n(2a + n − 1) = 2000.

Now, a and n have to be integers and n can be either odd or even. If n is odd, then (2a + n − 1) is even and if n is even, then (2a + n − 1) is odd.

So, we just need to find the number of ways in which 2000 can be expressed as the product of two integers, one even and one odd.

There are 8 such ways: (1 × 2000), (2000 × 1), (5 × 400), (400 × 5), (25 × 80), (80 × 25), (125 × 16) and (16 × 125)

One of these integers is the number of terms and the other is the sum of the first and last terms.

Following are the different cases possible:

A set of 1 integer (1000).

A set of 2000 integers (−999, −998, ..., 998, 999, 1000),

A set of 5 integers (198, 199, ..., 202),

A set of 400 integers (−197, −196, ..., 201, 202),

A set of 25 integers (28, 29, ..., 51, 52),

A set of 80 integers (−27, −26, ..., 51, 52),

A set of 125 integers (−54, −53, ..., 69, 70) and

A set of 16 integers (55, 56, ..., 70).

We want only sets of two or more integers, so there are 7 such sets.

3. 90

Arun offers a discount of 6.25%
6.25% = 1/16
So let us assume Arun's Marked Price (MP) as 16x,
MP = 16x
Discount = x
SP = 16x- x = 15x
If Baron paid 150 to purchase the item and Arun's SP = 15x, then
15x = 150
x= 10
Therefore, MP = 160, Discount = 10 and SP = 150.
Arun's profit = 20%
1.2 × CP = SP
1.2 × CP = 150
CP = 125 = SP of Varun
Profit of Varun = Profit of Arun = 25
CP of Varun = SP - Profit
= 125-25
= 100
CP of Varun - Discount offered by Arun = 100 - 10 = 90

4. (d)

Both the persons and the escalator are moving in the same direction. In this case, the relative speed would be Speed of (Man + Stairs)
Assume that the speed of the escalator to be x.
Now, both for Peyush and Ashneer the length of the escalator should be same.
and Peyush's speed is 6 steps/sec (say) and Ashneer's is 5 steps/sec
Piyush is walking 60 steps and he does it in 10 sec, but in these 10 secs, even the escalator must have moved with speed "x". The length moved by it would be 10x.
So, we can say the total length is 60 + 10x (step moved by Piyush and the escalator helps Peyush in reaching the top.
Similarly, for Ashneer we can write 55 + (55/5) × x
Both lengths must be same, so -
60 + 10 x = 55 + 55x/5
So, x = 5
So total length is 60 + 10x = 110
i.e., each have to climb 110 steps when the escalator is switched off.
Option (D) is correct.

5. 418588

Money took = Rs 384000
Amount after first year
= 384000 × (1+ 15.25/100)
= 442560
Amount paid after first year = 84000, amount remaining = 442560 – 73360 = 369200
Amount to be paid after second year
= 369200 × (1+ 15.25/100)
= 425503
Amount paid after second year = 58000, amount remaining = 425503 – 62303 = 363200
Amount to paid after third year
= 363200 × (1+ 15.25/100)
= Rs 418588

6. 7

Let the cost price be Rs.100

M.P-100+(100 x (50/100))

M.P=100+50= Rs. 150

Now,

After first discount

S.P.=(150-(150 x (5/100))

S.P. = Rs. 142.5

After second discount

S.P. =(142.5-(142.5 x (5/100))

S.P. = Rs. 135.375

After third discount

SP =(135.375-(135.375 x (5/100))

=> S.P=Rs. 128.60625

After fourth discount

SP =(128.60625 -(128.60625 x (5/100))

SP=Rs 122.1759375

After fifth discount,

SP = (122.1759375 - 122.1759375 × 5/100)

SP = 116.0671406 ≈ 116

After sixth discount,

SP = (116-116 × 5/100)

SP = 110.2

After seventh discount,

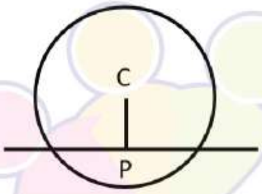
SP = (110.2 -110.2 × 5/100)

SP = 104.69

After seventh discount if further discount is given then Rabin makes loss.

So, total number of discounts = 7

7. 79



If the line cuts the circle, then CP<r .... (i)

Since, the equation of the circle is $x^2 + y^2 + 6x - 8y + 9 = 0$, so

Centre = (-3,4) and radius = $\sqrt{(9+16-9)} = \sqrt{16} = 4$

Also, the equation of the line is 6x+8y=m

Using (i) , we get

$|(-18+32-m)/\sqrt{(36+64)}|<4$

i.e., $|(14-m)/10|<4$

i.e., $|14-m|<40$

i.e., 14-m<40 and –(14-m)<40

i.e., m>-26 and -14+m<40

m>-26 and m<54

i.e., $m \in (-26, 54)$

Therefore, the number of integral values of m from -25 to -1 is 25 and the number of integral values of m from 1 to 53 is 53.

i.e., the number of integral values of k is 25+53+1 = 79.

8. (d)

The area of the highlighted zone = $(9\pi-4\pi)$ cm^2= 5π cm^2

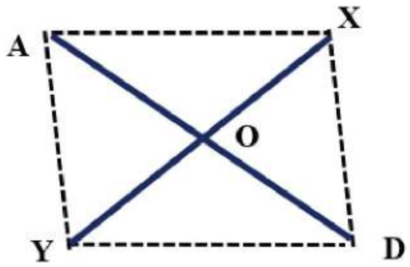
The probability of hitting the highlighted zone = 5π/25π = 1/5
If Deepika starts the game the probability of Elena's winning is-
(4/5)*(1/5) + (4/5)*(4/5)*(4/5)*(1/5) + (4/5)*(4/5)*(4/5)*(4/5)*(4/5)*(1/5) + ...
= (4/25)*[1/{1-$(4/5)^2$}]
= (4/25)*(25/9)
= 4/9
Hence, the right answer is option d.

9. 5
The prime factorisation of 8! /21, i.e., 1920 = $2^7 \times 3 \times 5$
The possible ways of forming the number are
$2^7 \times 3 \times 5 = 9!/7! = 72$
$4 \times 2^5 \times 3 \times 5 \times 1 = 9!/5! = 3024$
$4 \times 4 \times 2^3 \times 3 \times 5 \times 1^2 = 9!/(3!2!2!) = 15120$
$4 \times 4 \times 4 \times 2 \times 3 \times 5 \times 1 \times 1 \times 1 = 9!/(3!3!) = 10080$
Hence, by the given condition,
$786 \times 6^k = 72 + 3024 + 15120 + 10080 = 28296$
$\Rightarrow 6^k = 36$
$\Rightarrow k = 2$
Now,
f (x+y) - f (xy) = 0
f (x+y) = f (xy)
Putting x = 1 & y = 1
f (1+1) = f (1)
f (2) = f (1) = 5 [Since, f(k)=5, where k = 2]
Putting x = 0 & y = 1
f (0+1) = f (0)
f (0) = f (1) = 5
f (0+8!/21) = f (0)
f (8!/21) = f (0) = 5

10. (c)
Tap X does 4/5th of work in 20 hours.
Time Taken by tap X to complete the work
= 5/4 × 20 = 25 hours
Efficiency of tap Y is 30% more than that of tap X.
If Work done by tap X in one hour = 10, then work done by tap Y in one hour = 13
Ratio of time taken by tap X and Y = 13: 10
Time taken by tap Y to complete the work
=10/13 × 25
= 250/13 hours
Tap X and Y worked for ten hours.
Total work Completed by tap X and Y in 10 hours
=10(1/25+13/250)
=23/25
Work left = 2/25 which is done by tap Z in 4 hours.
Time taken by tap Z to complete the whole work = 25/2 × 4
Z= 50 hours
Ratio of Efficiency of tap X and Z = 50/25
Efficiency of tap Z is 50 % less than that of tap X.
Option (D) is correct.

11. 2
Let the sides of the cube is a

YX = BC and BC = $\sqrt{a^2 + a^2}$ = $a\sqrt{2}$
So, YX = $a\sqrt{2}$
AD = Diagonal of a cube = $\sqrt{a^2 + a^2 + a^2}$ = $a\sqrt{3}$
AC = BC = AB = $a\sqrt{2}$
AY = $\sqrt{a^2 + \left(\frac{a}{2}\right)^2}$ = $\sqrt{\frac{5a^2}{4}}$ = $\frac{a\sqrt{5}}{2}$
Now,
Let us join X & Y and A & D. Let call the point of intersection to be O.



AO= $\frac{AD}{2} = \frac{a\sqrt{3}}{2}$
AY = $\frac{a\sqrt{5}}{2}$
XO = $\frac{XY}{2} = \frac{a\sqrt{2}}{2}$
$AO^2 + XO^2 = AY^2$
So,
$\angle AOD = 90°$
So, the area of the quadrilateral AXDY is $A_1 = \frac{a^2\sqrt{6}}{2}$
The area of the triangle ABC is $A_2 = \frac{a^2\sqrt{3}}{2}$
So, $\left(\frac{A_1}{A_2}\right)^2 = 2$

12. (d)
Option 4 is correct.
Here, for each individual, the capital was not the same for the entire period his money was in the business. So, the term of the ratio for a person will be the sum of products of investment multiplied by the time period for different parts of the year.
Ravi has Rs. 45,000 for 6 months and then since he withdrew Rs. 5,000, so he had only 40, 000 for the rest of the 6 months. His term of the ratio will be
(45,000 × 6) + (40,000 × 6) = Rs. 5,10,000
Bharat joined with Rs. 32,000 which remained unchanged for 5 months and then he brought in 13, 000 more. So, he had 45, 000 for 4 months only as he joined 3 months after the business began. His term of the ratio will be
(32,000 × 5) + (45,000 × 4) = 3,40,000
Hence, the ratio of shares of the profit will be 5,10,000: 3,40,000 = 3:2.
Let the total profits be x.
Then, Ravi will receive 20% of x or 0.2x as commission
Amount Left for distribution = 0.8x
Amount Ravi will get from remaining profits = 3/5 × 0.8x = 0.48x
Total amount with Ravi = 0.2x + 0.48x = 0.68x
Amount with Bharat = x – 0.68x = 0.32x
Ratio of amount received = 0.68x/0.32x = 17/8

13. (b)
Let, OX = x
Angle M_1OX is A; Angle M_2OX is B

So,
We need to maximise (A-B).
tan (A-B) = $(50/x)/(1+3600/x^2)$
tan (A-B)= $50x/(x^2+3600)$ = y (Let's say)
$x^2y - 50x + 3600y = 0$
To have a real solution of the equation-

$\Rightarrow 2500 \geq 4y^2 \times 3600$
$\Rightarrow y \leq 5/12$
So, the maximum value of y will be 5/12.
So,
$50x/(x^2+3600) = 5/12$
$\Rightarrow x^2 - 120x + 3600 = 0$
$\Rightarrow x = 60$
So, the length of OX will be 60 m.

14. (b)
Let a and b be the least terms of A and B respectively.
$2P/2\ [2a + 2P - 1] = P$
$\Rightarrow 2a+2P-1=1$ .... (i)
Also:
$P/2\ [2b + P - 1] = 2P$
$\Rightarrow 2b+P-1=4$ .... (ii)
Subtracting equations (ii) from (i), we get:
$(2a+2P-1)-(2b+P-1)=1-4$
$\Rightarrow 2a-2b+p=-3$
$\Rightarrow a-b = -(p+3)/2$
Difference = $|(a+2P-1)-(b+P-1)| = |(P-3)/2|$
Given: $|(P-3)/2| = 316$
$\Rightarrow (P-3)/2 = \pm 316$
P must be positive. (Set B has P integers)
$(P-3)/2 = 316$
$\Rightarrow P = 632 + 3 = 635$
Thus, the required "option (B) 635" is correct.

15. (b)
He climbs up 12 m in an hour and then slides down 5 m in another hour.
It means the he actually climbs up 7 m (12–5) in 2 hours.
In the same manner he will climb every 7 m in 2 hours.
In this way, he will reach 42 m in 12 hours.
In 13 hours, he will reach 42+12 = 54 m.
In 14 hours, he will reach to 54-5 = 49 m.
The remaining distance (60 – 49 = 11 m), he will reach in $11 \times 60/12 = 55$ m.
[He climbs 12m in 60 minutes, then 1m in 60/12= 5 minutes. So, 11m in 11×5 = 55 minutes]
Hence, he will touch the flag in 14H 55m.
Option (2) is correct.

16. (b)
Total number of red and green marbles together = 36 + 4 = 40
Let number of red marbles = X
Then number of green marbles = 40 - X
Total weight of all marbles = $(36 + 40) \times 1.9 = 144.4$ gm
Total weight of black marbles = $36 \times 2.5 = 90$ gm
Total weight of red marbles = 2X gm

Total weight of green marbles = 1.2× (40-X) = (48 - 1.2X) gm
90+2X+48- 1.2X = 144.4
⇒0.8X = 6.4
⇒X = 8
Required difference = (40 - 8) - 8 = 24

17. (b)
|x-1| + |x-2| + |x-3| = 10
The value of the expression at x =3 is 3 and the value at x = 1 is also 3 while at x = 2 is 2.
So, the value of the expression equals 10 when x is greater than 3 or when x is less than 1
Case 1: x > 3
x-1 + x-2 +x-3 = 10
or x = 16/3
Case 2: x< 1
1 –x + 2-x + 3- x = 10
Or -4/3 = x
Sum of values = 16/3 + (-4/3) = 12/3 = 4

18. (b)
A can win in the following scenarios:
A strikes in first shot.
A misses in the first shot, B misses in the second, A strikes in the third.
A misses in the 1st shot, B misses in the 2nd, A misses the 3rd, B misses the 4th and A strikes the 5th.
And so on...
P(A in 1st shot) = 0.6
P(A in 3rd shot) = 0.4 * 0.2 * 0.6 {A misses, then B misses and then A strikes}
P(A in 5st shot) = 0.4 * 0.2 * 0.4 * 0.2 * 0.6 {A misses, then B misses and then A misses, then B misses, then A strikes}
Overall probability = Sum of all these = 0.6 + 0.4 * 0.2 * 0.6 + 0.4 * 0.2 * 0.4 * 0.2 * 0.6 + ...
Which is nothing but => 0.6 + (0.4 * 0.2) * 0.6 + (0.4 * 0.2)2 * 0.6 + (0.4 * 0.2)3 * 0.6...
This is an infinite geometric progression with first term 0.6 and common ratio 0.4 * 0.2

Required Probability = $\frac{a}{1-r} = \frac{0.6}{1-0.08} = \frac{0.6}{0.92} = \frac{30}{46} = \frac{15}{23}$

19. (b)
The following assumptions are taken for answering this question
a. All the buses have the same speed regardless of their direction
b. time interval between successive buses in any direction is same
Let speed of each city bus =x km/min
my speed =y km/min
Distance between two successive buses in any direction =D km
Every 60 minutes there is a city bus coming in my opposite direction.
Relative speed $=(x + y)$ km/min

$D = 60(x + y)$km

Every 70 minutes there is a city bus coming in my same direction.
Relative speed $=(x - y)$ km/min

D=70(x−y) km

$60(x+y)=70(x-y)$

$\Rightarrow 6(x+y) = 7(x-y)$

$\Rightarrow 6x+6y=7x-7y \Rightarrow x=13y$

$D=60(x+y) = 60(13y+y) = 840y$

Time gap between two successive buses when passing a stationary point

$= D/x = 840y/13y = 64.62$ minutes = 65 minutes (b)

20. (d)

Since the original cube is cut into 216 smaller cubes, let each side of the original cube be of length 6 units.

Each smaller cube is of length 1 unit.

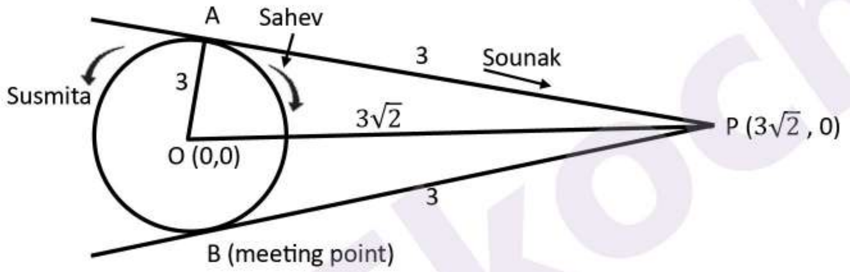
Now, let the division of these 216 cubes be such that there are x^3 cubes in the first group, y cubes in the second group and z^3 cubes in the third group. $x^3+y^3+z^3=216 = 6^3$.

The only possible integer solution is $3^3 + 4^3 + 5^3 = 6^3$. The sides of the new larger cubes are 3, 4 and 5 units. The sum total of the outer surface areas of the three new cubes

= $(6 \times 3^2) + (6 \times 4^2) + (6 \times 5^2)$ = 300 sq. units Total surface area of the original larger cube = 6 * 6^2 = 216.

Time required to paint the outer surface of all the three new cubes = 18*300/216=25 Mins.

21. (c)



Distance travelled by Sahev, $s = r\,\theta = \pi \times r/2$

$= 3\pi/2$ units

Distance travelled by Susmita = $6\pi - 3\pi/2$

$= 9\pi/2$ units

Distance travelled by Sounak = 3+3 = 6 units

Since all of them reach to B at the same time, so the ratio of speeds of Sounak, Sahev and Susmita is

$= 6 : 3\pi/2 : 9\pi/2$

$= 4 : \pi : 3\pi$

Option (C) is correct.

22. (a)

$\Rightarrow (x) = (x^2+3x-6)/(x^2-2x+4) = k$

$\Rightarrow (x^2+3x-6) = k(x^2-2x+4)$

$x^2(1-k) + x(3+2k) - (6+4k) = 0$

So,

For real values of x

$(3+2k)^2 + 8(3+2k)(1-k) \geq 0$

$\Rightarrow (3+2k)(3+2k+8-8k) \geq 0$

$\Rightarrow (k+3/2)(k-11/6) \leq 0$

$\Rightarrow -3/2 \leq k \leq 11/6$

So,

$\alpha = 6/11$; $\beta = -2/3$

$10(a_1 + a_2 + a_3 + \ldots)$

$= 10*\{(\alpha^1 + \alpha^2 + \alpha^3 + \alpha^4 + ...) - (\beta^1 + \beta^2 + \beta^3 + \beta^4 + ...)\}$
$= 10*\{\alpha/(1-\alpha) - \beta/(1-\beta)\}$
$= 10*\{(6/5) + (2/5)\}$
$= 16$

Mock 3

1. 300
Given that –
$F(n) = a+b+c$ if $(a+b+c) < 10$
$= F(a+b+c)$ if $(a+b+c) \geq 10$
So, F(n) can assume values from 1 to 9 and F(n) is nothing but the digital sum of n where n is a 3 digit number.
G(n) can assume value from 0 to 8.
From the properties of digital sum of a number, we know that if a number is not divisible by 9, the digital sum of the number is the remainder when the number is divided by 9 and 9 when the number is divisible by 9.
So, F(n) + G(n) can assume a maximum value of 16 which is a perfect square.
The other values it can assume are 4 & 9
1 is not possible as it is not possible to get the remainder 0 and digital sum 1.
Hence, only the below combinations are possible-
$4 = 2 + 2$
$9 = 9 + 0$
$16 = 8 + 8$
Which means any number which gives a remainder of 0, 2 or 8 satisfy the condition.
So, out of every 9 consecutive numbers starting 100; there exist 3 numbers which give either a 0, 2 or 8 as a remainder when divided by 9.
Hence, the total count is $(999-100+1)/3 = 300$.

2. 12.
9 5 4 **Divisors**
5 3 3 **Remainders**
So, the smallest number that satisfies the given condition is $\{(5\times3)+3\}\times9+5 = 167$.
The general form of numbers that satisfy the given condition is got by adding the LCM of divisors, which is 180, to 167.
i.e., the general form is $180k+167$, $k = 0, 1, 2, 3, ...$
Therefore, the smallest number is 167.
Now, the remainders when 167 is successively divided by 4, 5, and 9 respectively are as follows:
The remainder when 167 is divided by 4 is 3 and the quotient is 41.
The remainder when 41 is divided by 5 is 1 and the quotient is 8.
The remainder when 8 is divided by 9 is 8 and the quotient is 0.
Hence, the sum of the remainders = 3 +1+8 = 12

3. (c)
Distance travelled in the first half = 172/2
= 86 km
He travelled 86 km in 8 hours.
Distance travelled on the bicycle and a car = 13 km/hr and 7 km/hr.
We can form the equation as
$13(x) + 7(8 - x) = 86$
$13x + 56 - 7x = 86$
$6x = 30$

x = 5
Distance travelled by the car
= 7(8 - 5)
= 7 × 3
= 21 km
The second half of the distance travelled = 86 km
He travelled 86 km in 10 hours.
Distance travelled on the bicycle and a car = 8 km/hr and 9 km/hr.
We can form the equation as
8(x) + 9(10 - x) = 86
8x + 90 - 9x = 86
x = 4
Distance travelled by bike = 8x
= 8 × 4
= 32 km
The ratio of the distance travelled by him on the bike to the ratio of the distance travelled by car
= 21: 32
Hence, the correct answer is option (3).

4. (a)
Let's say the project volume is 5 unit.
Rishi does 'a' unit of work/day and that of Nupur is b/day.
So, as per case 1,
1/a + 4/b = 12 ____(i)
As per case 2,
4/a+1/b = 13 ____(ii)
Adding (i) & (ii) and dividing by 5 we get
1/a+1/b = 5 ____(iii)
(ii)-(iii)
3/a = 8
⇒ a = 3/8
So, Rishi alone can finish the work in 5/a = 5/(3/8) = 40/3 = 13.33 days

5. (b)
Let Obama buys 100 shirts on the first day.
Therefore, the number of shirts Johnson got = 60
Number of shirts Biden got = 40
Number of shirts Obama bought on next day = 100 × 120/100 = 120
Number of shirts Johnson got on next day = 60×105/100 = 63
Number of shirts Biden got on next day = 120 - 63 = 57
Required percentage = (57 - 40) × 100/40 = 42.5%

6. (b)
Let the 7 students in ascending order of their weight be a, b, c, d, e, f, and g.
Then,
$$\frac{a+b+c+d+e+f}{6} = 70$$
⇒ a + b + c + d + e + f = 420 .... (i)
and
$$\frac{b+c+d+e+f+g}{6} = 75$$
b + c + d + e + f + g = 450 .... (ii)
From equation (i) and (ii)
a - g = -30

=> g = 30 + a ... (iii)
For least possible average we need least value of a and g.
The least value of g can be 75 and (b = c = d = e = f = 75).
The, least value of a can be 75 − 30 = 45
Now, the least average = $\frac{45+75+75+75+75+75+75}{7} = \frac{495}{7}$

For maximum possible average we need maximum possible value of a and e.
The maximum value of a can be 70 and (b = c = d = e = f = 70).
Maximum value of g can be 70 + 30 = 100
Now, the maximum average = $\frac{70+70+70+70+70+70+100}{7} = \frac{520}{7}$
Now, the difference $\frac{520}{7} - \frac{495}{7} = \frac{25}{7} \approx 4$

7. (d)
C is sold at $30 at 20% profit.
CP of C = 30/1.2 = $25
Let the quantity of A and B be x and 2x.
As CP of A = $20 we get,
25 = [20x+(2x × CP of B)/(x+2x)
i.e., CP of B = $27.5
Now, 27.5 = (28a + 18b)/(a+b)
where a and b are the varieties of tea costing $28 and $18 respectively.
Solving this we get, a: b = 19:1
Poppyseeds costing $18 in 10 kg of variety B
= (1/20) × 10
=1/2 kg
=500 g

8. (b)
Given the printed price of the smartphone = Rs. 8800
The selling price of the smartphone = Rs. 4560
First discount = 20%
Therefore, discount = Marked price – selling price
=8800 – 4560
= Rs. 4240
Now, discount = Marked price × discount%
$4240 = 8800 \times x\%$
$x = \frac{530}{11}\%$
Successive discount $= \frac{530}{11}\%$
Let y be the second discount. Then,
$\frac{530}{11} = 20 + y - \frac{20y}{100}$
$\frac{80y}{100} = \frac{310}{11}$
$y = \frac{775}{22} \approx 35\%$

9. 1071
For scheme A, the simple interest for the first year is Rs. (10,000 x 12 x 1)/100 = Rs. 1200.
The simple interest for the second year is Rs. (10,000 x 15 x 1)/100 = Rs. 1500.
The simple interest for the third year is Rs. (10,000 x 18 x 1)/100 = Rs. 1800.
The total simple interest for three years is Rs. (1200 + 1500 + 1800) = Rs. 4500.
The amount received after deducting tax is Rs. (4500 - 4500 x 10/100) = Rs. 4050.
The final amount received from scheme A is Rs. (10,000 + 4050) = Rs. 14,050.

For scheme B, the compound interest for three years is calculated as follows:
The amount after the first year is Rs. (10,000 x (1 + 10/100)) = Rs. 11,000.
The amount after the second year is Rs. (11,000 x (1 + 10/100)) = Rs. 12,100.
The amount after the third year is Rs. (12,100 x (1 + 10/100)) = Rs. 13,310.
The compound interest for three years is Rs. (13,310 - 10,000) = Rs. 3310.
The amount received after deducting tax is Rs. (3310 - 3310 x 10/100) = Rs. 2979.
The final amount received from scheme B is Rs. (10,000 + 2979) = Rs. 12,979.
The difference between the final amounts received from the two schemes is Rs. (14,050 - 12,979) = Rs.1071.

10. (b)
The given function can be written as

$$\frac{49x^4e^{4x}+64}{x^2e^{2x}}=\frac{49x^4e^{4x}}{x^2e^{2x}}+\frac{64}{x^2e^{2x}}$$

$$=49x^2e^{2x}+\frac{64}{x^2e^{2x}}$$

$$=\left(7xe^x\right)^2+\left(\frac{8}{xe^x}\right)^2$$

So,

$$\frac{49x^4e^{4x}+64}{x^2e^{2x}}=\left(7xe^x\right)^2+\left(\frac{8}{xe^x}\right)^2$$

Now, by the formula of QM ≥ AM ≥ GM ≥ HM inequalities formula, we have

$$\sqrt{\frac{(7xe^x)^2+\left(\frac{8}{xe^x}\right)^2}{2}}\geq\sqrt{7xe^x\cdot\frac{8}{xe^x}}$$

$$(7xe^x)^2+\left(\frac{8}{xe^x}\right)^2\geq 2\times 56=112$$

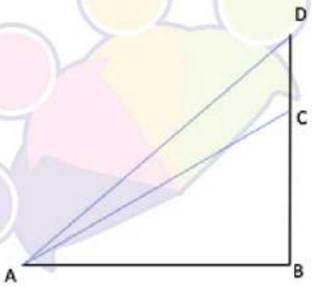
11. 103000
They made 1700 sunglasses costing ₹ 240 each and an additional ₹ 25000 expense on them.
Thus, total Cost = (1700×240) + 25000
= ₹ 433000
Now we will calculate the revenue they earned from selling them. They are able to sell 1400 sunglasses in the summer season for ₹340 each.
So, the revenue earned by them during the summer season = ₹340 × 1400
= ₹ 476000
Also, the left over 300 pieces of sunglasses would have been sold by the company in off season 200 each.
Revenue earned through these 300 sunglasses = 300×200
= ₹ 60000
Total Revenue = ₹ 476000 + ₹60000 = ₹536000
Profit = Revenue – Cost
= ₹ 536000 – 433000
= ₹ 103000

12. (c)
Total number of people who are in the line = (Number of new people who lined up in every minute)*(Total duration for which the people are allowed to line up in minutes) = (100)*(4 PM – 4 AM)*60 = 100*12*60 = 72000.
Let us assume that n number of people are needed to distribute all the tickets so that all these 72000 people get tickets.
So,
n*2*(5:30 PM – 11:30 AM)*60 = 72000

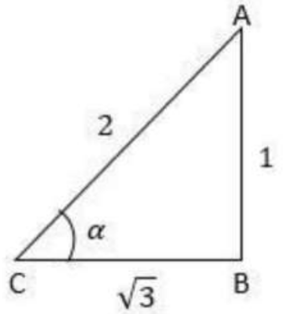
$\Rightarrow$n*2*6*60 = 72000
$\Rightarrow$n*720 = 72000
$\Rightarrow$n = 100
Hence, 100 BCCI officials are needed to distribute tickets.

13. (9)
Let the side of the square be 'a' cm
Perimeter of square = 4a cm
Diagonal of square = $a\sqrt{2}$ cm
Now,
$\Rightarrow 4.5 \times 4a = 11\sqrt{2} \times a\sqrt{2} - 12$
$\Rightarrow$ 18a = 22a – 12
$\Rightarrow$ 4a = 12
$\Rightarrow$ a = 3
∴ The side of the square is 3 cm.
i.e., S = 3. (Given)
Now, $1 + 2/S + 3/S^2 + 4/S^3 + \dots$
$= (1 + 1/S + 1/S^2 + 1/S^3 + \dots.) + (1/S + 1/S^2 + 1/S^3 + \dots.) + (1/S^2 + 1/S^3 + \dots.) + \dots$
$= (1 + 1/S + 1/S^2 + 1/S^3 + \dots.) + 1/S(1 + 1/S + 1/S^2 + 1/S^3 + \dots.) + 1/S^2(1 + 1/S + 1/S^2 + 1/S^3 + \dots.)$
$+ \dots$
$= (1 + 1/S + 1/S^2 + 1/S^3 + \dots.)(1 + 1/S + 1/S^2 + 1/S^3 + \dots.)$
$= (1 + 1/S + 1/S^2 + 1/S^3 + \dots.)^2$
$= \left(\frac{1}{1-\frac{1}{S}}\right)^2$
$= \left(\frac{1}{1-\frac{1}{3}}\right)^2$
$= (3/2)^2$
$= 9/4$
Hence, the required perimeter = 4 × 9/4 = 9 cm

14. (b)



In the above figure, let BC be the building, CD is the tower, A is the position of man.
Let ∠CAB be θ. Then ∠DAB = 90- θ.
tan θ = CB/AB and
tan (90 – θ) = DB/AB
tan θ = $6/4\sqrt{3}$ and
cot θ = $(6+CD)/4\sqrt{3}$
$6/4\sqrt{3} = (6+CD)/4\sqrt{3}$
6 + CD = 48/6
CD = 2 = h (given)
Therefore, sin α = 1/h = 1/2



(3 tanα – 2 cosα)

$= 3 \times 1/\sqrt{3} - 2 \times \frac{\sqrt{3}}{2}$

= 0

15. 2022

Since $f_1(x) = \frac{3x+5}{2x-3}$

Then

$f_2(x) = f_1(f_1(x)) = \frac{\{3f_1(x)+5\}}{2f_1(x)-3} = x$

Hence,

$f_2(x) = f_4(x) = \cdots = f_{2022}(x) = x$

and

$f_1(x) = f_3(x) = \cdots = f_{2021}(x) = \frac{3x+5}{2x-3}$

Then

$|f_1(1)|+|f_{2022}(1)| = 1 + |-8| = 9$

$|f_2(1)|+|f_{2021}(1)| = 1 + |-8| = 9$

.

.

$|f_{1011}(1)|+|f_{1012}(1)| = 1 + |-8| = 9$

Hence, $P_i = 9 \; for \; all \;\; 1 \leq i \leq 1011$

So, $P_i \; = 2$

So, S= 2*1011 = 2022

16. 3.

Timing of reaching the home at the speeds of 6 km/h and 15 km/h, are 9:05 PM and 8:50 PM, respectively.

Hence, the difference in the time taken = 15 minutes

Let the distance from the home to the lab be x km.

So, we have the relation to calculate time as:

(x/6) - (x/15) = 15/60

⇒x= 2.5 km

He needs to reach the home by travelling for (8:20 pm to 9:10 pm) = 50 minutes

The required speed = 2.5/(50/60) = 3 km/h

17. (b)

External volume of the box = 36 × 25 × 8 = 7200 cm^3

The thickness of the wood is given as 5 mm = 0.5 cm

Therefore, internal length of the box = 36 – 2 × 0.5

= 35 cm.

Internal breadth of the box = 25 – 2 × 0.5

= 24 cm

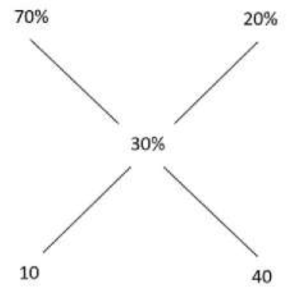
and internal height of the box = 8 – 2 × 0.5 = 7 cm

Now, we have to find
Internal volume of the box = 35 × 24 × 7
= 5880 cm^3
So, the volume of the wood = 7200 – 5880 = 1320 cm^3.
Now, the total weight of the wood = Volume × Weight of 1 cm^3 wood.
9000 gm = 1320 × Weight of 1 cm^3 wood.
So, weight of 1 cm^3 wood = 9000/1320 = 6.8 gm. (approx.)

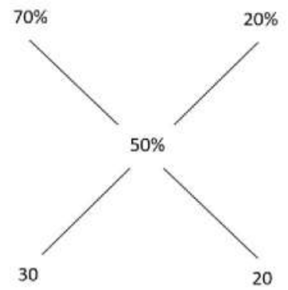
18. 770
Let the monthly income of Rajnikant = Rs. 100 y
Money, he gave to his sister = $100y \times \frac{30}{100} = 30y$
Thus, the remaining income of Rajnikant = 100y – 30y = 70y
And 60% of his remaining income he invests in business and health policy
= $70y \times \frac{60}{100} = 42y$
Now, according to the question,
$30y - 42y \times \frac{5}{12} = 1750$
$30y - \frac{35}{2}y = 1750$
$\frac{60y-35y}{2} = 1750$
$\frac{25y}{2} = 1750$
⇒ y = 140
Thus, the monthly income of Rajnikant = 100y = 100 × 140 =Rs. 14000
Money, he gave to his sister = 30 × 140 =Rs. 4200
And money he spent in business = $42 \times 140 \times \frac{7}{12}$ = Rs. 3430.

19. (b)
Given the radius of the circle = r units
Then, the area of the circle = πr^2
Now, the area of each blue sectors inside the circle = $2 \times 90^\circ/360^\circ \times \pi r^2$
= $2 \times ¼ \times \pi r^2$
= $\pi r^2/2$
Hence, the area of the white portion inside the circle = The area of the circle – The area of the blue portion inside the circle
= $\pi r^2 - \pi r^2/2$
= $\pi r^2/2$
Option 2 is correct.

20. (b)
To get a mixture with 30% concentration:



We should add both the mixtures in 1:4 ratio, hence a = 60*4 = 240 litres
To get a mixture with 50% concentration:



We should add both the mixtures in 3:2 ratio, hence a = 60/3*2 = 40 litres
Hence, the required range is 40 litres to 240 litres.

21. 1

$[(x-5)(x-3)+2][(x-2)(x-6)+4] = 0$
So, either $[(x-5)(x-3)+2] = 0$ or, $[(x-2)(x-6)+4] = 0$
$[(x-5)(x-3)+2] = 0$
$\Rightarrow x^2 - 8x + 17 = 0$
As, $8^2 < 4 \times 17$
So, no real roots are possible from $(x-3)(x-5) + 2 = 0$

Also, $[(x-2)(x-6)+4] = 0$
$\Rightarrow x^2 - 8x + 16 = 0$
$\Rightarrow (x-4)^2 = 0$
$\Rightarrow x = 4, 4$
Hence, the number of distinct real numbers is 1.

22. (b)

Given that from equation $x^2 + 2x + 2 = 0$
$(\alpha + \beta) = -2$
$\alpha\beta = 2$
$(\alpha^2 + \beta^2)$
$= (\alpha + \beta)^2 - 2\alpha\beta$
$= 4 - 4$
$= 0$
$(\alpha^4 + \beta^4)$
$= (\alpha^2 + \beta^2)^2 - 2\alpha^2\beta^2$
$= -2^3$
Also given that from equation $x^2 - 2x + 2 = 0$
$(\gamma + \delta) = 2$
$\gamma\delta = 2$
$(\gamma^2 + \delta^2)$
$= (\gamma + \delta)^2 - 2\gamma\delta$
$= 4 - 4$
$= 0$
$(\gamma^4 + \delta^4)$
$= (\gamma^2 + \delta^2)^2 - 2\gamma^2\delta^2$
$= -2^3$
$(\gamma^6 + \delta^6)$
$= (\gamma^4 + \delta^4)(\gamma^2 + \delta^2) - \gamma^2\delta^2(\gamma^2 + \delta^2)$
$= 0$
Hence,
$(\gamma^6 + \delta^6)(\alpha^4 + \beta^4) = 0$

Mock 4

1. (d)
The number of ways of selecting 3 Comic cards out of 10 = $^{10}C_3$ = 120
The number of ways of selecting 2 Comic cards lying next to each other = 9
The number of ways selecting the 3rd Comic card such that the 3rd Comic card does not lie adjacent to the first 2 Comic cards = 2*7+6*7 = 56
The number of ways selecting 3 Comic cards such that all the 3 Comic cards lie next to each other = 8
Thus, the total number of ways of selecting 3 Comic cards such that none of the 2 were lying next to each other = 120-56-8 = 56
Hence, the required probability = 56/120 = 7/15
Hence, option D is the correct answer.

2. 77
Area = $(2 * (1 + \sqrt{2}) * s^2)$, where s is the length of a side.
Using this formula, we can calculate the area of the octagon:
Area = $(2 * (1 + \sqrt{2}) * 4^2)$
= (2 * (1 + 1.41) * 16)
= 77.12 m^2

3. (b)
We see that the buses take 16 hr and 10 hr respectively to complete their journeys.
Let the distance between the stoppages be LCM (16, 10), i.e., 80 km.
∴ Speed of the first bus = 5 km/hr.
Speed of the second bus = 8 km/hr.
By the time the bus from X starts, bus from Y already would have travelled 8 km in 1 hr.
Now the distance between the buses = 80 – 8 = 72 km.
Relative speed of the buses = 8 + 5 = 13 km/hr.
Therefore, they will take 72/13 hr. after 10 p.m.
i.e., approximately at 3:32 a.m.
Option (2) is correct.

4. 50.
The number of boys who dropped out = n
The number of girls who joined = 2n
Total number of students increased = (2n – n) = n
Given,
n = 135
Also, let us assume that the number of boys at the beginning of 1^{st} year is 3k and the girls are k.
So,
(3k – 135)/(k + 270) = 5/4
12k – 540 = 5k + 1350
7k = 1890
k = 270
Initially total number of students = (3k + k) = 4k = 1080
% increase in the headcount = 135*100/1080 % = 50/4 % = a%
Thus, a = 50/4
4a = 50 (Answer)

5. (a)
Vinit mixes Rs. 20, Rs. 17 and Rs. 18 in the ratio x:y:z. y is the geometric mean of x and z. Let and z = 1, y = r and z = r^2

Let C be the CP of the sanitizer obtained after mixing the 3 elements.
Thus, 20x+17y+18z = C(x+y+z) => $20 + 17r + 18r^2 = C(1 + r + r^2)$
Company marks up the price of the sanitizer by 66.67%
Thus, MP = 5C/3
Company gives a 20% discount on this and thus, the SP = 4C/3
Company makes a profit of Rs 6 while selling 1 kg sanitizer.
=> 4C/3 – C = 6, C = 18.
Thus, $20 + 17r + 18r^2 = 18 + 18r + 18r^2$, r = 2
Hence, x:y:z = 1:2:4
Thus, if company mixes Rs 20, Rs 17 and Rs 18 varieties of rice in the ratio 4:1:2, then the CP of the mixture will be
= (17*1 + 18*2 + 20*4) / (1 + 2 + 4) = 19
Thus, the profit to company is 24 – 19 = Rs. 5 per kg.

6. (a)
3x + 2y = 12
x + 2y = 12 – 2x
From the above equation, we can say that maximum value x can take is 4 and minimum value x can take is 0.
x + 2y is maximum when 2x is minimum, when x = 0.
i.e., at x = 0,
Maximum value of x + 2y = 12 – 0 = 12
x + 2y is minimum when 2x is maximum, i.e., x = 4
Minimum value of x + 2y = 12 – 2(4) = 4
Now, the required average = (12+4)/2 = 8

7. (a)
Let total number of balls in tank = X
So, number of red balls (18X/100)
Number of blue balls = (4X/9)
Number of green balls = (8X/100)
Number of Yellow balls = X - [(18X/100) + (4X/9) + (8X/100)] = 266X/900
Given that,
266X/900 = 133
X = 900/2 = 450
Required difference = (18X/100) - (8X/100) = 10X/100 = 450/10 = 45.

8. 300.
To solve this question, we need to calculate the interest earned from each scheme and then find the difference between the two.
Scheme A: Simple Interest
The formula for calculating simple interest is:
Simple Interest = Principal × Rate × Time
In this case, the Principal is $10,000, the Rate is 12% per annum (0.12 as a decimal), and Time is 2 years.
Simple Interest = $10,000 × 0.12 × 2
Simple Interest = $2,400
Scheme B: Compound Interest
The formula for calculating compound interest is:
Amount = Principal × $(1 + \text{Rate})^{\text{Time}}$
In this case, the Principal is $10,000, the Rate is 10% per annum (0.10 as a decimal), and Time is 2 years.
Amount = $10,000 × $(1 + 0.10)^2$
Amount = $10,000 × $(1.10)^2$

Amount = $10,000 × 1.21
Amount = $12,100
Now, to find the compound interest earned, we subtract the principal from the final amount:
Compound Interest = Amount - Principal
Compound Interest = $12,100 - $10,000
Compound Interest = $2,100
Now we need to find the difference between the interest earned from Scheme B and Scheme A:
Difference = Compound Interest (Scheme A) - Simple Interest (Scheme B)
Difference = $2,400 - $2,100
Difference = $300
The person will earn $300 less in Scheme B than in Scheme A at the end of the period.

9. (c)

$$\frac{3\sin^2\theta+\sin\theta+3}{\sin\theta}\times\frac{4\cos^2\theta+\cos\theta+4}{\cos\theta}$$

$$\left(3\left(\sin\theta+\frac{1}{\sin\theta}\right)+1\right)\times\left(4\left(\cos\theta+\frac{1}{\cos\theta}\right)+1\right)$$

$$AM\geq GM$$

$$\frac{\sin\theta+\frac{1}{\sin\theta}}{2}\geq\sqrt{\sin\theta\times\frac{1}{\sin\theta}}$$

and

$$\frac{\cos\theta+\frac{1}{\cos\theta}}{2}\geq\sqrt{\cos\theta\times\frac{1}{\cos\theta}}$$

$$(3(2)+1)(4(2)+1)=7\times9=63$$

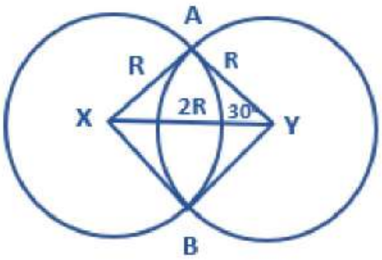
The minimum value of the expression is 63.

10. 1008.
It is given, 5D = 20V = 7Q and Ankita bought 6D, 16V and 8Q.
Let, 5D = 20V = 7Q = 140k
D = 28k, V = 7k, and Q = 20k
Cost price of 6D, 16V and 8Q = 6(28k) + 16(7k) + 8(20k) = 440k
Marked up price = 440k + 1695
S.P. = 6/30 × (440k + 1695) + (1-6/30) (440k + 1695) (1-50/3%) [Since, 16.66% = 50/3 %]
= 1/5(440k + 1695) + 4/5 × 5/6 × (440k + 1695)
= 13/15 (440k + 1695)
So, the profit = S.P. – C.P.
= 13/15 (440k + 1695) - 440k
= 1469 – 176k/3
Therefore, by the condition,
1469 – 176k/3 = 1117
176k/3 = 1469 – 1117
176k/3 = 352
k = 6
Then, the cost of almonds = 6D = 6 × 28 × 6 = $1008

11. (b)
Cost of each shirt. = C
Cost of each jacket = 3C
Kartik bought 18 jackets and S shirts.
Total Cost = 18×3C + SC

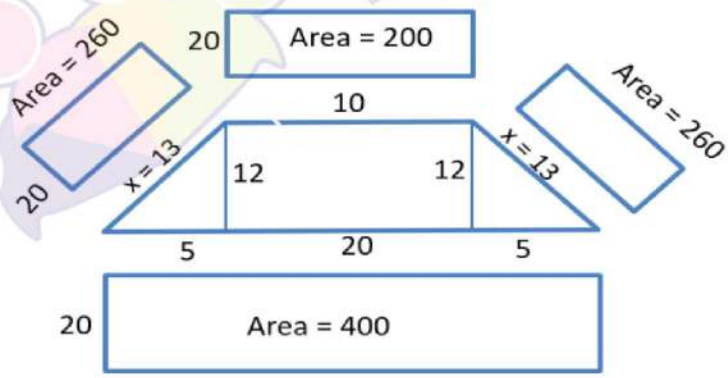
= 54C + SC
= C (S + 54)
Kartik bought an S jacket and 18 shirts.
Total Cost = 18 × C + S (3C)
= 3C (S + 6)
C (S + 54) (1 – 1/17) = 3C (S + 6)
=> S = 558/35
S ≈ 16

12. 130.



Let us assume that XA = R where X is the centre of the left circle.
So, YA = $R\sqrt{3}$, XY = 2R
In ΔAXY,
XY = 2R, AX = R, AY = $R\sqrt{3}$
So, $XY^2 = AX^2 + AY^2$
Thus, ∠XAY = 90°, $\angle AXY = 60^o$, $\angle AYX = 30^o$
So, $\angle AXB = 120^o$, $\angle AYB = 60^o$
Hence, Ramesh covered (360° – 120°) = 240° angle and Suresh covered (360° – 60°) = 300° angle in 10s.
So, Ramesh travels 24°/s and Suresh 30°/s.
Ramesh takes 15s to make a full circle and Suresh takes 12s to make a full circle.
Thus, they will meet at B in every 60s.
So, they will meet for the 3rd time at {(60×2)+10}s = 130s.

13. (c)



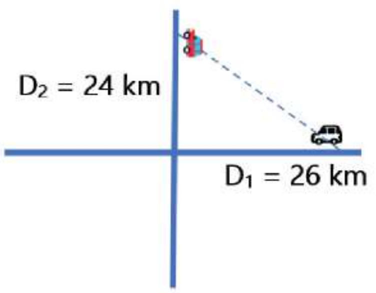
We have to find the total area of all six surfaces of the pillar which is 4 rectangles + 2 trapeziums one at the top and one at the bottom
Area of the rectangle = b × h
⟹ Area of rectangle with l = 20 b = 10
⟹ Area = 200 sq.cm
⟹ Area of rectangle with l = 20 b = 20
Area = 400 sq.cm
⟹ Area of 2 rectangles with l = 20 b = 13 is 2 × 13 × 20 = 520 sq. cm
Sum of areas of 4 rectangles = 520 + 200 + 400 = 1120 sq.cm
Area of the trapezium = $\frac{1}{2}$ × 12 (10 + 20)

Area of the trapezium = 6 × 30 = 180 sq.cm
Area of both the trapezium = 2 × 180 = 360 sq.cm
Sum of areas of 4 rectangles = 1120 sq.cm.
Area of both the trapezium = 360 sq.cm
Total surface area of the pillar = 4 rectangles + 2 trapeziums
Total surface area of the pillar = 1120 + 360
Total surface area of the pillar = 1480 sq.cm

14. 5.
The prime factorisation of 8! /21, i.e., 1920 = 27 × 3 × 5
The possible ways of forming the number are
27 × 3 × 5 = 9!/7! = 72
4 × 25 × 3 × 5 × 1 = 9!/5! = 3024
4 × 4 × 23 × 3 × 5 × 12 = 9!/(3!2!2!) = 15120
4 × 4 × 4 × 2 × 3 × 5 × 1 × 1 × 1 = 9!/(3!3!) = 10080
Hence, by the given condition,
786 × 6k = 72 + 3024 + 15120 + 10080 = 28296
6k = 36
k = 2
Now,
f (x+y) - f (xy) = 0
f (x+y) = f (xy)
Putting x = 1 & y = 1
f (1+1) = f (1)
f (2) = f (1) = 5 [Since, f(k)=5, where k = 2]
Putting x = 0 & y = 1
f (0+1) = f (0)
f (0) = f (1) = 5
f (0+8!/21) = f (0)
f (8!/21) = f (0) = 5

15. (c)
Let the speed of the cycle = x km/hr
The difference of time taken in both cases is 4 hr, so we have
90/x – 90/(x+6) = 4
$90(x+6)-90x=4x^2+24x$
$540 = 4x^2+24x$
x=9
Hence, the speed of the car = 9+6 =15 km/hr

16. (c)
Let the initial distance of the black car and the red car from the intersection is D_1 and D_2 respectively as shown in the diagram below.



The black car is moving at a speed of 70 km/hr towards the point of intersection.
In 12 minutes i.e., 1/5 hrs, it would have travelled a distance of 70 × 1/5 = 14 km.

So, after 12 minutes, the distance between the black car and the point of intersection = 26 - 14 = 12 km
The red car is moving away from the point of intersection at a speed of 55 km/hr.
In 12 minutes i.e., 1/5 hrs, it would have travelled a distance of 11 km.
So, the distance of the red car from the point of intersection = 24 + 11 = 35 km
Hence, after 12 minutes, the distance between the two cars = $\sqrt{12^2 + 35^2}$ = 37 km
Hence, option (C) is correct.

17. 2233
Let the annual profit be Rs. x.
Then, \$(x – 95 × 12), i.e., \$(x-1140) will be distributed between Mr. Richard and Mr. Nadar as their shares of profit.
Ratio of profits = Ratio of investments
So, Mr. Richard: Mr. Nadar = 6000: 7000 = 6: 7
Mr. Richard 's share = 1140 + (x - 1140) × 6/13
=> 1140 +(x-1140) × 6/13 = 3054
=>x-1140 = 4147
Mr. Nadar's share = 7/13 × (x-1140)
= 7/13 × 4147
=\$2233

18. (c)
There are a total of 9 stoppages.
Let name them as A, B, C, ..., I
If anyone wants to travel from A to B, C, D, E, ..., I then there will be 8 tickets required.
Now from B station to C, D, E.....I then there will be 7 tickets required. In the same it will go until 1 ticket will be required.
So, the total bus tickets required will be =8+7+6+5+4+...+1
= (8×9)/2
= 36
But for both ways double tickets will be required.
So, total tickets = 36 × 2=72

19. 8
Let the other root is r.
Then, m – m + r = - (-k/12)
r = k/12 .... (i)
- m^2 + rm – rm = - 432/12 = -36
m^2 = 36 .... (ii)
Also, -m^2r = - 144/12 = -12
r × 36 = 12
r = 1/3 .... (iii)
So, from (i) and (iii) we have
k = 12r = 12 × 1/3 = 4
Now, $^nP_4$ = 1680
$\frac{n!}{(n-4)!} = 1680$
n(n-1)(n-2)(n-3) = 8 × 7 × 6 × 5
After solving, we get n = 8

20. (c)
3$\log_2$x – $\log_x$(1/4) = 3$\log_2$x + $\log_x$4
3$\log_2$x + 2$\log_x$2 = 3$\log_2$x + $2/log_2x$
Let $\log_2$x be 'a'.
So, 3$\log_2$x + 2$\log_x$2 = 3a + 2/a

Now checking manually for integer values
Let 3a + 2/a = 1
$3a^2$ -a +2 =0, no real roots as D<0

Let 3a + 2/a = 2
$3a^2$ -2a +2 =0, no real roots as D<0

Let 3a + 2/a = 3
$3a^2$ -3a +2 =0, no real roots as D<0

Let 3a + 2/a = 4
$3a^2$ -4a +2 =0, no real roots as D<0

Let 3a + 2/a = **5 (answer)**
$3a^2$ -5a +2 = 0 has real roots as D = 1 > 0.

21. (c)
PQR will have the least profit if the product was sold by the person who is in the bottom most position of the pyramid.
The profits distributed as commission is
(30% + 10%*30% + 10%*10%*30% + ...)
= 30%*(1 + 10% + $(10\%)^2$ + ...)
= 30%*(1/(1-10%))
= 100%/3
The true selling price of the company is = (100% - 100%/3)* ₹300 = ₹200
% Profit = (₹200 - ₹160)/ ₹160 = 25%

22. (c)
Given, y < 5
i.e., 5 – y >0
Now, let z = 5 – y > 0
Then,
$\frac{y^2-10y+26}{5-y} = \frac{y^2-10y+25+1}{5-y} = \frac{(5-y)^2+1}{5-y}$
$= \frac{z^2+1}{z}$
$= z + \frac{1}{z}$
Now, the minimum value of $z + \frac{1}{z} = 1 + 1 = 2$, since z > 0.
Hence, the minimum value of $\frac{y^2-10y+26}{5-y}$ is 2.

Mock 5

1. (c)
In the time that Abhay runs 200 m, Chetan runs 160m so the ratio of speeds of Abhay and Chetan is 5:4
In the time Chetan runs 200m, Kundan runs 180m. So the ratio of speeds of Chetan and Kundan is 10:9
Thus we can say that in the time that Chetan runs 160m, Kundan runs $\frac{160\times9}{10}$ = 144 m
Thus in a 200 m race, Abhay will Kundan by 56m. Thus in a 500 m race, Abhay will beat Chandan by 56×2.5 = 140m

2. (d)

Let's say Sunita and Danish came up with 3 numbers in the dice as 3, 4 & 5 then first they multiply the number and they write all the natural numbers which are less than the (3*4*5) in an ascending order and then deletes the number which are not co-prime to the number 3*4*5. So, eventually, they will be left with all the numbers which are less than (3*4*5) and co-prime to it which we can find through Euler's theorem.

So, for 3*4*5, value of N is

3*4*5*(1-1/2)*(1-1/2)*(1-1/5)

= 16

From the given options, 42 is not possible as 42 has a prime factor as 7 which can not appear when we are rolling a dice. Thus, option II is not possible.

The highest outcome post multiplying the 3 rolls which do not have any multiple of 2 is 5*5*5 = 125.

N for 125 is 125*(1-1/5) = 100. Thus, 100 is possible. So, option III is possible.

The value of N should always be less than 108 as –

Any number which is more than 125 (that can come as an outcome) is going to have 2 as one of it's factor, so the value of N corresponding to that value is going to be less than ½ of the value. As it is not possible to have an outcome of 240 as a product of the three rolls (maximum number is 216), thus 120 is wrong.

As, option II, IV are wrong, the only option supporting these 2 are option D. Hence, option D is the right answer.

3. (b)

When Rajdhaani express starts its journey, Banaras express has already travelled for 7 hours.

Hence, it must be 350 km away from Delhi when Rajdhaani express starts.

Similarly, Shatabdi express would have travelled for 4 hours and 30 minutes. Hence, it would be 40*4.5 = 180 km away from Delhi.

Now at 1:30 pm, the distance between Banaras and Shatabdi express is 170 km. Now the relative speed between the two is 10 km/hr.

Hence, this difference will increase by 10 km every hour. Moreover, at the same time (1:30 pm), the distance between Banaras and Rajdhaani express is 880 - 350 = 530 km.

Now, the relative speed of the two trains is 110 km/hr.

Hence, the distance will keep reducing at the speed of 110 km/hr.

Now suppose, Rajdhaani and Shatabdi express are equidistant from Banaras express 'x' hours after 1:30 pm.

So, we have 170 + 10x = 530 – 110x

120x = 360

x=3

Hence, both the trains will be equidistant from Banaras express at 4:30 pm.

4. 32.

Time taken by Tap A alone to completely fill the empty pool = 16 hours

Efficiency of tap B = 4 × efficiency of tap A

(Efficiency of tap B)/ (Efficiency of tap A) = 4/1

(Time taken by tap B) / (Time taken by tap A) = 1/4 [Since, time and efficiency are inversely proportional to each other]

Time taken by tap B alone to completely fill the empty pool = 16/4 = 4 hours

Let total capacity of pool LCM of 4 and 16 = 16 m^3

Efficiency of tap A = 1 m^3/hr

Efficiency of tap B = 4 m^3/hr

Part of pool filled by tap A and tap B in two hours together = (1+4) × 2 = 10 m^3

Remaining part = 16-10 = 6 m^3

Remaining part is completed by tap C alone in 12 hours

Efficiency of tap C = 6/12 = 0.5 m^3/hrz

Time required by tap C alone to completely fill the empty pool = 16/0.5 = 32 hours

5. 310.
Himani will add the minimum amount of C when he needs a solution of 17%.
Let x be the minimum amount of C he needs to add to the solution.
Thus,
0.18*120 + 0.16*160 + 0.21x = 0.17(280+x)
Thus, 18*120 + 16*160 + 21x = 17(280+x)
2160+2560+21x = 4760+17x
=> 4x = 40
Thus, x = 10 is the minimum amount of C he needs to add.
He will add the maximum amount of C when he needs a solution of concentration 19%.
Let y be the maximum amount of C that Harish can add.
Thus,
0.18*120 + 0.16*160 + 0.21y = 0.19(280+y)
18*120 + 16*160 + 21y = 19(280+y)
4720+21y = 5320+19y
2y = 600
=> y = 300 is the maximum amount of C that can be added.
Hence, x+y = 10+300 = 310 is the required answer.

6. 80.
Total number of students = 20 + X + 1 + X- 9 = 2X + 12 = 2(X + 6)
so, total weight of the class VI, VII and VIII = 2(X + 6) × 48.75 = 97.5(X + 6)
=> 20 × 45 + (X + 1) × 60 + (X - 9) × 36 = 97.5(X + 6)
=> 900 + 60X + 60 + 36X - 324 = 97.5X + 585
=> 1.5X = 51
=> x = 51/1.5
= > x = 34
Hence, total number of students = 2 (34 + 6) = 80

7. 11.
Let the total time be "T" months.
After 5 months let the time remaining be 't' months.
Initial investments are,
Elara = 5 × 90000/12 = 37500
Johnson = 7 × 90000/12 = 52500
Ratio of profit share is,
{37500 × 5 + 37500 × 0.75 × (t - 3)}: (52500 × 5 + 52500 × 0.8 × t) = 725: 1372
{375× (5+0.75t - 2.25)}: {525× (5 + 0.8t)} = 725: 1372
{5× (2.75 +0.75t)}/ {7× (5+0.8t)} = 725/1372
(2.75 +0.75t)/ (5+0.8t) = 145/ 196
539 +147t = 725 + 116t
31t = 186
t = 6
We get,
t = 6 months
Total time period = 5+t = 11 months

8. 15.
Let the cost price of 1 kg of Apple be Rs.1.
Selling price of 1 kg Apple packet = Rs.1.3
Selling price of 3kg of Apple packet = Rs.3.9.
But, by paying Rs. 3.9, the customer gets 5 kg of Apples.

Therefore, the selling price of Apples that are not sold as 1 kg packets = 3.9/5
Let the number of 1 kg packets that are sold for a price (not counting the ones given away with the 3 kg packets) be x.
x kg of Apples is sold as 1 kg packets and the remaining are sold as 5 kg combos (3 kg + 2*1kg packets).
It has been given that the net profit percentage is 17%. Therefore, the net revenue = Rs. 117
$1.3x + 3.9(100-x)/5 = 117$
$6.5x + 390 - 3.9x = 585$
$2.6x = 195$
$x = 75.$
Therefore, 75 kg of Apples are sold as 1 kg packets.
Remaining 25 kg must be sold as 5 kg combos. 25/5 = 5 combos are sold in total. 5 combos will contain 5 packets of 3 kg. Therefore, quantity of Apple sold as 3 kg packets = 5*3 = 15 kg or 15%.

9. (a)
Interest = 40,625 × 88/625 = Rs. 5720
$1/5^{th}$ money = 65000/5 = 13,000
Let rate = r%
$13,000 \times ((1+ r/100)^2 - 1) = 5720$
r = 20% p.a.
Now, money invested by Adani in business = 4 × 65000/5 - 4000 = 48,000
Investment of QIA = m
Ratio of share of profit of Adani and QIA is,
40,625: (87,100 - 40,625) = 125: 143
i.e., (48000×7 + 48000 × 1.1 × 5): (m × 5 + (m – 4800) ×7) = 125: 143
We get, m = Rs. 60,000

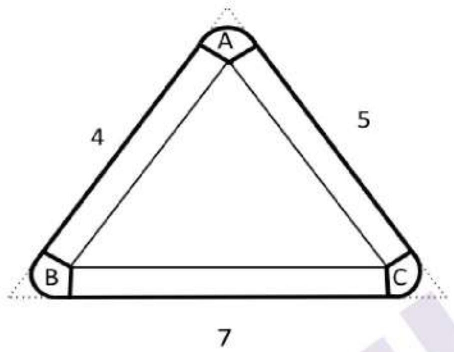
10. 120.
Let Trevor and Adani have x and y number of shares respectively. It is given x + y < 125. Let the number of shares they exchanged be k.
Then, (x + k) = 5(y-k)
And (x-k) = 4(y+k)
i.e., x- 5y = -6k and x- 4y = 5k
(x - 5y) / (x - 4y) = -6/5
Cancelling k, we get 11x = 49y
x: y = 49:11.
Therefore, the possible sum of numbers is 60 & 120.
Since, 60 is not possible, so the answer is 120.

11. 41.
Let us consider that at least ‘a’ items must be sold to gain 35% profit.
Total cost price = 30a
Total selling price = 1 + 3 + 5 ... (a terms) = a^2
Since minimum profit requirement is 35%
Total selling price = 1.35 × Total cost price,
$a^2 = 1.35 \times 30a$,
a = 40.5 = 41 items
Hence, 41 items is the right answer.

12. (d)
$2^{(2x + 2)} + 2^{(x + 2)} = 24$
$4*2^{(2x)} + 4*2^x = 24$
$2^{(2x)} + 2^x = 6$
Let us assume that $2^x = p$

So,
$2^{(2x)} + 2^x = 6$
$p^2 + p = 6$
$p^2 + 3p - 2p - 6 = 0$
$p(p+3) - 2(p+3) = 0$
$p = -3, 2$
2^x cannot assume a negative value.
So,
$2^x = 2$
$x = 1$
So,
$(x^{2023} + x^{2022} + x^{2021}) = 1 + 1 + 1 = 3$
Option A is $x^2 + 1 = 1 + 1 = 2$
Option B is $2^x + x^2 = 2 + 1 = 3$ [Correct]
Option C is $(x + 2) = 1 + 2 = 3$ [Correct]
So, both option B & C are correct.
Hence, option D is the right choice.

13. (c)



Distance travelled by the man is
= 4+5+7+circumference of sections (A+B+C)
$=16+2\pi$ {Since circumference of sector (A+B+C) = circumference of full circle}

14. 2.
$(b \sin \theta - \sqrt{3})^2 + (b \cos \theta - 1)^2 = 0$
It is possible only when,
$b \sin \theta - \sqrt{3} = 0$ and $b \cos \theta - 1 = 0$
$b \sin \theta = \sqrt{3}$ and $b \cos \theta = 1$
Now, $b^2 \cos^2 \theta + b^2 \sin^2 \theta = (\sqrt{3})^2 + 1^2 = 4$
$b^2 = 4$
Now,
$x^{\frac{5}{6}} x^{\frac{1}{6}} k \left(\frac{x}{k} + \frac{k}{x}\right) = 4 \Rightarrow xk\left(\frac{x^2+k^2}{kx}\right) = 4 \Rightarrow (x^2 + k^2) = 4$
$x^2 = 4 - k^2$
The maximum value of x will be obtained if k=0.
Then, $x^2 = 4$
$x = 2$ (maximum value)

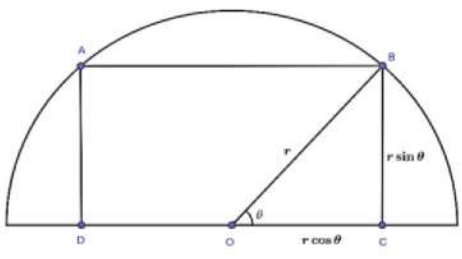
15. (c)
Let us assume that after t days Pathan will recover its cost. Let us assume that t < 10 days.
So, 5000*10*t = 1000000
t = 20
This is not true as we assumed that t < 10.
So, t cannot be < 10. Now let us assume that 10 < t < 20.

So,
5000*10*10 + (5000 – 500)*(10 – 1)*(t – 10) = 1000000
4500*9*(t – 10) = 500000
(t – 10) = 5000/(45*9) > 10
(t – 10) > 10
t > 20 which is not possible as the assumption was t < 20
Thus, t < 20 is not possible.
Now, let us consider that 20 < t < 30
So,
5000*10*10 + (5000 – 500)*(10 – 1)*10 + (5000 – 500 – 500)*(10 – 2)*(t – 20) = 1000000
4000*8*(t – 20) = 500000 – 405000 = 95000
(t – 20) = 95/32
t ≈ 23
So, after the end of 23rd day Pathan will be able to get its cost recovered.
Thus, the answer is (22 + 25th January) = 16th February.

16. 12.
Speed of boat downstream = 120/2 = 60 km/hr
Speed of current = 1/3 × 60 = 20 km/hr
Let the speed of boat in still water = x km/hr
Speed of boat downstream = speed of boat in still water + speed of current
60 = x + 20
x = 40
Speed of boat upstream = speed of boat in still water - speed of current
= 40 - 20
= 20 km/hr
Required time = 240/20 = 12 hours.

17. (a)
Let length of shorter and longer diagonals of the rhombus is 'a' and 'b' respectively.
Height of cylinder = b × (100/40) = 2.5b
Volume of sphere = $(4/3)\pi(a)^3$
Volume of cylinder = $\pi(b)^2(2.5b)$
Ratio of volumes = $(4/3)\pi(a)^3 : \pi(b)^2(2.5b) = 9 : 5$
=> $a^3/b^3 = 27/8$
=> a: b = 3: 2
Let the length of diagonals of the rhombus is 3x and 2x respectively.
Area of rhombus = (1/2) × 3x × 2x = 147
=> $x^2 = 49$
=> x = 7 cm
Difference between the length of both the diagonals of the rhombus
= 3x – 2x= x
= 7 cm.

18. (b)



The area of the rectangle ABCD = BC × CD = Δ
= r sin θ × 2r cos θ
= $r^2 \sin 2\theta$
Max (Δ) = r^2
Thus, the minimum area of the remaining sheet = $\pi r^2/2 - r^2$
= $r^2(\pi/2 - 1)$

19. 17
For x = 1 to 2
$\left[\frac{2}{3}+\frac{x}{9}\right] = 0$
For x = 3 to 11 [Total 9 positive integers.]
$\left[\frac{2}{3}+\frac{x}{9}\right] = 1$
For x = 12 to 17 [Total 6 positive integers.]
$\left[\frac{2}{3}+\frac{x}{9}\right] = 2$
Hence, M = 17
[i.e., $\sum_{x=1}^{17}\left[\frac{2}{3}+\frac{x}{9}\right] = 1 \times 9 + 6 \times 2 = 21$]

20. (d)
It is given that α, β are the real roots of the quadratic equation $(px^2 - 4px + 2p + 1) = 0$
So, for $(px^2 - 4px + 2p + 1) = 0$ to have a real solution, the discriminant should be greater than or equal to 0.
So,
$(4p)^2 \geq 4p(2p + 1)$
$4p \geq 2p + 1$ [As $p \neq 0$ given that $(px^2 - 4px + 2p + 1) = 0$ is a quadratic equation]
$p \geq ½$
It is given that $p \leq ½$, so $p = ½$
Hence,
$(px^2 - 4px + 2p + 1) = 0$
$x^2/2 - 2x + 2 = 0$
$x^2 - 4x + 4 = 0$
x = 2, 2
$\alpha = \beta = 2$
So,
$(\alpha/\beta)^{2023}x^2 - (\alpha+\beta)p^2x - (\alpha/p)^2 - (\beta/p) = 0$
$x^2 - x - 16 - 4 = 0$
$x^2 - 5x + 4x - 20 = 0$
x = 5, -4

21. (a)
$\log_{256}(16\log_2(1 + \log_6(3 + 3\log_3 x))) = ½$
$256^{1/2} = 16\log_2(1 + \log_6(3 + 3\log_3 x))$
$16\log_2(1 + \log_6(3 + 3\log_3 x)) = 16$
$\log_2(1 + \log_6(3 + 3\log_3 x)) = 1$
$(1 + \log_6(3 + 3\log_3 x)) = 2$
$\log_6(3 + 3\log_3 x) = 1$
$3 + 3\log_3 x = 6$, $3\log_3 x = 3$
Hence x = 3.

22. 0.
Let $2x^2 + x = y$
Then, the inequality becomes
$\frac{y-5}{(y-3)(y-1)} \geq 1$

Rewriting in the standard form, we have
$\frac{-y^2+5y-8}{(y-3)(y-1)} \geq 0$
After solving by wavy curvy method, we have
$1 < y < 3$
Now,
$1 < 2x^2 + x < 3$
$\Rightarrow 1 < 2x^2 + x \Rightarrow x < -1$ or, $x > ½$
Also, $2x^2 + x < 3 \Rightarrow -3/2 < x < 1$
Combining the intervals, we have
$-3/2 < x < -1$ or, $½ < x < 1$
i.e., $x \in (-3/2, -1) \cup (1/2, 1) = (-a-1, -1) \cup (a, 1)$ [Given]
$\Rightarrow a = ½$
Now, $\log_{2048} [3a/(1+a)]$
$= \log_{2048} [3(1/2)/(1+1/2)]$
$= \log_{2048} (1)$
$= 0$

Mock 6

1. 225

Only 2 points in the same row or column can form the sides of the rectangle.
The first side of the rectangle can be chosen in 6 ways (Selecting the row or column). Then, 2 points from that row must be selected. This can be done in ${}^6C_2 = 15$ ways.
Now, we have fixed the length of the rectangle. Now, apart from the point selected, each row will have 5 other points. One of these points has to be selected to complete the rectangle. This can be done in 5 ways.
Therefore, the total number of rectangles that can be formed = 6*15*5 = 450.
However, we could have obtained the same rectangle by selecting the second row first and the first row second. Therefore, the total number of rectangles that can be formed = 450/2 = 225.

2. 4x

The last two digits of 9867^{1668} is equivalent to the last two digits of $(...21)^{1668/4} = (....21)^{417}$.
Now, the unit's digit of a number ending with 1 is 1.
Also, the ten's digit can be obtained as (2 × 7 = 14) i.e., 4.
Therefore, the last two digits of 9867^{1668} are 4, 1.
Then, the sum of the last two digits = 4 + 1 = 5
Now, √☐, since p = 5

Let, f(x) = √☐

Then, √☐

- √☐
- √☐
- −¿ (x - 1) (x - 3) ≥ 0
- $(x - 1)(x - 3) \leq 0$
- $1 \leq x \leq 3$

Now, let $g(x) = 5 - 2x$
Then, either $g(x) \geq 0$ or, $g(x) < 0$
i.e., $5 - 2x \geq 0$ or, $5 - 2x < 0$

=> $x \leq 5/2$ or, $x > 5/2$
Now, two cases can be arrived when $f(x) > g(x)$.
Case 1: $f(x) \geq 0, g(x) \geq 0$
$1 \leq x \leq 3$, and $x \leq 5/2$ .... (i)
Case 2: $f(x) \geq 0, g(x) < 0$
$1 \leq x \leq 3$, and $x > 5/2$ ..... (ii)
Assuming Case 1-

Therefore, $\sqrt{\square}$

=> $-x^2 + 4x - 3 > (5 - 2x)^2$

=> $-x^2 + 4x - 3 > 25 - 20x + 4x^2$

- $5x^2 - 24x + 28 < 0$
- $5x^2 - 10x - 14x + 28 < 0$
- $5x(x - 2) - 14(x - 2) < 0$
- $(5x - 14)(x - 2) < 0$

$5x - 14 < 0$ and $x - 2 > 0$

- $x < 14/5$ and $x > 2$
- $x \in (2, 14/5)$

i.e., $2 < x < 14/5$ .... (iii)

Therefore, when $1 \leq x \leq 5/2$, $f(x) > g(x)$ is possible if $2 < x < 14/5$.

- $2 < x \leq 5/2$

Case II
When $5/2 < x \leq 3$, then $f(x) \geq 0, g(x) < 0$
Thus, $f(x) > g(x)$ implies $x \in (2, 3]$
Now, 4x will be integer if x = 2.5, 2.25, 2.75 and 3
Hence, x can have 4 values for which 4x is an integer.

3. (d)
When two people run on a circular track with speeds a m/s and b m/s in the same direction, then the number of distinct meeting points will be |x - y| where x:y is a:b in the minimal format.
If they meet at the starting point the fourth time they meet, then they can meet at 1 distinct point or 2 distinct points or 4 distinct points.
This corresponds to |x - y| being 1, 2 or 4. Now let us take a look at the options.
Option A - x = 3 and y = 4. |x - y| = 1. Hence, this option is valid.
Option B - a:b = 36/28 = 9/7. Hence, |x - y| = 2. Hence, this is a valid option.
Option C - a:b = 35/15 = 7/3. Hence, |x - y| = 4. Hence, this is a valid option.
Option D - a:b = 28/7= 4/1. Hence, |x - y| 3. This is not a valid value. Thus,the answer is option D.

4. 196
Let the number of flowerpots that 1 male and 1 female individually can create in a day be 'm' and 'f' respectively.
: $(5m + 3f) \times 4 = (3m + 3f) \times 5$
:$5m = 3f$ .... (1)
Also, $(m + f) \times 50 = 400$
$m + f = 8$...... (2)

Solving the two equations, we get m = 3 and f = 5.
The required answer = (6m + 2f) x 7 = 196

5. (c)
Ratio of oil and water in first tank = 2 : 5…….(1)
Total = 7 units.
Ratio of oil and water in second tank = 6 : 11……..(2)
Total = 17 units.
Here it is given that the total quantity on both the tank is similar,
On multiplying the first equation by 17 and second by 7 we get,
Ratio of oil and water in first tank = 34 : 85
Total = 119 units
Ratio of oil and water in second tank = 42 : 77
Total = 119 units.
On mixing both the solution the combined ratio will be
= 34 + 42 : 85 + 77 = 76 : 162
= 38 : 81.
Hence option(c) is correct

6. (c)
Let the number of students in class X and class Y be a and b respectively.
We know that the average weight of both the classes combined is 75kg.
Total weight of the 2 classes combined = 75(a + b) = 75a + 75b ---------(1)
The average weight of class X is 45 kg more than the average weight of class Y.
Let the average weight of class Y be 'x'.
Total weight of the 2 classes combined = (x + 45)a + xb --------------------(2)
Combining (1) and (2), we get,
75a + 75b = (x + 45)a + xb
75a + 75b = xa + 45a + xb
75a - 45a - xa = xb - 75b
30a - xa = xb - 75b
a(30 - x) = b(x - 75)
a/b = (x - 75)/(30 - x)
It has been given that x is an integer
Option A:
(x - 75) / (30 - x) = 8/1
x - 75 = 240 - 8x
9x = 315
x = 35
Option B:
(x - 75) / (30 - x) = 1/2
2x - 150 = 30 - x
3x = 180
x = 60
Option D:
(x - 75) / (30 - x) = 2/1
x - 75 = 60 - 2x
3x = 135
x = 45
Option C:
(x - 75) / (30 - x) = 1/5
5x - 375 = 30 - x
6x = 405
x = 67.5

It has been given that x is an integer. Therefore, the ratio of the number of students in class X and class Y cannot be 1:5 and hence, option C is the right answer.

7. (b)
The dishonest shopkeeper had purchased 1/0.8 kg = 1.25 kg of R1 rice at 50 INR/kg.
So, his cost price is 50 INR/1.25kg = 40 INR/kg.
He purchased 1.25 kg of R2 rice at 30 INR/kg.
So, his cost price for R2 rice is 30 INR/1.25 = 24 INR/kg.
R1 & R2 rice is mixed in the ratio of 3 : 1.
Thus, the cost price of the mixture is (40*3 + 24*1)/4 INR/kg = 36 INR/kg.
While selling he sells rice of actual weight 1 kg, showing 1.2 kg to his customer.
So, when he sells 1/1.2 kg of rice, his cost price is 36/1.2 INR = 30 INR.
To get 50% profit, the selling price should be 30*1.5 INR = 45 INR
Thus, the discount offered will be (1 - 45/50)*100% = 10%

8. 1650
Given, 3 friends Abir, Babar and Cantor, started a partnership business by taking bank loan of Rs. 4800, Rs.6400 and Rs. 3600.
Ratio of partnership = 4800 : 6400 : 3600
= 12 : 16 : 9
Total profit = 35,150
Abir's profit = 12/37 × 35150 = Rs. 11,400
Babar's profit = 16/37 × 35,150 = Rs. 15,200
Cantor's profit = 9/37 × 35,150 = Rs. 8550
Hence, Abir's, Babar's and Cantor's share after they have returned their respective Loans:
Abir's share = Rs. 11,400 – 4800 = Rs. 6600
Babar's share = Rs. 15,200 – 6400 = Rs. 8800
Cantor's share = Rs. 8550 – 3600 = Rs. 4950
The required difference = Abir's share - Cantor's share
= Rs. 6600 – 4950
= Rs. 1650

9. 50 kg
Given,
Cost of kg of coffee is = Rs.1500/kg.
Cost of 20 kg of coffee is = Rs.2000/kg.
Total weight of coffee is = 20 + x
Average cost of total coffee = Rs1700
Therefore, according to the question

$$\Rightarrow \frac{1500x+(20\times 2000)}{20+x}=1700$$

$$\Rightarrow 1500x+40000=1700(20+x)$$

$$\Rightarrow 40000-34000=1700x-1500x$$

$$\Rightarrow 6000=200x$$

$$\Rightarrow x=6000/200$$

$$\Rightarrow x=30$$

Total weight of coffee purchased is = (20 + 30) kg ¿ 50 kg

10. (c)

Let the number of items bought by Aman be 8x, Rohit be 5y and Samson be 8z.
Thus, the number of pens bought will be 5x + 3z, the number of erasers bought will be 3x + 2y and the number of rulers bought will be 3y + 5z.
We are given that,
5x + 3z > 3y + 5z and 3y + 5z > 3x + 2y
5x + 3z > 3y + 5z 5x > 3y + 2z {Therefore, we can say that the value of x is greater than at least one of y and z}
We have to find out the minimum value of 8x + 5y + 8z. x, y, z are positive natural numbers since these are used to represent the ratio equivalent.
Case 1: When x = 2, y = 1 and z = 1
Then, we can see that 5x + 3z > 3y + 5z. But 3y + 5z = 3x + 2y which is incorrect as we have to ensure that 3y + 5z > 3x + 2y.
Case 2: When x = 2, y = 2 and z = 1
Then, we can see that 5x+3z>3y+5z and 3y + 5z > 3x + 2y. Therefore, this is a possible solution.
We can find out the value of 8x+5y+8z = 8*2 + 5*2 + 8*1 = 34.
Case 3: When x = 2, y = 1 and z = 2
Then, we can see that 5x + 3z > 3y + 5z and 3y + 5z > 3x + 2y. Therefore, this is also a possible solution.
We can find out the value of 8x + 5y + 8z = 8*2 + 5*1 + 8*2 = 37.
Now if we increase the value of x then the value of '8x + 5y + 8z' will increase further.
Therefore, we can say that the minimum value of 8x + 5y + 8z = 34. Hence, option C is the correct answer.

11. (d)

Cost price of the items A, B, C and D are p, q, r and s respectively.
Selling price of the items will be 1.15p, 1.25q, 1.35r, and 1.45s.
Profits on individual items will be 0.15p, 0.25q, 0.35r, and 0.45s.
Further since the net profit is 40%, we have, {0.15p + 0.25q + 0.35r + 0.45s} / {p + q + r + s} = 0.4
0.15p + 0.25q + 0.35r + 0.45s = 0.4p + 0.4q + 0.4r + 0.4s
0.05s = 0.05r + 0.15q + 0.25p
s = r + 3q + 5p. All options except D satisfy the equation.
Hence, option D is the right choice

12. 1 million

Let there be x virus in 1st generation.
Due to environmental haphazard, 60% i.e., 3x/5 would be able to produce the next generation and they will give rise to 15(3x/5) = 9x virus
Likewise, 60% of 9x i.e., 27x/5 would be able to produce the next generation and they will give rise to 15(27x/5) = 81x virus.
So, the number of viruses in every generation forms a G.P.,
x, 9x, 81x, 729x, ...
So, the seventh-generation number = a × r
n-1 = x × 9
6 = 531441
=> x = 531441/96 = 1 million

13. 2.

Let s = (a + b + c)/2 = Semi-perimeter of the triangle.
Using AM ≥ GM, we get

$$\left[\frac{p\left(\frac{s-r}{p}\right)+q\left(\frac{s-p}{q}\right)+r\left(\frac{s-q}{r}\right)}{p+q+r}\right] \ge \left[\left(\frac{s-r}{p}\right)^p\left(\frac{s-p}{q}\right)^q\left(\frac{s-q}{r}\right)^r\right]^{\frac{1}{p+q+r}}$$

- $\left(\frac{3s-2s}{2s}\right)^{p+q+r} \ge \left[\left(\frac{s-r}{p}\right)^p\left(\frac{s-p}{q}\right)^q\left(\frac{s-q}{r}\right)^r\right]$
- $1 \ge \left[\left(\frac{2s-2r}{p}\right)^p\left(\frac{2s-2p}{q}\right)^q\left(\frac{2s-2q}{r}\right)^r\right]$
- $1 \ge \left(\frac{p+q-r}{p}\right)^p\left(\frac{q+r-p}{q}\right)^q\left(\frac{r+p-q}{r}\right)^r$
  - $\left(1+\frac{q-r}{p}\right)^p\left(1+\frac{r-p}{q}\right)^q\left(1+\frac{p-q}{r}\right)^r \le 1$

Given that, $\left(1+\frac{q-r}{p}\right)^p \times \left(1+\frac{r-p}{q}\right)^q \times \left(1+\frac{p-q}{r}\right)^r \ge 1$

So, $\left(1+\frac{q-r}{p}\right)^p \times \left(1+\frac{r-p}{q}\right)^q \times \left(1+\frac{p-q}{r}\right)^r = 1$

This means, (s - r) = (s - p) = (s - q)

- p = q = r

Given that, in-radius = 1 cm

So, $\frac{\Delta}{s}=1$

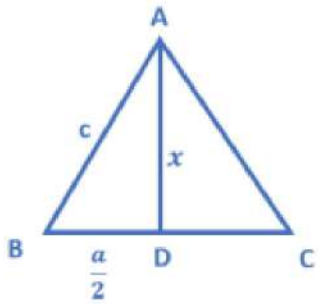
- $\frac{\frac{p^2\sqrt{\square}}{\square}}{\square}$
- $\frac{p}{\sqrt{\square}}$
- $p=2\sqrt{\square}$

Therefore, the circumradius = abc/4Δ

= $24\sqrt{\square}$ / ($12\sqrt{\square}$)

= 2

14. 4.



Let AD = Median = x

Then, $\cos B = \dfrac{c^2 + \frac{a^2}{4} - x^2}{ac} = \dfrac{c^2 + a^2 - b^2}{2ac}$

- $2c^2 + a^2/2 - 2x^2 = c^2 + a^2 - b^2$
- $c^2 - a^2/2 + b^2 = 2x^2$
- $\dfrac{2(b^2 + c^2) - a^2}{4} = x^2$
- $x = \frac{\sqrt{\square}}{\square}$

So, $\sqrt{\square}$

- $2(b^2 + c^2) - a^2 = 592k$ ..... (i)
- $2(c^2 + a^2) - b^2 = 505k$ ..... (ii)
- $2(a^2 + b^2) - c^2 = 673k$ ..... (iii)

where $k \neq 0$.

(i) + (ii) + (iii) =>

$3(a^2 + b^2 + c^2) = 1770k$

- $a^2 + b^2 + c^2 = 590k$ .... (iv)

$2 \times$ (iv) – (i) =>

$3a^2 = 590k \times 2 - 592k$

- $3a^2 = 588k$
- $a = 14\sqrt{\square}$

Similarly, we get

b = 15√☐

c = 13√☐

As, a, b, c are co-prime integers, √☐

So, a = 14, b = 15, c = 13, s = (a+ b+ c)/2 = 21

Hence, $r = \frac{\Delta}{s} = \frac{\sqrt{☐}}{☐}$

$= \frac{\sqrt{☐}}{☐}$

= 84/21

= 4

15. 233
Let's suppose number of Hammer, Screwdriver, Plier and Drill in the work-shop be a, b, c and d respectively.
Hence according to the first condition, b + c + d = 191 .... (1)
Similarly, a + c + d = 178 .... (2)
Also, a + b + d = 169 .... (3)
And, a + b + c = 161 .... (4)
Adding all the above four equations we will get,
3(a+ b + c+ d) = 191 + 178 + 169 + 161
=> a + b + c + d = 233

16. (b)
Time taken by Paul to drop Sam

$= Distance\, of\, capital\, city ¿ home \frac{¿}{Speed\, of\, Paul}$

$= \frac{10}{5}$ hrs(or hours)

= 2 hrs

In this time distance covered by Nuanc

= (2× 2 kmph ¿= 4 km

Remaining distance between Nuanc and capital city = (10 − 4 ¿ km = ¿ 6 km

Now Sam will return to pick up his walking friend Nuanc

Time taken to meet Nuanc = $\frac{Remaining\, distance}{Relative\, speed\, of\, Paul \wedge Nuanc}$

$= \frac{6}{5+2}$ hrs $= \frac{6}{7}$ hrs

And finally time taken by Paul to return to the capital city

$= \frac{Remaining\ distance\ between\ city \wedge Paul}{speed\ of\ Paul}$

$= \frac{(6 - distance\ covered\ by\ Nuanc)}{5}$

$= \frac{6 - \frac{12}{7}}{5} = \frac{6}{7} hrs$

Total time taken by Paul $= (2\frac{+6}{7} + \frac{6}{7})$ hrs

$= \frac{26}{7}$ hrs

17. 58.
As the two lines intersect each other at point P, so we can solve the equations representing the lines to get coordinates of point P. So,
3x - 4y + 5 = 0 and 8x - 6y + 11 = 0
3x = 4y - 5
x = (4y-5)/3
Putting this in the second equation, we get:
8(4y - 5) / 3 - 6y + 11 = 0
32y – 40 - 18y + 33 = 0
14y = 7
y = 1/2
So, x = -1
a = - 1, b = 1/2
$16(a^3 + b3 + a(b - 5)) = 16 \times (-1 + 1 / 8 - (1 / 2 - 5))$
= 16 × (-7 + 36) / 8
= 16 × 29 / 8
= 58

18. 5 years
Let the age of Smith and Robert is 13x and 11x respectively.
Age of Johnson = (11x - 8)
Age of their father = 11x - 8 + 46 = (11x + 38)
Age of their mother = (11x + 38) × (9/10) = (9.9x + 34.2)
Average age of the family = [(13x) + (11x) + (11x - 8) + (11x + 38) + (9.9x + 34.2)]/5 = 35.2
=> 55.9x = 111.8
=> x = 2
Required average = [(11x + 38) + (9.9x + 34.2)]/2 = [(20.9 × 2) + 72.2]/2 = 114/2 = 57 years

19. (c)
Since the ball is being transferred from the box A to the box B, it can be either a White ball or a Yellow ball.
Case I: If a White ball is transferred, the box A would contain 4 Yellow balls and 2 White balls and the box B would contain 5 Yellow balls and 1 White ball, after the transfer.

Probability of getting a White ball transferred = 3/7
Probability of selecting two Yellow balls after the transfer (P1) = 4/6 * 5/6
Case II: If a Yellow ball is transferred, the box A would contain 3 Yellow balls and 3 White balls and the box B would contain 6 Yellow balls, after the transfer.
Probability of getting a Yellow ball transferred = 4/7
Probability of selecting two Yellow balls after the transfer (P2) = 3/6 * 6/6
Required probability = 3/7 * P1 + 4/7 * P2 = 3/7 * 5*9 + 4/7 * ½ = 11/21

20. (a)
Given that –
$(\alpha + \beta) = -2$
$\alpha\beta = 2$
$(\alpha^2 + \beta^2)$
$= (\alpha + \beta)^2 - 2\alpha\beta$
$= 4 – 4$
$= 0$
$(\alpha^4 + \beta^4)$
$= (\alpha^2 + \beta^2)^2 - 2\alpha^2\beta^2$
$= -2^3$
$(\alpha^6 + \beta^6)$
$= (\alpha^4 + \beta^4)(\alpha^2 + \beta^2) – \alpha^2\beta^2(\alpha^2 + \beta^2)$
$= 0$
$(\alpha^8 + \beta^8)$
$= (\alpha^6 + \beta^6)(\alpha^2 + \beta^2) - \alpha^2\beta^2(\alpha^4 + \beta^4)$
$= 0 – 2^2(-8)$
$= 2^5$
$(\alpha^{10} + \beta^{10})$
$= (\alpha^8 + \beta^8)(\alpha^2 + \beta^2) – \alpha^2\beta^2(\alpha^6 + \beta^6)$
$= 0$
$(\alpha^{12} + \beta^{12})$
$= (\alpha^{10} + \beta^{10})(\alpha^2 + \beta^2) – \alpha^2\beta^2(\alpha^8 + \beta^8)$
$= -2^2 2^5$
$= -27$
So, we can see that $\alpha^{(4n)} + \beta^{(4n)} = (-1)^n 2^{(2n+1)}$ where n is any natural number.
Thus,
$(\alpha^{2024} + \beta^{2024})$
$= (-1)^{506} 2(1012 + 1)$
$= 2^{1013}$
Also,
$\alpha^{2024}\beta^{2024} = (\alpha\beta)^{2024} = (2)^{2024}$
Thus, the equation having roots α^2 & β^2 is
$K(x^2 – 2^{1013}x + 2^{2023}) = 0$
Given that K = 1, we get
$(x^2 – 2^{1013}x + 2^{2023}) = 0$

21. 998
Let us assume that $x = (2^{n+1} - 1)$

$S = [1¿ + [2] + [3] + ... + (2^{n+1} - 1)¿$

$$S = 0 + (1+1)_{2\times¿¿} + (2+2+2+2)_{2^2\times¿¿} + (3+3+3+\ldots)_{2^3\times¿¿} + \ldots + (n+n+n+\ldots)_{2^n\times¿¿}$$

$S = (0 \times 2^0 + 1 \times 2^1 + 2 \times 2^2 + 3 \times 2^3 + ... + n \times 2^n)$

$S = \sum_{n=0}^{n} n \cdot 2^n$ ..... (i)

- $S/2 = \sum_{n=0}^{n} n \cdot 2^{(n-1)}$ ... (ii)

$S = 1 \times 2 + 2 \times 2^2 + 3 \times 2^3 + 4 \times 2^4 + ... + (n - 1) \times 2^{n-1} + n \times 2^n$

$S/2 = 1 + 2 \times 2 + 3 \times 2^2 + 4 \times 2^3 + 5 \times 2^4 + ... + n \times 2^{n-1}$
$S/2 = -1 - 2 - 2^2 - 2^3 - 2^4 - ...... - 2^{n-1} + n \times 2^n$

- $S/2 = n \times 2^n - (1 + 2 + 2^2 + 2^3 + ... + 2^{n-1})$
- $S/2 = n \times 2^n - (2^n - 1)$
- $S = (n - 1) \times 2^{n+1} + 2 \leq 1000$
- $(n - 1) \times 2^{n+1} \leq 998$

If $n = 6$, then $(n-1) \times 2^{n+1} = 640 < 998$

If $n = 7$, then $6 \times 256 > 1000$

So, $n = 6$

Now, let $S_1 = S + [2^{n+1}] + [2^{n+1} + 1] + ... + [2^{n+1} + y]$, where $2^{n+1} + y < 2^{n+2} - 1$

Then,

$S_1 = (n - 1) \times 2^{n+1} + 2 + (n + 1)(y + 1)$

As, $n = 6$, $S_1 = 642 + 7(y + 1)$

$642 + 7(y + 1) \leq 1000$

- $(y + 1) \leq 51$
- $y \leq 50$

Hence, $x_{max} = 2^7 + 50$

$= 178$

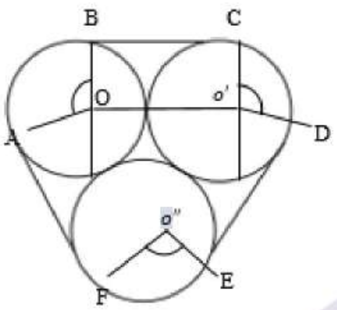
22. (b)
2/60 + 1/170 + 2/816 + 1/744 + ... 2/9636 = 1/30 + 1/170 + 1/408 + 1/744 + ... + 1/4818
= 1/3*10 + 1/10*17 + 1/17*24 + 1/24*31 + ... + 1/66*73
= 1/7 * [1/3 – 1/10 + 1/10 – 1/17 + ... – 1/73]
All terms except 1/3 and 1/73 will get cancelled
Therefore, sum = 1/7 * [1/3 – 1/73]
= 10/219

Therefore, option b is the right answer.

Mock 7

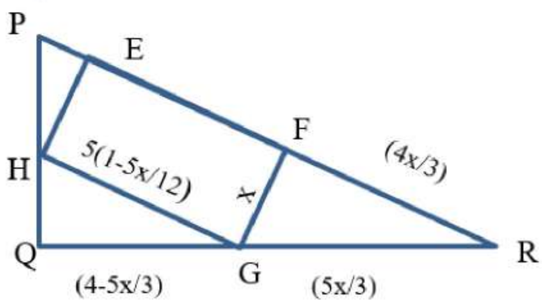
1. 13
10 men can complete the work in 20 days.
Let the total work be 10 x 20 = 200 units.
Work completed by 1 man in 1 day =200/ 10 x 20 = = 1 unit.
On the first two days, (10 + 10) a unit of work is done.
Next 2 days (12+12) units of work is done.
Next 2 days (14+14) units of work is done.
Next 2 days (16+16) units of work is done.
Next 2 days (18+18) units of work is done.
Next 2 days (20+20) units of work is done.
Total work done in 12 days = 20 + 24 + 28+32+36 + 40 = 180
On the 13th day 22 units of work can be done.
Work will be completed in 13 days.

2. (a)
The extended figure is as follows



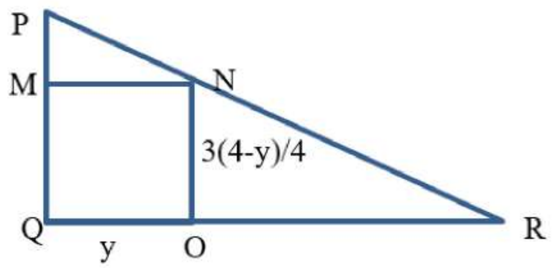
The minimum possible perimeter is
$= BC + DE + FA +$ circumference of sectors AOB, $CO'D, FO''E$
Now $\angle AOB = \angle CO'D = \angle FO''E = 120^{\circ}$
and $BC = DE = AF = 1$ m
Since three equal sectors of $120^{\circ} = 1$ full circle of same radius
Then the perimeter is $= 2\pi \times \frac{1}{2} + 3 = (\pi + 3)$ m
So, **Option (A)**

3. (d)



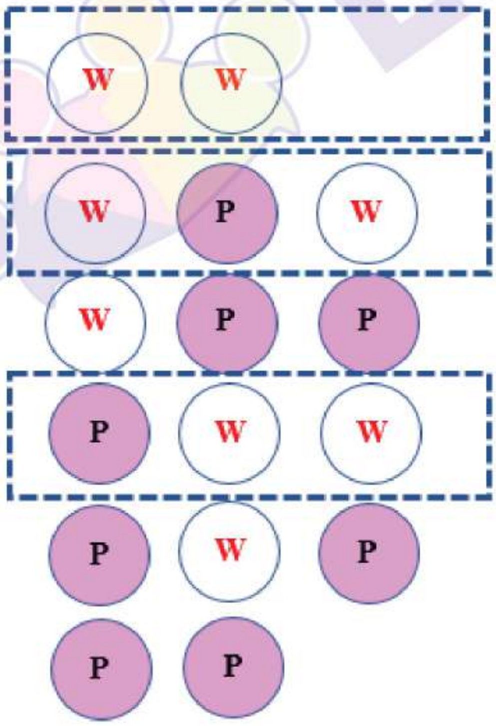
The circumradius of the right-angle triangle is 2.5 cm. So, the length of the hypotenuses is 5 cm.
One of the sides of the triangle is of length 3 cm. So, the other side is 4 cm.
Let,
PQ = 3 cm
QR = 4 cm

PR= 5 cm
FG = x cm
The length of the sides of rectangle is also shown in the diagram.
So, the area of the rectangle is $5x(1-5x/12) = A_1$
So,
$A_1 = 5x(1-5x/12)$
⇨ $A_1 = 5(x-5x^2/12)$
To maximize A_1 we need to maximize $(x-5x^2/12)$
$f(x) = (x-5x^2/12)$
⇨ $f(x) = (5/12)*(12x/5-x^2)$
⇨ $f(x) = (5/12)*\{36/25 - (x-6/5)^2\}$
So, the maximum value will be achieved if $x=6/5$
So, $A_1 = 5*(6/5)*\{1-(5/12)*(6/5)\} = 3$
Now, let assume that $OQ = y$



Total area of the rectangle MNOQ is $A_2 = 3y(4-y)/4$
The maximum value will be achieved if $y = 2$
So, maximum value of A_2 is 3 cm^2
The inradius of the triangle PQR is 1 cm. So $A_3 = \pi$
So, 2,3,5 are right.

4. (c)
The possible outcomes are-



$P_1 = n(n-1)/\{(n+1)(n+2)\}$

$P_2 = 2(n-1)/\{(n+1)(n+2)\}$

$P_3 = 2/\{(n+1)(n+2)\}$

$P_4 = 2(n-1)/\{(n+1)(n+2)\}$

$P_5 = 2/\{(n+1)(n+2)\}$

$P_6 = 2/\{(n+1)(n+2)\}$

$B(n) = (P_1 + P_2 + P_4)/(P_1 + P_2 + P_3 + P_4 + P_5 + P_6)$ for all n ≥1
$B(n) = (n^2+3n-4)/(n^2+3n+2)$
$B(n) = (n-1)(n+4)/\{(n+1)(n+2)\}$

B(2)*B(3)*B(4)*B(5)...
= {(1X6)/(3X4)} X {(2X7)/(4X5)} X {(3X8)/(5X6)} X {(4X9)/(6X7)} X {(5X10)/(7X8)} X {(6X11)/(8X9)} ....
= (1 X 2)/(4 X 5)
= 1/10
So, the right answer is option C.

5. 2500

First coin	Second coin	Ways
1	100	1
2	99/100	2
3	98/99/100	3
....	....	....
50	51/52/.../100	50
51	52/53/.../100	49
....	....	....
99	100	1

Total number of ways = ∑50 + ∑49

$= 2\sum 50 - 50 = 2 \times \left(\frac{50(50+1)}{2}\right) - 50 = (50 \times 51) - 50 = 2500$

6. (d)
Let Rs. a, Rs. b and Rs. c be the salaries of Rajesh, Deepak and Pankaj respectively.
According to the question: a + b + c = Rs. 1136 .... (i)

Expenses of Rajesh = 0.84a ⇒ Savings of Rajesh = 0.16a
Expenses of Deepak = 0.82b ⇒ Savings of Deepak = 0.18b
Expenses of Pankaj = 0.75c ⇒ Savings of Pankaj = 0.25c
∴ 0.16a : 0.18b : 0.25c = 8 : 10.8 : 8 = 8k : 10.8k : 8k
⇒0.16a = 8k, 0.18b = 10.8k and 0.25c = 8k
∴ a = 50k, b = 60k and c = 32k .... (ii)
From equations (i) and (ii), we get:
50k + 60k + 32k = 1136
⇒ 142k = 1136 ⇒ k = 8
∴The salary of Rajesh = Rs. 50 × 8 = Rs.400
The salary of Deepak = Rs. 60 × 8 = Rs. 480
The salary of Pankaj = Rs. 32 × 8 = Rs.256
Thus, the salaries of Rajesh and Deepak = Rs. 400, Rs. 480
Thus, option D) is correct.

7. 1300
Let both trains meet after t hours.
Distance = speed × time
55t – 45t = 130
10t = 130
t = 13 hours
Required distance = 55t + 45 t
= 100t
= 100 × 13 = 1300 km

8. (b)
Let the votes received by C be 'x'
Then the votes received by B is = 1.1 x
The votes received by A = 1.4 B
And the votes received by A is = 1.4 × 1.1 x = 1.54 x
Difference in the votes of A and C = 1.54 x – x = 0.54 x = 10800
x = 20000
A = 1.54 x = 1.54 × 20000 = 30800
B = 1.1 x = 1.1 × 20000 = 22000
Total number of votes = 30800+22000+20000 = 72800
Given 80% of the total voters cast their vote then the total number of voters = 728000 /0.8 = 91000
Hence, option (B) is correct.

9. (c)

Number of diagonals of an n-sided polygon =
${}^{n}C_2 - n = 9 \Rightarrow n = 6$
So, the polygon inscribed inside the circle is a hexagon.
Following figure shows the given case:

Since area of square is given as 100 sq. unit, side of square = diameter of circle = 10 unit, and side of hexagon = 5 unit.
So, perimeter of square = (10 + 10) × 2 = 40
Perimeter of circle = 2 × π × 5 = 10π
Perimeter of hexagon = 6 × 5 = 30.
Hence, the required ratio is 3 : π : 4.

10. 1
The region formed from L1 & L2 will be a square having side length of a and one of the vertices as (0,0) and two sides lying on X & Y axis respectively and the square completely lying on the first quadrant.
The smaller triangle as formed by the lines are 1/3rd of the area of the square.
So, the area of each of the triangle is $a^2/3$
So, Area of OPC = $a^2/3$
Area of OAQ = $a^2/3$
Thus, CP = QA = 2a/3
So, the equation of OP will be-
y = 3x/2
The equation of OQ will be
y = 2x/3
So, the value of $m_1 * m_2 = (3/2)*(2/3) = 1$

11. (a)
$T = 3/5 + 6/5^2 + 11/5^3 + 18/5^4 + 27/5^5 + 38/5^6 + \dots$
$T/5 = 3/5^2 + 6/5^3 + 11/5^4 + 18/5^5 + 27/5^6 + \dots$
$(T-T/5) = 3/5 + 3/5^2 + 5/5^3 + 7/5^4 + 9/5^5 + 11/5^6 + \dots$
$4T/5 = 3/5 + 3/5^2 + 5/5^3 + 7/5^4 + 9/5^5 + 11/5^6 + \dots$
$4T/5^2 = 3/5^2 + 3/5^3 + 5/5^4 + 7/5^5 + 9/5^6 + \dots$
$(4T/5 - 4T/5^2) = 3/5 + 2/5^3 + 2/5^4 + 2/5^5 + 2/5^6 + \dots$
16T/25 = 3/5+ 1/50
16T/25 = 31/50
T = 31/32
So,
$(1+T+T^2+T^3+T^4+\dots)$
= 1/(1-T) [As 0<T <1]
= 32

12. (b)
The given equation is $5^{4x} - 3.5^{2x+1} - 54 = 0$.
We will try to convert it into a quadratic equation.

$5^{4x} - 3.5^{2x+1} - 54 = 0$
$(5^{2x})^2 - 3.5^{2x}.5^1 - 54 = 0$
$(5^{2x})^2 - 15.5^{2x} - 54 = 0$
Let $5^{2x} = a \Rightarrow$ The equation becomes
$a^2 - 15a - 54 = 0$
$(a - 18) \times (a + 3) = 0$
$a = 18$ or $a = -3$
$5^{2x} = a$ will always be positive. ∴ $a = -3$ is not a valid solution.
$a = 18$
$5^{2x} = 18$
$2x = \log_5 18$
$x = (\log_5 18)/2$
Hence, (B).

13. (c)
Correct Answer Option (C)
Let A compete in 'a' events and 'b' in B events
For events (a,b):
Overall points of A: $\frac{32}{a^2} + a = \frac{32+a^3}{a^2}$
Overall points of B: $\frac{36}{b^2} + b = \frac{36+b^3}{b^2}$
Ratio of A and B
$\frac{32+a^3}{a^2} \div \frac{36+b^3}{b^2} = 6:7$
$\frac{(32+a^3)b^2}{a^2(36+b^3)} = 6:7$
Now putting pairs of a and b such that a,b≤4
The only possible combination is (a,b) = (4,3) such that ratio $\frac{(32+a^3)b^2}{a^2(36+b^3)} = 6:7$

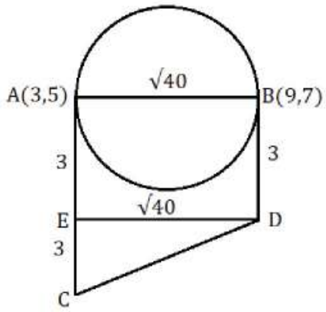
14. (a)
Here any term is equal to the sum of its neighbors except for the first and the last term.
So, if f(1) = a, f(2) = b, then f(3) = b-a, f(4) = -a, f(5) = -b and f(6) = a-b f(7) =a, f(8) =b and so on
Thus, terms repeat after a gap of 6 i.e., there is a cyclicity of 6
So, f(25) = a and f(26) = b or a +b = 9
Also, f(47) = f(5) = -b = -5. Or b = 5 or a = 4
The sum of the first six terms is zero, i.e., groups of 6 terms starting from the first will be zero.
So, sum up-to 96 terms will be zero. Thus, we need to calculate f(97) +f(98)+f(99) = a + b + b-a = 2b = 2*5 = 10
So, f(1) + f(2) + f(3)…………+ f(99) = 10
Hence option (A) is correct.

15. (b)
f(500, 350) = f(150, 350) = f(200, 150) = f(50, 150) = f(100, 50) = f(50, 50) = 100
f(1000, 700) = f(300, 700) = f(300, 400) = f(100, 300)
= f(200, 100) = f(100, 100) = 200
f(2000, 1950) = f(50, 1950) = f(1900, 50) = f(1850, 50) = ... = f(100, 50) = f(50, 50) = 100
f(4000, 3950) = f(50, 3950) = f(3900, 50) = ... = f(100, 50) = f(50, 50) = 100
Hence, (B) is correct.

16. (b)
Assume the total number of students is 100. Let a, b and c represent the number of students opting for exactly 1, 2 and 3 subjects respectively.
∴ a + 2b + 3c = 40 + 60 + 25 = 125 ...(i)
Also, a + b + c = 100 ...(ii)

Subtracting equation (ii) from (i), we get,
(a + 2b + 3c) − (a + b + c) = 125 − 100 = 25
b + 2c = 25
For 'c' to be maximum, the value of b should be 0.
∴ c = 25/2 = 12.5
∴ Maximum possible percentage of students who could have opted for all three subjects = 12.5%
Hence, option (B) is correct.

17. (c)



$AB = \sqrt{(1-3)^2+(7-5)^2} = \sqrt{40}$ cm

ABDE is a rectangle

So, area of a rectangle = $3\sqrt{40}$ cm^2

Area of trianlge DEC = $\frac{1}{2} \times 3 \times \sqrt{40} = 3\sqrt{40}$ cm^2

Area enclosed by figure ABDC

$= 3\sqrt{40} + \frac{3}{2}\sqrt{40} = 9\sqrt{10}$

18. (b)
Let Aisha completes 'b' units of work in one day, while Piranha completes 'p' units of the work.
∴ 30b = 45p ⇒ b = 1.5p
Work done in first 5 days = 5b
Work done in next 5 days = 5b + 5p
Assume that Piranha needs 'y' days to complete the remaining work.
∴ (5b) + (5b + 5p) + yp = 45p
∴ 10b +5p + yp = 45p
∴ 10(1.5p) + 5p + yp = 45p
∴ 20p + yp = 45p
∴ y = 25 Therefore, the required answer is 25.
Hence, option (b) is correct.

19. 40.
Let the milk solution be x%.
After replacing 1/4 of the milk solution with water, the resultant solution will be 1-1/4 = 3/4 of the original mixture.
Now after replacing 1/3 of this solution with water, the resultant solution will be 1-1/3 = 2/3 of the solution after the 1st replacement.
=> x% × (1-1/4) × (1-1/3) = 35%
=> x × 3/4 × 2/3 = 35
x = 70
Now 70% represents milk and 30% represents water.
If 30% water is 12, then 70% of milk is 28.
Total quantity of milk solution = 12+28 = 40

20. (b)
Let's assume that the distance between Bipin's home and coaching is d km.
While going to coaching, he took d/16 hour
While returning back he took (d/2)/16+(d/2)/8 hour = (3d/2)/16 hour
Also let the average speed be v kmph.
So,
d/16+3d/32 = 2d/v
=> 5/32 = 2/v
=> v = 64/5
=> v = 12.80
Thus, the average speed is 12.80 kmph.

21. (c)
Kiran and Johal can complete a task in = 21 days
Kiran can complete the task in = 15.75 days = 63/4 days
Let total work be 63 unit
In 1 day, Kiran and Johal can do = 63/21 = 3 unit
In 1 day, Kiran can do = 4/63 x 63 = 4 unit
In 1 day, Johal can do = 3-4 = -1 unit (Negative work)
Johal leaves 10.5 days before the completion of the work.
For these 10.5 days, Kiran worked alone i.e., 4 unit x 10.5 = 42 unit
Amount of work Kiran and Johal done together is = 63-42 = 21 unit
= no. of days Kiran and Johal work done together by = 21/3 = 7 days
Kiran and Johal worked together for 7 days.
Option (d) is correct.

22. 4
Raj's total marks = 40% of 700 = 280
Total score in 3 subjects = 48 × 3 = 144
Since the maximum marks in one of the three given subjects is 64, total marks in the remaining two subjects of this group = 144 − 64 = 80
and, total score obtained in the remaining 4 subjects is 136.
To find M.
80 can be split as 34 + 46
He can fail in at most one of the three given subjects.
For the remaining 4 subjects, 136 can be split as 34 × 4 i.e., he fails in all four subjects.
M = 4 + 1 = 5
To find m.
80 can be split as 40 + 40.
He doesn't fail in at any of the three given subjects.
For the remaining 4 subjects, 136 can be split as (35 × 3) + 31 i.e., he fails in at most one subject.
m = 1
M − m = 5 − 1 = 4

Mock 8

1. 2450.
It is given that x is a natural number such that x ≤ 100
Therefore, x can take 100 distinct values.

Here, y will be minimum when we take the median value of x and y will be maximum when we take either minimum or maximum value of x. As there are even number of values that x can take, therefore, either x = 50 or x = 51 will give minimum value for y.

Ymin = f(50) = |50 – 1| + |50 – 2| + ... + |50 – 100|
= 49 + 48 + ... + 2 + 1 + 0 + 1 + 2 + ... + 49 + 50
= (49 x 50/2) x 2 + 50
= 2450 + 50 = 2500
Ymax = f(1) = |1 – 1| + |1 – 2| + ... + |1 – 100|
= 0 + 1 + 2 +...+ 99
= 99 x 100 / 2 = 4950
Range of y = 4950 – 2500 = 2450
Hence, B.

2. (c)

October has 31 days thus, the money spends by him will be:

$1, \frac{1}{2}, 3, \frac{3}{2}, 5, \frac{5}{2}, \ldots\ldots\ldots\ldots \frac{29}{2}, 31$

Total spending is the sum of the series, thus

$1+\frac{1}{2}+3+\frac{3}{2}+5+\frac{5}{2}+\ldots\ldots\ldots\ldots\frac{29}{2}+31$

$(1+3+5+\ldots\ldots 31) + (\frac{1}{2}+\frac{3}{2}+\ldots\ldots\ldots\frac{29}{2})$

$\frac{15}{2}(1+31) + \frac{15}{2}(\frac{1}{2}+\frac{29}{2})$

240 + 112.5

352.5

Average spending of the month = $\frac{352.5}{31} = 11.37$

Number of days in which the daily spending is less than 11.37

$1, \frac{1}{2}, 3, \frac{3}{2}, 5, \frac{5}{2}\ldots\ldots \frac{11}{2} = 12$ days

$\frac{13}{2}+\frac{15}{2}+\frac{17}{2}+\frac{19}{2}+\frac{21}{2} = 5$ days

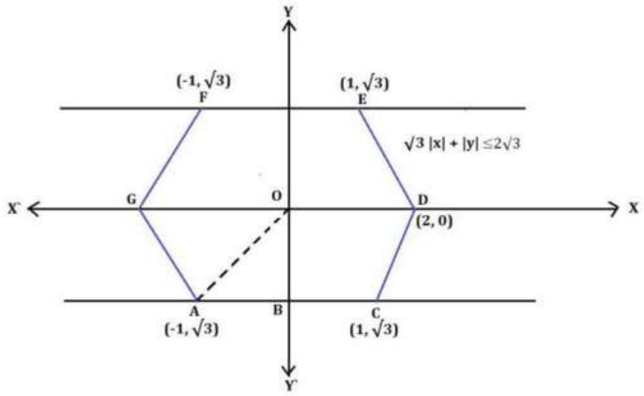
Total = 17 days.

Option (C) is correct.

3. (b)

Let 3^x be a and let 2^x be b
$3^x - 2^x + (3^x)(4^x)-(9^x)(2^x) = 0$
$a - b + ab^2 - ba^2 = 0$
$b(ab-1) - a(ab-1) = 0$
$(b-a)(ab-1)=0$
$ab=1$
$3^x 2^x = 6^x=1$
$x=0$
i.e., 1 solution
Hence, option (B) is correct.

4. (d)



In Δ OAB, ∠B = 90°

AB = 1

OB = $\sqrt{3}$

∴ By pythagoras theorem,

OA = 2 = OE = OC = OD = OE = OF = OG

∴ ACDEFG is a regular hexagon with side 2 unit

$$\text{Area} = 6\times\frac{\sqrt{3}}{4}\times a^2 = 6\times\frac{\sqrt{3}}{4}\times 2^2 = 6\sqrt{3}$$

Area of two parts (1:2) = $2\sqrt{3}$, $4\sqrt{3}$

5. (a)

Let $g(x) \equiv x^4 - x^3 - x^2 - 1 = 0$

Since a, b, c, d are the roots of g(x) = 0,

We have

$a^4 - a^3 - a^2 - 1 = 0$

$b^4 - b^3 - b^2 - 1 = 0$

$c^4 - c^3 - c^2 - 1 = 0$

$d^4 - d^3 - d^2 - 1 = 0$

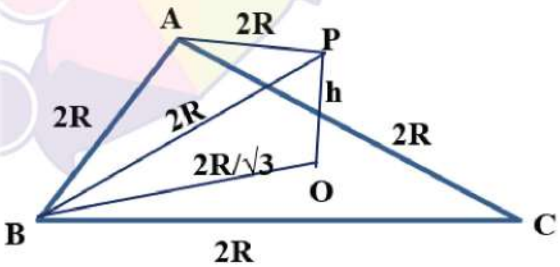
But $f(x) = x^2 (x^4 - x^3 - x^2 - 1) - x$

So, $f(a) = a^2 \times 0 - a = -a$

Hence f(a) + f(b) + f(c) + f(d)

$= -(a + b + c + d) = -1$ {∵ sum of roots = 1}

6. 2.



Let the base of the element is ABC. P is the center of the summit atom.

So,

BO = 2R/√3 ; where R is the radius of the atoms.

The surface area of the atom = $4\pi R^2 = 6\pi$

$R = \sqrt{(3/2)}$

So,

$PO^2 + BO^2 = PB^2$

$PO^2 = 8R^2/3$

$PO = 2R\sqrt{(2/3)}$

PO = 2

So, the height of the center of the summit atom is 2 cm.

7. (c)

Let the radius of the original sphere be R and that of each smaller one be r.

$\Rightarrow r = \frac{R}{8}$

Then, volumes of the larger and smaller spheres are $\frac{4}{3}\pi R^3$ and $\frac{4}{3}\pi(\frac{R}{8})^3$, respectively.

Volume lost due to melting = $\frac{4}{3}\pi R^3 \times \frac{20}{100} = \frac{4\pi R^3}{15}$

Volume left = $\frac{4}{3}\pi R^3 \times \frac{80}{100} = \frac{4\pi R^3 \times 0.8}{3}$

Number of smaller spheres formed = $\frac{\text{Volume left}}{\text{Volume of smaller sphere}} = \frac{\frac{4}{3}\pi R^3 \times 0.8}{\frac{4}{3}\pi \times (R/8)^3} = 8^3 \times 0.8$

Surface area of original sphere = $4\pi R^2$

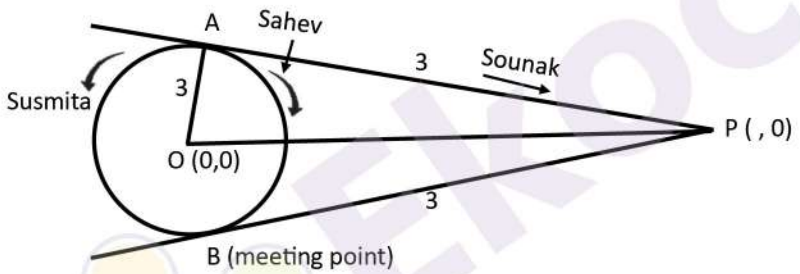
Surface area of each smaller sphere = $4\pi r^2 = 4\pi(\frac{R}{8})^2 = \frac{4\pi R^2}{64}$

Surface area of all smaller spheres = Number of small spheres × Surface area of each smaller sphere = $8^3 \times 0.8 \times \frac{4\pi R^2}{64} = 6.4 \times (4\pi R^2)$

Therefore, ratio of the total surface area of all smaller spheres to the surface area of original sphere = $\frac{[6.4 \times (4\pi R^2)]}{4\pi R^2} = \frac{6.4}{1}$

Volume of paint required = 6.4 × Volume of paint used on original sphere = 6.4 × 20 = 128 litres

8. (c)



Distance travelled by Sahev, s = r θ = π × r/2
= 3 π/2 units
Distance travelled by Susmita = 6π - 3π/2
= 9π/2 units
Distance travelled by Sounak = 3+3 = 6 units
Since all of them reach to B at the same time, so the ratio of speeds of Sounak, Sahev and Susmita is
= 6: 3 π/2: 9π/2
= 4: π: 3 π
Option (C) is correct

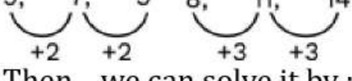
9. 4920.

Let each worker put in 1 unit of work per hour. Let, it take p, q and r units of work to produce one unit of the products P, Q and R respectively.
So, 100 = 80 p + 160 q + 120 r ...(i)
150 = 125 p + 140 q + 180 r ...(ii)
450 = 150p + X q + 540 r ...(iii)
Solving for (1.5 (i) – (ii)) gives the relation, p = 20 q.
Substituting, p = 20 q in (3 (ii) – (iii))
We get X = 4920.

10. (b)

Explanation- A's total investment after time-aligning will be $2000*12 + $2000*11 + $2000*10 = $2000*33 = $66000.
B's total investment after time-aligning will be $4000*6 + $4000*5 + $4000*4 = $60000
C's total investment after time-aligning will be $6000*2 + $6000 = $18000
So, the ratio of A's investment to C's investment will be 66 : 18 = 11 : 3.
The ratio of A's investment to B's investment will be 66 : 60 = 11 : 10.
Let us assume that D invested $12000 for t months.
C's total investment after time-aligning will be $12000t.
However, as A worked actively in the project, he gets 10% of profit as a salary.
Let, us assume that the profit is $ P.
So, A's share will be P/10 + (9P/10)*(11/(10+11+3+2t)) = $1500 ……(I)
B's share will be (9P/10)*(10/(10+11+3+2t)) = $1000 …………(II)
So, we can write-
P/10 + (9P/10)*(11/(10+11+3+2t)) = 1500
P/10 + 1100 = 1500
P/10 = 400
P = 4000
Hence, putting the value of P in equation (II) we get-
3600*10/(24 + 2t) = 1000
36 = 24 + 2t
t = 6
Hence, D's amount remained invested for 6 months.
D's profit share will be $3600*(12/36) = $1200.

11. (a)
Explanation-
Given that from equation $x^2 + 2x + 2 = 0$
$(\alpha + \beta) = -2$
$\alpha\beta = 2$
The roots of the new equation are $1/\alpha$ and $1/\beta$.
So,
$(1/\alpha + 1/\beta)$
$= (\alpha + \beta)/\alpha\beta$
$= -1$
The product of the roots are $1/(\alpha\beta) = ½$
So, the equation is
$2(x^2 + x + ½)$
$= 2x^2 + 2x + 1$

12. (d)
Let cost of 1 pen, 1 chocolate and 1 ice cream is ₹ x, ₹ y and ₹ z.
Therefore, 5x + 7y + 9z = 65 ……………..(1)
8x + 11y + 14z = 103 ……………..(2)
Since, the coefficient of x, y and z are in A.P. for both the equation.


Then, we can solve it by :
5x + 5y + 2y + 5z + 4z = 65
5(x + y + z) + 2(y + 2z) = 65 ………………(3)
Similarly, 8x + 11y + 14z = 103
8(x + y + z) + 3(y + 2z) = 103 ……………..(4)
Let a = x +y + z and b = y + 2z
now, both the equation becomes
[5a + 2b = 65]

$[8a + 3b = 103]$
multiply the first equation by 3 and second equation by 2
$[5a + 2b = 65] \times 3$
$[8a + 3b = 103] \times 2$

$$\Rightarrow \begin{array}{r} 15a + 6b = 195 \\ 16a + 6b = 206 \\ - \quad - \quad\quad - \\ \hline -a = -11 \end{array}$$

$$\boxed{a = 11}$$

Since, $a = x + y + z$ (which is sum of cost of 1 pen, 1 chocolate and 1 ice cream).
Hence, $x + y + z = \text{Rs. } 11$

13. (d)
$x^3 = 1$
So, $x^{2016} = 1$ and $x^{2015} = x^2 * x^{2012} = x^2$
$x^3 - 1 = (x-1)(x^2 + x + 1)$
Now as x is not equal to 1, so $x^2 + x = -1$
$\log(x^{2015} + 1/x^{2015} + x^{2016} + 1/x^{2016}) = \log(x^2 + 1/x^2 + 1 + 1) = \log(x^2 + x + 1 + 1) =$
$\log(-1 + 1 + 1) = \log 1 = 0$
Hence option D is correct.

14. 2.
$F(x) = ax^3 - 2x + c$
Substituting $x = 1$, $a - 2 + c = -5$
$\Rightarrow a + c = -3$
Substituting $x = 4$, $64a - 8 + c = 52$
$\Rightarrow 64a + c = 60$
Solving above equations, we get
$a = 1$ and $c = -4$.
Hence, expression is $x^3 - 2x - 4$
Also, $x^3 - 2x - 4$ is 0 at $x = 2$.
$\therefore$ Required value of x is 2.

15. 6.
$$2|e^{3x}| - 4|e^{2x}| - 46|e^x| + 120 = 0$$
$$\Rightarrow 2|(e^x)^3| - 4|(e^x)^2| - 46|e^x| + 120 = 0$$
$$\Rightarrow 2(|e^x| - 3)(|e^x| - 4) = 0$$
$$\Rightarrow e^x = 3,\ e^x = 4,\ e^x \neq -4,\ e^x \neq -3$$
So, $e^x = 3$ and $e^x = 4$
i.e., $x = \ln 3$ and $x = \ln 4$.
Thus, the sum of the roots $= \ln 3 + \ln 4 = \ln 12 = \ln k$ (given)
i.e., $k = 12$
Now, $12 = 2^2 \times 3^1$
Hence, the number of divisors of 12 is $(2+1)(1+1) = 6$

16. (d)

We will solve this question using AM $\geq$ GM

$$\frac{a^4 + b^4 + \frac{c^2}{2} + \frac{c^2}{2}}{4} \geq \sqrt[4]{\frac{a^4 b^4 c^2 c^2}{2 \times 2}}$$

$$a^4 + b^4 + \frac{c^2}{2} + \frac{c^2}{2} \geq 4\left(\frac{abc}{\sqrt{2}}\right)$$

$$\frac{a^4 + b^4 + c^2}{abc} \geq 2\sqrt{2}$$

So, the minimum value of the expression is $2\sqrt{2}$

17. 6.

Let the speed of the water = x kmph
The speed of the boat in still water = 20 kmph (Given)
Then, the upstream speed = (20 – x) kmph
The downstream speed = (20 + x) kmph
According to the given condition,
The downstream speed = 20 + x = $\frac{90}{3}$ = 30
x = 30 – 20 = 10
So, the speed of the water = 10 kmph
Upstream speed = (20 – 10) = 10 kmph
Note that, when the polythene was dropped in the water, then the polythene was flowing at the same speed as the water.
So, the speed of the polythene = 10 kmph
Since Rekha travels from Dakhhineshwar to Babughat in 3 hours and she dropped the polythene at Dakhhineshwar, so at that time the polythene also travels (3 × 10) = 30 km.
So, the rest of the distance = (90 – 30) km = 60 km.
This means that Rekha will meet the polythene in $\frac{60}{10+10}$ h = 3h
Hence, the total time needed to find the polythene by Rekha = 3 + 3 = 6 hours from the time she left for Babughat.

18. 16.

Let initial quantity of mixture = 100x
Petrol = 40% of 100x = 40x
Diesel = 100x - 40x = 60x
Ratio of petrol to diesel = 40x: 60x = 2:3
Quantity of petrol when 30 L of mixture is replaced with 10 L petrol
= 40x - [30×(2/5)] + 10 = (40x - 2)
Quantity of diesel when 30 L of mixture is replaced with 10 L petrol
= 60x - [30 × (3/5)] = (60x - 18)
Now,
40x-2 = 60x - 18
16 = 20x
x = 0.8
Required difference = 60x - 40x
= 20x
= 16 L

19. 3

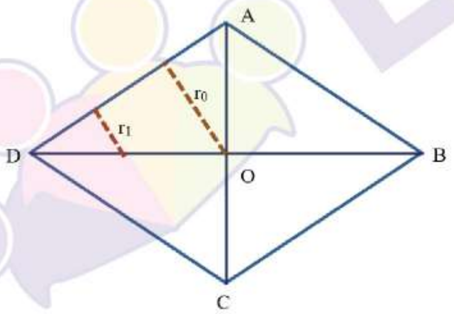
Let x kg of yellow pulses is mixed.
The mixture was sold at Rs. 97.5 per kg and 25% profit was earned.

$(125/100) \times CP = 97.5$
$\Rightarrow CP = (97.5 \times 100)/125$
$\Rightarrow CP =$ Rs. 78 per kg
So, $(27 \times 80 + x \times 60)/(27 + x) = 78$
$\Rightarrow 2160 + 60x = 2106 + 78x$
$\Rightarrow 18x = 54$
$\Rightarrow x = 3$

20. 27800
Let 3x, 5x and 7x be the amount invested by Ram, Rahim and Shyam respectively.
Amount after one year:
$= (3x \times 8) : (5x \times 9) : (7x \times 10) = 24x : 45x : 70x$
According to the question:
$45x – 24x = 4200$
$\Rightarrow 21x = 4200 \Rightarrow x = 200$
$\therefore$ Total income $= 139x = 139 \times 200 =$ Rs. 27,800

21. (d)
Let's assume that the lengths of the sides of the triangle are a, b, c respectively.
Let the length of the medians of the triangles are p, q, r such that-
$p^2 = [2(b^2+c^2)-a^2]/4 = 25$
$2(b^2+c^2)-a^2 = 100$ .... (i)
$q^2 = [2(a^2+b^2)-c^2]/4 = 52$
$2(a^2+b^2)-c^2 = 208$ .....(ii)
$r^2 = [2(a^2+c^2)-b^2]/4 = 73$
$2(a^2+c^2)-b^2 = 292$ .....(iii)
Solving the 3 equations, we get-
a = 10 cm; b =6 cm; c= 8 cm
Perimeter = 10+8+6=24

22. (c)



The area of the rhombus is $A= 32\sqrt{3}$ cm^2
Let, <ADC is P.
So,
$A = 8*8*\sin P = 32\sqrt{3}$
P = 60 degree
Let the radius of C_0 is r_0
So,
$OD = 4\sqrt{3}$ cm; $r_0 = 2\sqrt{3}$ cm
Also,
$2r_1+r_1+r_0 = OD = 4\sqrt{3}$
$3r_1 = 2\sqrt{3}$
$r_1 = 2/\sqrt{3}$
$(r_1/r_0) = (r_2/r_1) = (r_3/r_2) =...= (1/3)$

Total required area is A*.
Then $A^* = \pi r_0^2 + 2(\pi r_1^2 + \pi r_2^2 + \pi r_3^2 + \pi r_4^2 + \ldots)$
$= \pi r_0^2 + 2\pi r_0^2(1/9 + 1/9^2 + 1/9^3 + \ldots)$
$= (5/4)*\pi r_0^2$
$= (5/4)*\pi*12$
$= 15\pi$
Area of the unshaded region is $32\sqrt{3} - 15\pi = 8.3\ cm^2$

Mock 9

1. (a)
Now, OA = OB = OD = radius of the circle.
Let the radius of the circle be 'r'.
Triangles ABC and AOD are similar.
BC/2r = OD/r
We know that OD = r.
BC = 2r
2r = 10 cm
r = 5 cm.
Area of the shaded region = Area of the circle - Area of the triangle AOD - Area of the sector ODB.
$\pi*5*5 - 25/2 - \pi*5^2/4 = (75\pi - 50)/4$
Therefore, option A is the right answer.

2. 32.
The diagonals of the rectangle are x -3 = 0 and y - 7 = 0.
Both the diagonals are straight lines represented by x = 3 and y= 7.
x = 3 is parallel to Y-axis and y = 7 is parallel to X-axis.
Therefore, the diagonals of the rectangle are perpendicular to each other
When the diagonals of a rectangle are perpendicular to each other, the rectangle will be a square.
Also, the diagonals of a rectangle bisect each other.
The point of intersection of the 2 diagonals will be (3,7).
(3,7) is the midpoint of the diagonal.
Therefore, the length of the diagonal will be 2*(3-(-1)) = 2*4 = 8 units.
Therefore, the area of the square = product of the diagonals/2 = 8*8/2 = 32 square units.

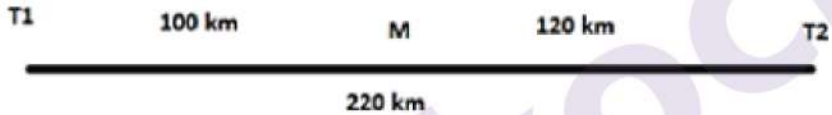
3. (a)
Solution: $(a + b + c)^2 = a^2 + b^2 + c^2 + 2(ab + bc + ac)$
L + B + H = 17, so $(L + B + H)^2 = 289$ and longest diagonal is $L^2 + B^2 + H^2 = 11^2 = 121$
$(L + B + H)^2 = L^2 + B^2 + H^2 + 2(LB + BH + LH)$
2(LB + BH + LH) = 289 – 121 = 168
Total surface area = 168
Hence, A.

4. 110
Let us assume that the capacity of the tank is 120 unit.
P can fill at 120 unit/20min = 6 unit/min
Q can fill at a rate of 120 unit/30 min = 4 unit/min
R can fill at a rate of 120 unit/60 min = 2 unit/min
The hole H can drain out water at 120 unit/120 minute = 1unit/minute rate.
Total amount of water filled in first minute is (6 + 4 + 2 - 1) unit = 11 unit.
A can empty at 120 unit/30 min = 4 unit/min

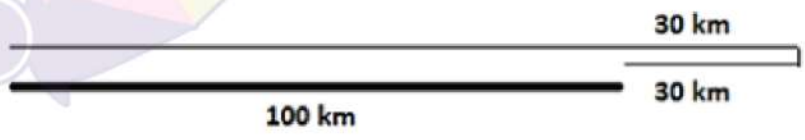
B can empty at 120 unit/40 min = 3 unit/min
C can empty at 120 unit/120 min = 1 unit/min rate
Total water emptied in a minute is (4 + 3 + 1 + 1) unit = 9 unit.
Hence, total volume filled in 2 minutes = (11 unit – 9 unit) = 2 unit.
Total time needed to fill 108 unit is = (108*2/2) = 108 minute.
In the 109^{th} minute the volume filled will be 108 unit + 11 unit = 119 unit.
In 110^{th} minute the volume filled will be (119 – 9) unit = 110 unit.
The remaining volume will be filled in (10/11) minute.
Thus, in the 111^{th} minute the tank will be filled.

5. (b)
$f(x) = \log_2(\log_3(x^2 + 5x + 7))$
Since, $\log3(x^2 + 5x + 7)$ always greater than 0,
$\log_3(x^2 + 5x + 7) > 0$
$\Rightarrow x2 + 5x + 7 > 30$
$\Rightarrow x2 + 5x + 7 > 1$
$\Rightarrow x2 + 5x + 6 > 0$
$\Rightarrow (x + 2)(x + 3) > 0$
$\Rightarrow x < -3$ or $-2 < x$
$\Rightarrow x \in (-\infty, -3) \cup (-2, \infty)$
Hence, domain of x is $x \in (-\infty, -3) \cup (-2, \infty)$.

6. (c)
The situation is as follows



Suppose T1 and T2 are the original positions of the trains and M is their meeting point.
The time taken by the two trains to meet = 220/50+60 = 2 hours
The bird continuously flies for 2 hours. Therefore, the distance covered by the bird = 80 x 2=160 km.
The distance travelled by the first train till the two trains meet =50 x 2=100 km, as shown.
That means the bird finds itself at a point 100 km away from the starting point after having flown 160 km.
This is possible only if the bird travels an additional 30 km in the forward direction and 30 km in the backward direction i.e.



Therefore, the total distance flew by the bird in the forward direction =100+30=130 km Hence, option C is correct.

7. (b)
Let us assume that the below

Item	Price/unit ($)
Cab	a
Movie Ticket	b
Popcorn	c
Chocolate	d

So,
$a + 2b + 2c + 4d = 19$

Here a, b, c, d are all distinct integers.
Let us try to find out the minimum value that (a + 2b + 2c + 4d) can assume.
Minimum value of a, b, c & d will be 1, 2, 3 & 4 but not in any specific order.
To minimise a + 2b + 2c + 4d we need to make sure that lower number gets multiplied with higher coefficient.
So,
Minimum value of (a + 2b + 2c + 4d)
= a + 2(b + c) + 4d = 4 + 2(2+3) + 4*1 = 18
So, a + 2b + 2c + 4d = 19 is possible where a = 5 and as b, c, and d are integers.
So, (b+c) = 5; d = 1
Hence, Reshma will incur a minimum total cost of 3(b+c) + d = $(3*5 + 1) = $16

8. 56
We will represent the stations by numbers 1, 2, ... up to 10
Let the first, second and third stop be represented by A, B and C respectively
Case 1: The first stop A is at station 1. So, the second stop cannot be at station 2. Let the second stop B be at station 3 as shown in the following table

1	2	3	4	5	6	7	8	9	10
A		B							

Third stop cannot be at station 4. So, the third stop can be any station from station 5 to 10 i.e., 6 possibilities.
Let the second stop B be at station 4 as shown in the following table

1	2	3	4	5	6	7	8	9	10
A			B						

Third stop cannot be at station 5. So, the third stop can be any station from station 6 to 10 i.e., 5 possibilities.
Similarly, if the second stop B is at station 5, 6, 7 or 8 then the number of possibilities for C will be 4, 3, 2, 1respectively
∴ Total number of possibilities in Case 1 = 6 + 5 + 4 + 3 + 2 + 1= 21
Case 2: The first stop A is at station 2.
On solving in a similar manner, we get the number of possibilities = 5 + 4 + 3 + 2 + 1 = 15
Case 3: The first stop A is at station 3.
Number of possibilities = 4 + 3 + 2 + 1 = 10
Case 4: The first stop A is at station 4.
Number of possibilities = 3 + 2 + 1 = 6
Case 5: The first stop A is at station 5.
Number of possibilities = 2 + 1 = 3
Case 6: The first stop A is at station 6.
Number of possibilities = 1
Total number of possibilities = 21 + 15 + 10 + 6 + 3 + 1 = 56 ways

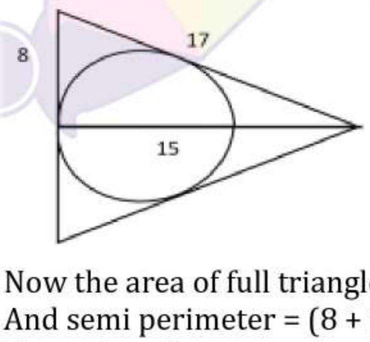
9. 5
Let the distance between the 2 cities be D
Now, when they meet for the first time, Taran would have covered 60 km and Karan would have covered D – 60 Km.
Therefore, the ratio of speeds of Taran and Karan = 60 / (D – 60) --------------(1)
When they meet for the second time, Taran would have covered D + 80 Km and Karan would have covered
(2D – 80) Km.
Ratio of speeds of Taran and Karan = (D + 80) / (2D – 80) ----------------------(2)
Using (1) and (2), we can write,
60 / (D – 60) = (D + 80) / (2D – 80)

$120D - 4800 = D^2 + 20D - 4800$
$120D = D^2 + 20D$
$D^2 = 100D$
$D = 100$
Therefore, the ratio of speeds of Taran and Karan will be 60/40 = 3/2
p + q = 3 + 2 = 5.

10. (b)
As a, b, c are natural numbers in the quadratic equation $(ax^2 + bx + c) = 0$ the other root of the equation will be $5 - 2\sqrt{6}$
So,
$-b/a = 5 + 2\sqrt{6} + 5 - 2\sqrt{6} = 10$
$\Rightarrow b = -10a$
$c/a = (5+2\sqrt{6})(5-2\sqrt{6}) = 1$
$c = a$
So, the value of $(b + c)/a = (-10a + a)/a = -9$

11. (d)
As a, b, c are natural numbers in the quadratic equation $(ax^2 + bx + c) = 0$ the other root of the equation will be $5 - 2\sqrt{6}$
So,
$-b/a = 5 + 2\sqrt{6} + 5 - 2\sqrt{6} = 10$
$\Rightarrow b = -10a$
$c/a = (5+2\sqrt{6})(5-2\sqrt{6}) = 1$
$c = a$
$cx^2 + px + a = 0$ has one root as $(3 + 2\sqrt{2})$ and the other root as β (lets us assume)
So,
$\beta(3 + 2\sqrt{2}) = a/c = 1$
$\beta = 3 - 2\sqrt{2}$
So,
The sum of the roots are $(3+2\sqrt{2}) + (3-2\sqrt{2}) = 6 = -p/a$
$p = -6a = 3b/5 = -6c$
Thus, both option a & b are correct

12. (b)
Let us draw the mirror image of this figure on the side measuring 15 cm.



Now the area of full triangle is ½ * (8 + 8) * 15 = 120
And semi perimeter = (8 + 17 + 17 + 8)/2 = 25
Hence inradius = area / semi perimeter = 120/25 = 4.8

13. 10
The minimum number of riders n, at which there is no loss.
The number of riders travelling = m and let the number of rounds is d.
Then, $P \propto (m-n)\,d$
or, $p = k(m - n)\,d$, where k is a constant

When P = 2700, m = 30 and d = 42, then

2700 = k (30 – n) × 42 ... (1)

Again, when p = 5400, m = 45, d = 48, then

5400 = k (45 – n) × 48 ... (2)

Dividing equation (2) by (1)

$$\frac{5400}{2700} = \frac{[k(45-n) \times 48]}{[k(30-n) \times 42]}$$

=> -37800n + 1134000 = -21600n + 972000

=> -37800n = -21600n - 162000

=> n = 10

14. $200
Let's assume that A invested $x at the start of the year. C's investment will also be $x.
B invested $4000 for 9 months.
Let's assume that the total profit is 10P
So, A's share will be P + 9P*12x/(12x + 36000 + 6x) = P + 18Px/(3x + 6000) = P + 6Px/(x + 2000)
B's share will be 9P*36000/(12x + 36000 + 6x) = 18000P/(x + 2000)
So, A's share : B's share = 5 : 3
(x + 2000 + 6x)/18000 = 5/3
3(7x + 2000) = 90000
7x + 2000 = 30000
x = 4000
So, B's profit share : C's profit share = 36000 : 4000*6 = 3:2
A's profit : B's profit : C's profit = 5 : 3 : 2
Thus, C's profit will be $2*1000/(5 + 3+ 2) = $200.

15. (b)
Let us assume that Rahul's age is r and that of Sumit's is s.
The possible values that Sumit can assume as his age are 3 & 5
The possible values that Rahul can assume as his age are 5 & 7 respectively as Rahul is older than Sumit.
Given that -
Twice of Sumit's age (2s) + Thrice of Rahul's age (3r) = Prime number
Now let us see if Sumit's age is 3 and Rahul's age is 5;
Then,
3*5 + 2*3 = 21 (not a prime number)
Now let us see if Sumit's age is 3 and Rahul's age is 7;
Then,
3*7 + 2*3 = 27 (not a prime number)
Now let us see if Sumit's age is 5 and Rahul's age is 7;
Then,
3*7 + 2*5 = 31 (prime number).
Hence, Rahul's age is 7 years

16. 11 kg

Fresh grapes contain 20% pulp.

∴ 40 kg of fresh grapes contains 8 kg pulp.

Dry grapes contain 70% pulp.

∴ 8 kg pulp would be contained in = 8/0.7 = 11.4 kg which is approx. 11 kg.

Thus, the required answer is approximately 11 kg is correct

17. (a)

Let the total number of voters be 100.

Total number of valid votes $80\times0.95=76$

Candidate A got = 80% of the valid votes $0.80\times76=60.8$

When 60.8 votes for candidate A got, then the total votes is 100.

When 7296 votes candidate A got, then the total votes = $(7296 \times 100)/60.8 = 12000$

Hence, option A is correct.

18. (d)

We know that,

$X^5 - 1 = (x - 1)(x^4+x^3+x^2+x+1)$

Since, $x^4+x^3+x^2+x+1= 0$

$\therefore x^5 - 1 = 0$

$\Rightarrow x^5 = 1$

Now, $x^{2050} + x^{2021}+ x^{2022}$

$= x2020(x^{30} + x + x^2)$

$= (x^5)^{410}[(x^5)^6+ x + x^2]$

$= 1\times (1+x+x^2)$

$= 1+x+x^2$

= - x3(1+x) [Since, x4+x3+x2+x+1= 0]

Hence, option D.

19. (d)

Correct Answer Option (D)

$$a-b=\left(1+\frac{1}{2}+\frac{1}{4}+\frac{1}{8}+\ldots\right)-\left(1+\frac{1}{4}+\frac{1}{16}+\ldots\right)=\frac{1}{2}+\frac{1}{8}+\frac{1}{32}+\ldots=\frac{1}{2}\left(1+\frac{1}{4}+\frac{1}{16}+\ldots\right)$$

$$a-b=\frac{1}{2}b$$

$$a=\frac{3}{2}b$$

Using a¿ $\frac{3}{2}b$:

10a-14b = b

8a-12b = 0

6a-10b = -b

4a-8b = -2b

2a-6b = -3b

Thus, 10-14b is the only term greater than 0.

20. 3240

Solution

Given that,

$a+b+c=45$ .... (i)

Also, $a^2+b^2+c^2=693$ .... (ii)

Again, $ab+bc+ca=666$ .... (iii)

Also, $a^3+b^3+c^3=10935$ .... (iv)

We know that,

$a^3+b^3+c^3-3abc=(a+b+c)(a^2+b^2+c^2-ab-bc-ca)$

$\Rightarrow 3abc=a^3+b^3+c^3-(a+b+c)(a^2+b^2+c^2-ab-bc-ca)$

$=10935-45\times(693-666)$

$=9720$

$abc=3240$

21. (c)

$$\frac{x+2}{2x^2+8x+8}=\frac{x+2}{2(x+2)^2}$$

$$=\frac{1}{2(x+2)}$$

As this is a fraction its value keeps decreasing as x increases. So maximum value exists at $x = 0$

Hence, the required value $=\frac{1}{4}$.

22. (b)

Let the sum of money be Rs. P.

Then, $\frac{P\times 13.5\times 5}{100}-\frac{P\times 18\times 3}{100}=621$.

$\Rightarrow P=$ Rs. 4,600.

Mock 10

1. (a)
Let the number of seats covered in the first week be 100x.
Then the number of tickets sold in the 2nd work week = 100x - 12% of 100x
= 100x -12/100 × 100x
= 100x-12x
= 88x
Then the number of seats covered in the 3rd week = 88x +14% of 88x
= 88x + 12.32x
= 100.32x
Then the number of seats covered in the 4th week = 100.32x - 20% of 100.32x
= 100.32x - 20/100 × 100.32x
= 100.32x – 20.064x
= 80.256x
We are given that 80.256x = 80256
⇒ x = 80256/80.256
⇒ x = 1000
Thus, the number of seats covered in the 3rd week = 1000 × 100.32 = 100320
Thus, option (a) is the correct answer

2. 48
$\Rightarrow (1100 + 52)^{651}$
$\Rightarrow (52)^{651}$
$\Rightarrow (4 \times 13)^{651}$
$\Rightarrow 2^{1302} \times (13^{4})^{162} \times 13^{3}$
$\Rightarrow (2^{10})^{130} \times 2^{2} \times (61)^{162} \times 69 \times 13$
$\Rightarrow (24)^{130} \times 4 \times 21 \times 97$
$\Rightarrow 76 \times 4 \times 21 \times 97 = 619248$
⇒ Last two digit would be 48

3. (d)
The escalator moves 12 steps upward in the first 1 min and then moves 5 steps downward in the second 1 min.
It means the escalator actually moves upward 5 steps (i.e., 12–7) in 2 minutes.
In the same manner the escalator will moves upward every 5 steps in 2 minutes.
Similarly, in it will move 10 steps in 4 minutes, 15 steps in 6 minutes.
In this way, the escalator will move 50 steps upward in 20 minutes.
The remaining steps (60 – 50 = 10 steps), the escalator will reach in 5/6 minutes, i.e., in 50 seconds.
Hence, the escalator will move 60 steps in 20 minute 50 seconds.
Thus, Rohit with the escalator will reach to the first floor in 20 minute 50 seconds.

4. (c)
Here, one hour work done by one man = 1/(28 × 90 × 3)
Also, one hour work done by one man = 1/(36× (3X+6) × 5)
Then, 1/(28 × 90 × 3) = 1/(36× (3X+6) × 5)
⇒ X = 12
Therefore, time taken by (X - 12) men to complete the whole work while working 4 hours a day
= (28 × 90 × 3)/(12 × 4)

= 157.5 days

5. 150.

The oil supply does not start until the oil level reaches the 25,000-gallon mark, which will take 25 hr (25000/1000). Once the level reaches that mark, there is an inflow at the rate of 800 gallons per hour and an outflow at the rate of 1000 gallons per hour. So effective emptying rate will be 200 gallons per hour. At this rate, the tank will be emptied in another 125 hr. So, the total time taken to empty the tank is 125+25 =150 hr.

6. (a)

The number of possible outcomes can be determined by the multiplication principle. The multiplication principle tells us that the number of ways in which an independent event can occur together can be determined by multiplying together the number of possible outcomes for each event. There are two outcomes possible while tossing a coin i.e., heads or tails. Thus, the number of possible outcomes is

= 2 × 2 × 2 × 2 × 2 × 2 × 2 × 2 = 256.

The number of ways in which 5 tails can occur out of 8 tosses is the number of combinations of 8 objects taken 5 at a time.

The number of combinations of n objects taken r at a time is given by C (n, r) = n!/(r!(n-r)!

C(8, 5) = 8!/(5!× 3!) = 56

Hence, the probability of occurring 5 tails is 56/256 = 7/32.

7. 45.

Total mixture = 42 + 168 = 210 litre

% Of Nitric acid = 42/ 210 × 100 = 20%

% of HCL = 80%

In the final mixture Nitric acid= 25%, HCL = 75%

Ratio = 25: 75 = 1:3

=> (42 – x × 20% + 25): (168 – x × 80% + 42) = 1:3

=> -75x+100x = 1125

=> x=45 litres

45 litres of mixture is taken out.

8. 98

The cost price of the first type rice = Rs.35 per kg

The cost price of the second type of rice = Rs.45 per kg

Cost price of mixture = Rs.38 per kg

Ratio = 7/3

Quantity of the first type of rice/ quantity of the second type of rice

= 7/3

Quantity of first type of rice = (7/3) × 42 = 98 kg.

9. (a)

$$P\left(1+\frac{10}{100}\right)^2 - P = 441$$

On solving, P = 2100

Let the value of each installment is I.

$$\text{So, } 2100 = \frac{I}{(1.1)} + \frac{I}{(1.1)^2}$$

Therefore, I = 1210

Total amount paid is Rs.2420 in which interest paid is Rs.320.

∴ Difference of the interest = 441 – 320 = 121.

10. (b)

Given that $f(x) = x^3$ and $g(x) = 3^x$.
We have to find the value of $f(f(g(x)) + g(f(x)))$ at $x = 1$,
$\Longrightarrow g(1) = 3^1 = 3$; $f(1) = 1^3 = 1$
First, let us find the value of $f(g(x)) + g(f(x))$ at $x = 1$,
$\Longrightarrow f(g(1)) + g(f(1)) = f(3) + g(1)$
$= 3^3 + 3$
$= 27 + 3$
$= 30$
Therefore, $f(g(1)) + g(f(1)) = 30$.
The value of $f(f(g(1)) + g(f(1))) = f(30)$
$\Longrightarrow f(30) = x^3 = 30^3 = 27000$

11. (a)
Let x, y and z in Rs. be respective shares of X, Y and Z (as per the agreement)
x = 2/3 of y
⇒ x: y = 2: 3
Further,
z= (1+1/3)y
⇒ y= 3/4 z
⇒ y:z = 3:4
Thus x : y : z = 2 : 3 : 4
Now total bill they pay = 3310 + 5220 + 6230 = 14760
As per agreement,
X' s share 2/9(14760) = Rs. 3280
Y' s share = 3/9 (14760) = Rs. 4920
Z' share = 4/9 (14760) = Rs. 6560
Now,

	X	Y	Z
Share of each as per agreement	3280	4920	6560
Bill amount paid	3310	5220	6230
Amount paid more	30	300	-
Amount paid less	-	-	330

Hence, Z pays Rs. 30 to X and Rs. 300 to Y for the final settlement of their accounts.

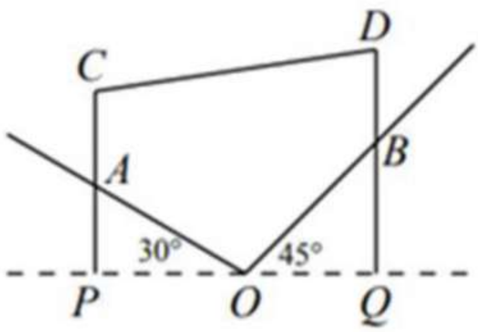
12. (d)
From 5 PM to 7 AM the next day, total 14 hours will be passed according to incorrect clock, but this clock runs faster than the correct clock. So, we need to find how much time will be elapsed according to correct clock.

Y (Incorrect clock)	**X (correct clock)**
10 hours 16 minutes	10 hours
$(10 + \frac{16}{60}) = \frac{154}{15}$ hours	10 hours
1 hour	$\frac{150}{154}$ hours
14 hours	$\frac{150}{154} \times 14 = \frac{150}{11} = 13\frac{7}{11}$ hours
	$= 13$ hours $\frac{420}{11}$ minutes

	Y Clock	X Clock
Today	5:00 PM	5:00 PM
Tomorrow	7:00 AM	$6:\frac{420}{11}$ AM

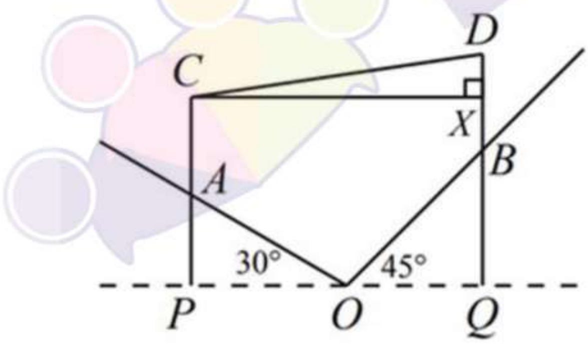
So, according to clock X the time would be 6: 420/11 AM.
Using formula,
Angle between the hands of a clock (θ) = $|30H - 11/2\ M|$
Given, H= 6 & M = 420/11
$\theta = |30 \times 6 - 11/2 \times 420/11| = |180\text{-}210| = 30^{\circ}$
Hence, option (d) is correct.

13. (c)
Extend CA and DB downwards until they meet the horizontal through O at P and Q, respectively.



Since CA and DB are vertical, then $\angle CPO = \angle DQO = 90^{\circ}$.
Since OA = 20 m, then $AP = OA \sin 30^{\circ} = (20\text{ m}) \cdot 1/2 = 10$ m.
Since OB = 20 m, then $BQ = OB \sin 45^{\circ} = (20\text{ m}) \cdot 1/= 10\sqrt{2}$ m.
Since AC = 6 m, then CP = AC + AP = 16 m.
For CD to be as short as possible and given that C is fixed, then it must be the case that CD is horizontal:

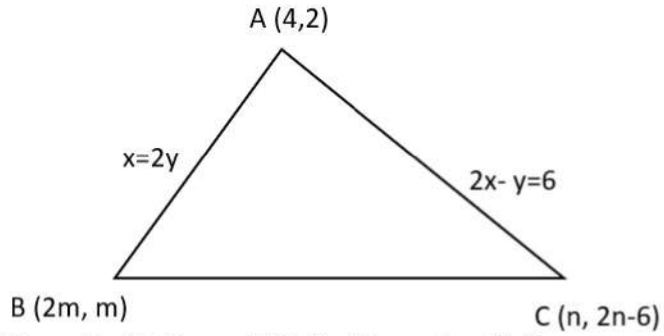
If CD were not horizontal, then suppose that X is on DQ, possibly extended, so that CX is horizontal



Then $\angle CXD = 90^{\circ}$ and so ΔCXD is right-angled with hypotenuse CD.
In this case, the CD is longer than CX or XD.
In particular, CD > CX, which means that if D were at X, then CD would be
shorter. In other words, a horizontal CD makes CD as short as possible.
When CD is horizontal, CDQP is a rectangle, since it has two vertical and two horizontal sides.
Thus, DQ = CP = 16 m.
Finally, this means that $BD = DQ - BQ = (16 - 10\sqrt{2})$ m.
Hence, Option 3 is correct.

14. (c)
The lines x - 2y = 0, 2x - y = 6 meet at A (4, 2). Any point on x - 2y = 0 is B (2m, m).

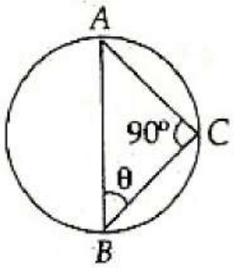
Any point on 2x -y = 6 is C (n, 2n-6)
Centroid is (2, 3).



Thus, 2= (4+2m+n)/3, 3=(2+m+2n-6)/3
or, 2m+ n =6-4, m+2n = 9+4
i.e., 2m+n=2, m+2n=13
Therefore, m= -3, n= 8
Thus, B= (-6, -3) and C= (8,10)
Hence, the equation of BC is
(y+3)/(x+6) = (10+3)/(8+6) = 13/14
14y+42=13x+78
=> 13x-14y+36=0
Now the equation of the perpendicular line to BC is
14x+13y+k=0
Now, since it passes through the centroid (2,3), so
14(2)+13(3)+k=0
k=-67
Hence, the required equation of the perpendicular is 14x+13y-67=0

15. 6.
G(12) = 6+3+1+0+0… = 10
Now,
10 ≤ G(0) + G(1) + G(2) + G(3) + …
G(0) = 0 + 0 + …
G(1) = 0 + 0 + …
G(2) = 1 + 0 + 0 + …
G(3) = 1 + 0 + 0 + …
G(4) = 2 + 1 + 0 + 0 + …
G(5) = 2 + 1 + 0 + 0 + …
G(6) = 3 + 1 + 0 + 0 + …
G(7) = 3 + 1 + 0 + 0 + …
G(8) = 4 + 2 + 1 + 0 + 0 + …
10 ≤ 0 + 0 + 1 + 1 + 3 + 3 + 4 = 12

16. (a)
Clearly, ∠C = 90°.
Let a be the area of triangle ABC.



AC = AB sinθ = 2r sinθ
BC = AB cosθ = 2r cosθ
Area = $\frac{1}{2}$ AC.BC. sin 90°
= $\frac{1}{2}$ × 2r sinθ × 2r cosθ
= $2r^2$ sinθ cosθ = r^2 sin 2θ
Area is maximum when sin 2θ = 1,
θ = $\pi/4$
i.e. Triangle ABC is isosceles.

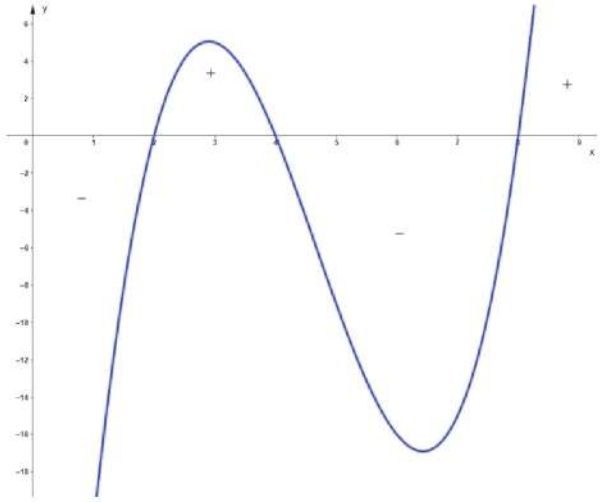
17. (a)
When a right angled triangle is rotated about its perpendicular lengths a cone is formed.
Therefore,
$\pi \times XY \times YZ^2/3 = 6400\pi$,
$\pi \times YZ \times XY^2/3 = 15360\pi$,
Therefore,
XY/YZ = 2.4 = 12/5
So, if XY = 12a then YZ= 5a
Then, $12a \times 25a^2/3 = 6400$
$a^3 = 64$
i.e. a = 4
So, perpendicular sides are 48 and 20.

Thus, the hypotenuse XZ = $\sqrt{48^2 + 20^2} = 52$

18. (d)
Let the rice grains X and Y be sold at Rs. a and Rs. b respectively
When X and Y are mixed in the ratio 5 : 3 and sold at a profit of 12% at Rs. 50 per Kg
(5a+ 3b)/8 = 50/1.12 ..... (1)
When X and Y are mixed in the ratio 3 : 5 and sold at a profit of 6% at Rs. 50 per Kg
(3a + 5b)/8 = 50/1.06 .... (2)
Solving equations (1) and (2), we get

$$1.12\times\left(\frac{5a+3b}{8}\right)=1.06\times\left(\frac{3a+5b}{8}\right)$$
$$\Rightarrow 112(5a+3b)=106(3a+5b)$$
$$\Rightarrow 242a=194b$$
$$\Rightarrow \frac{a}{b}=\frac{97}{121}$$

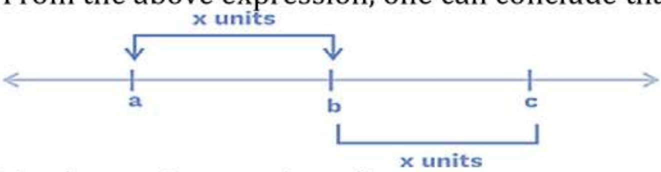
19. 13



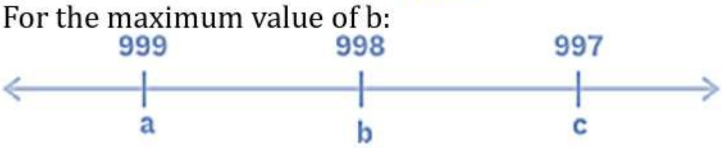
From the above wavy curve, we can say that,
$(x-2)(x-4)(x-8) \le 0$
$\Rightarrow 4 \le x \le 8$ or, $x \le 2$
Also, x is a positive integer.
So, x can assume a minimum value of 1 and a maximum value of 8.
$1 \le x \le 8$
$1+2 \le x+2 \le 8+2$
$3 \le x+2 \le 10$
So, $3 \le (x+2) \le 10$
So, $(a + b) = (3 + 10) = 13$

20. (a)
We first need to find by trial and error the minimum value of N! which divides 2^{26}
If N = 10 10! is divisible by 2^8
N = 20 20! is divisible by 2^{18}
N = 25 25! is divisible by 2^{22}
N = 30 30! is divisible by 2^{26}
Now $30! = 2^{26} \times 3^{14} \times$ ....
So 30! is the minimum number that divides 2^{26} but not $3^{26.}$
So 30! 31! , 32! .... up to 53!
There will be 24 possible numbers that divide 2^{26} but not 3^{26}
As $53! = 2^{49} \times 3^{23} \times$ ......
Whereas $54! = 2^{50} \times 3^{26} \times$ ......, Which is divisible by both 2^{26} and 3^{26} so not required.

21. (a)
It is given that,
$|a – b| + |b – c| – |c – a| = 0$
ð $|a – b| + |b – c| = |c – a|$
From the above expression, one can conclude that a, b and c are collinear points.

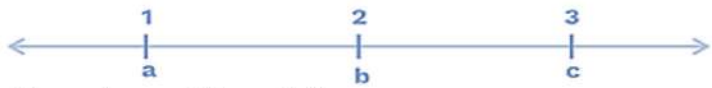


For the maximum value of b:



Above inequality satisfies.

For the minimum value of b:



Above inequality satisfies.
$b_{(max)} - b_{(min)} = 998 - 2 = 996$

22. (b)
Given digits are 1, 2, 5, 6, 8 and 9.
We need 5-digit numbers greater than 70000 and 6-digit numbers and will add them to get the result. Now, 6-digit numbers = ${}^6P_6 = 6! = 720$
Now, for 5-digit numbers each greater than 70000, left extreme place can be filled in ${}^2C_1$, ways as this place have choices with 8, 9 digits. Now the remaining four places can be filled by choices 4, 3 and 2 ways. Required such numbers = ${}^2C_1 \times 5\times4x3x2= 240$
Required numbers greater than 70000
= 720 + 240 = 960
Now, the given equation is $7^{4x} - 7.7^{2x+1} - n = 0$ i.e., $7^{4x} - 7.7^{2x+1} - 960=0$
We will try to convert it into a quadratic equation.
$7^{4x} - 7.7^{2x+1} - 960 = 0$
$(7^{2x})^2 - 7.7^{2x}.7^1 - 960 = 0$
$(7^{2x})^2 - 49.7^{2x} - 960 = 0$
Let $7^{2x} = a \Rightarrow$ The equation becomes
$a^2 - 49a - 960 = 0$
$(a - 64) \times (a + 15) = 0$
a = 64 or a = –15
7^{2x} = a will always be positive. ∴ a = –15 is not a valid solution.
a = 64
$7^{2x} = 64$
$2x = \log_7 64$
x = ($\log_7 64)/2$
Hence, (2) is correct.

Mock 11

1. 300.
F(n) = a+b+c if (a+b+c) < 10
= F(a+b+c) if (a+b+c) ≥ 10
So, F(n) can assume values from 1 to 9 and F(n) is nothing but the digital sum of n where n is a 3digit number.
G(n) can assume value from 0 to 8.
From the properties of the digital sum of a number, we know that if a number is not divisile by 9, the digital sum of the number is itself the remainder and if the number is divisible by 9 the remainder would be 0.
So, F(n) + G(n) can assume a maximum value of 16 which is a perfect square.
The other values it can assume are 4 & 9
1 is not possible as it is not possible to get the remainder 0 and digital sum 1.
Hence, only the below combinations are possible-
4 = 2 + 2
9 = 9 + 0
16 = 8 + 8
Which means any number which gives a remainder of 0, 2 or 8 satisfy the condition.
So, out of every 9 consecutive numbers starting 100; there exist 3 numbers which give ether a 0, 2 or 8 as a remainder when divided by 9.
Hence, the total count is (999-100+1)/3 = 300.

2. (b)

Let Obama bought 100 shirts on first day.
Therefore, the number of shirts Johnson got = 60
Number of shirts Biden got = 40
Number of shirts Obama bought on next day = 100 × 120/100 = 120
Number of shirts Johnson got on next day = 60×105/100 = 63
Number of shirts Biden got on next day = 120 - 63 = 57
Required percentage = (57 - 40) × 100/40 = 42.5%

3. 9000

Solution
Let the investment in scheme C = x
Profit = Investment × Time
Time = 1 year.
Then, ratio of their profit:

	A	B	C	
	$4 \times \frac{3}{4}x$	$\frac{3}{4}x$	x	(Time = 1)
⇒	3x	$\frac{3}{4}x$	x	
⇒	12x	3x	4x	

Total 19x → 57000 (Total profit)
x → ₹ 3000
Profit of scheme B = 3x
= 3 × 3000
= ₹ 9000

4. 6.

Let the price of a pen is \$x and that of a pencil is \$y and the price of an eraser is \$z.
So,
37x + 17y + 5z = 150
x can assume the below values as 37x < 150
a) x = 1 (Not possible as x > z)
b) x = 2
c) x = 3
d) x = 4

x = 4 is not possible as \$37*4 = \$148 which will give no room for purchasing 17 pencils and 5 erasers.

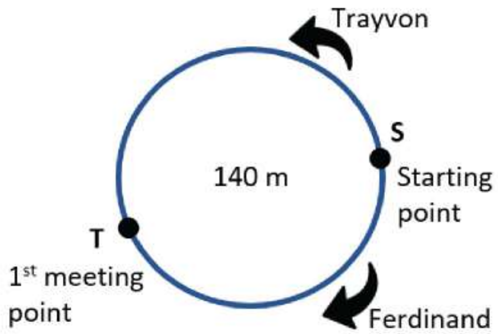
If x = 2, then 17y + 5z = (150 – 74) = 76
If x = 2 and z = 1 as that is the only possible option.
So,
17y = 71
This is not possible as y is an integer.

If x = 3, then 17y + 5z = (150 – 111) = 39
If x = 3 and z = 1
Then 17y = 34
So, y = 2

This is possible

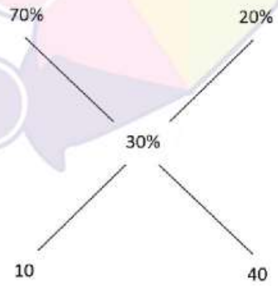
Now let us see another combination-
If x = 3 and z = 2,
Then 17y = 29
This is not possible as y is an integer.
Hence, x = 3, y = 2 and z = 1.
Therefore, the combined price of 1 pen, 1 pencil and 1 eraser
= 3+2+1
= 6

5. 84.

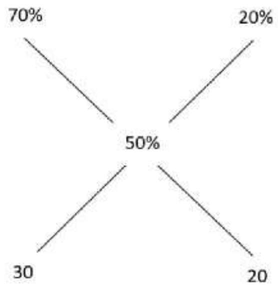


Time taken to meet for the first time =(Total track length)/(Relative Speed) = 140/10 = 14s
Say they meet at point T.
The distance ST = speed of Trayvon × time taken = 6 m/s × 14 sec = 84 m
Once they meet for the first time at T, they exchange their speed.
So, now the speed of Ferdinand becomes 6m/s and Trayvon's speed = 4m/s.
The interesting thing now is that Ferdinand with the increased speed of 6m/s will take 14 sec only to reach the starting point. Same for Trayvon he would take 14 sec to reach point S.
Once they meet again at point S after 28 sec from the time they started together, the same cycle will repeat. Hence they would keep on meeting only at points T and S alternatively.
Hence for the 25^{th} Time, they will meet at point T which is 84 m away from starting point.

6. (b)
To get a mixture with 30% concentration:



We should add both the mixtures in 1:4 ratio, hence a = 60*4 = 240 litres
To get a mixture with 50% concentration:



We should add both the mixtures in 3:2 ratio, hence a = 60/3*2 = 40 litres

Hence, the required range is 40 litres to 240 litres.

7. (d)

Let a = $\sqrt{870 + \sqrt{870 + \sqrt{870 + \cdots \ldots \ldots \infty}}}$

Then, a = $\sqrt{870 + a}$

Squaring both sides, we get

$a^2 = 870 + a$

(a-30)(a+29) = 0

a = 30 [Since, a ≠ -29]

So, the equations become

$x^2 - xy - x = 102$ .... (i)

$y^2 - xy + y = 30$ .... (ii)

Now, if we add these two equations, we get

$(x - y)^2 - x + y = 132$ or $(y - x)^2 - x + y = 132$

Since we need to find for x > y, we should take $(x - y)^2 - x + y = 132$

$(x - y)^2 - (x - y) = 132$

(x - y) (x - y - 1) = 132

If we take x - y = n, then we will boil down to n (n - 1) = 132

Therefore, x - y = 12

8. (a)

It is given that |x + y| + |x – y| = 6

If x + y ≥ 0, then |x + y| = x + y and if x + y < 0, then |x + y| = -(x + y).

Again, if x - y ≥ 0, then |x - y| = x - y.

And if x - y < 0, |x - y| = -(x - y).

Applying the above conditions, we get four cases:

I. x + y ≥ 0, x - y ≥ 0

|x + y| + |x – y| = 6

(x + y + x – y) = 6

So, x = 3

II. x + y ≥ 0, x - y < 0

|x + y| + |x – y| = 6

x + y - x + y = 6

So, y = 3

III. x + y < 0, x - y ≥ 0

|x + y| + |x – y| = 6

- x - y + x - y = 6.

So, y = - 3

IV. x + y < 0, x - y < 0 = |x + y| + |x – y| = 6

- x - y - x + y = 6

So, x = -3

Now $x^2 + y^2 + 5xy$ will be minimum when (xy) is negative so one of x and y is 3 and the other is -3.

Then $x^2 + y^2 + 5xy = (3)^2 + (3)^2 + 5(-9) = 9 + 9 - 45 = -27$

Hence, the minimum value of $x^2 + y^2 + 5xy$ is -27

9. 1295

It is given that,

$\frac{7.5 \times 1 \times 10{,}000}{100} + \frac{4.5 \times 1 \times 4000}{100} + \frac{x \times 1 \times 11{,}000}{100} = \frac{6}{100} \times 25000$

7.5 × 10,000 + 4.5 × 4000 + 11,000x = 6 × 25,000 x = 5.18%

Hence, the required interest $= \frac{25000 \times 5.18 \times 1}{100} = Rs. 1295$

10. (c)

Let the cash price be Rs.a and Rs.b be the 17th part that was equally distributed between tthe captain and the vice-captain.

Then, we get,

a – a/10 – 5/100 × 9a/10 – 100 = 17b

a – (145a/1000) – 100 = 17b

855a / (1000 – 100) = 17b

For the captain to get an amount which is a multiple of 100, b should be an even multiple of 100, ie, b should be a multiple of 200.

Option [a]

17b = (855 × 18000) / 1000 - 100 = 15290

b is not a multiple of 100

Option [b]

17b = (855×19000)/1000 – 100 = 855 × 19 - 100

b is not a multiple of 100

Option [c]

17b = 855× 20000/1000 – 100 = 17000

Hence, option c is a answer.

11. 101

$N = 100^2 + 99^2 - 98^2 - 97^2 + 96^2 + 95^2 \ldots\ldots\ldots + 3^2 - 2^2 - 1^2$

Or, $N = 100^2 - 98^2 + 99^2 - 97^2 \ldots\ldots\ldots + 4^2 - 2^2 + 3^2 - 1^2$

N = (100 + 98)(100 − 98) + (99 + 97)(99 − 97)………… + (4 + 2)(4 − 2) + (3 + 1)(3 − 1)

N = 2(100 + 99 + 98 + 97 + 96 ….. + 4 + 3 + 2 + 1)

N = 2*100*101/2

N / 100 = 101

12. (c)

The GP is of the form a, ar, ar^2 and when consecutive perfect squares starting from 1 are subtracted from the terms we get (a - 1), (ar-4), (ar^2-9) which is an AP.

So, we get (ar-4) - (a-1) = (ar^2-9) - (ar-4) = common difference, which gives ar^2-2ar+a-2 = 0

As we are given a = 1/2, the equation above becomes (1/2) r^2 – (1/2) × 2r + (1/2) -2 = 0 which is same as r^2 - 2r – 3 = 0

i.e., (r- 3) (r + 1) = 0 which gives r = 3 or r = -1

As we are given that the common ratio is greater than 1, r cannot be -1, so the value of r = 3.

So, the AP is

(a - 1) = {(1/2) -1} = -(1/2),

(1/2 × 3 – 4) = 5/2 &

(ar^2 – 9) = {((3)^2/2)-9} = – 9/2

we get the 20th term of the AP = first term + (20-1) × common difference

= a+ 19d

= 1/2 + 19x (-2)

= – 77/2

13. 9

$\log_3 \log_7 (\sqrt{(x+7)} + \sqrt{x}) = 0$

$\log_7 (\sqrt{(x+7)} + \sqrt{x}) = 1$

$(\sqrt{(x+7)} + \sqrt{x}) = 7$

$\sqrt{(x+7)} = 7 - \sqrt{x}$

Squaring both the sides

$x+7 = 49+x- 14\sqrt{x}$
$14\sqrt{x} = 42$
$\sqrt{x}= 3$
Squaring both sides
$x = 9$

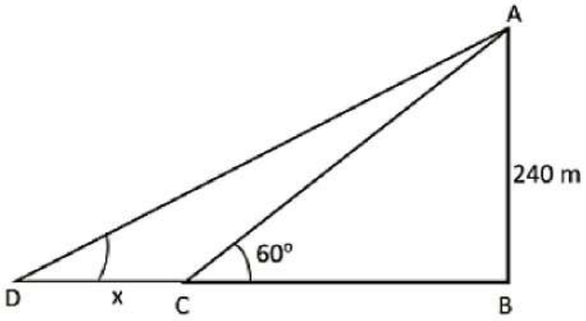
14. (c)
Let the AP be a, a+ d, a+ 2d…
$T_{20} = a +19d$
$T_{30} = a + 29d$
$T_{40} = a + 39d$
$T_{88} = a + 87d$
$T_{20} + T_{30} + T_{40} = a +87d$
$3a +87d = a+87d$
So, a=0
$T_{20} + T_{30} + T_{40} = 87d$ and
$T_5 +T_{10} + T_{15} = 4d + 9d + 14d = 27d$.
The required ratio = 87 : 27 = 29: 9

15. 26.
Let number of terms in the arithmetic progression be n, then
$721 = 1 + (n–1) d$
$=>(n–1) d = 720$
$=> n – 1 = 720/d$
Since n is an integer, so (n – 1) is also an integer. This means that 'd' is a factor of 720.
As, 720 has 30 factors which are {1 , 2 , 3 ,. . . , 720}
Out of these 30 factors, for 4 factors (720,360,240,180), the value of n cannot be at least 6 and hence we will reject them.
Now, 'd' can take 26 different values.
So, in total, 26 A.Ps. are possible.

16. (d)
Distance covered by Snail in 1st, 2nd, 3rd ……. Minute is:
1, 1/2, 1/4 ……
This is a GP with infinite terms. 1st term of GP, a = 1 and common ratio, r = 1/2 < 1
Sum of Infinitie terms of GP = a/(1 - r) = 1/(1 - 1/2) = 2 cm
Thus, the snail moves ahead by only 2cm in this whole journey
Therefore, snail never reaches a point 2.4 cm away from Starting point.

17. (a)
It is given that,
A plant grows 1.53 cm in its first week.
The growth in the first nine weeks is as follows:
$1.53, 1.53 \times 10.3, 1.53 \times (1.03)^2, 1.53 \times (1.03)^3, \ldots\ldots 1.53 \times (1.03)^8$
Total growth in the first nine weeks is
$S_9 = 1.53\left[\frac{(1.03)^9-1}{1.03-1}\right]$
$= 15.54$ cm

18. (c)



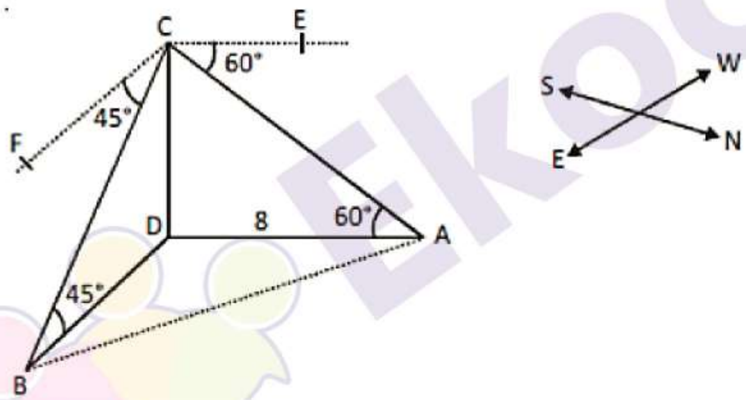
In triangle ABC,
$\tan 60^{\circ} = 240/BC$
$\sqrt{3} = 240/BC$ .... (1)
$BC = 240/\sqrt{3} = 80\sqrt{3}$ m
In triangle ABD,
$\tan 45^{\circ} = AB/BD = 240/BD$ .... (2)
From equation I and II,

$$1 = \frac{240}{x + 80\sqrt{3}}$$

$$x + 80\sqrt{3} = 240$$

$$x = 240 - 80\sqrt{3} = 80(3 - \sqrt{3})m$$

19. (c)
For this type of 3-dimensional space question,
Let A and B be the two airports respectively and C be the plane. This can be represented as



∠ECA=∠CAD=60° (Alternate interior angle)
Similarly,
∠FCB=∠CBD=45°
Now, in ΔADC,

$$\tan 60^{\circ} = \frac{CD}{AD} \Rightarrow CD = 8\sqrt{3}$$

And in triangle ΔBDC,

$$\tan 45^{\circ} = \frac{CD}{BD} \Rightarrow CD = BD = 8\sqrt{3}$$

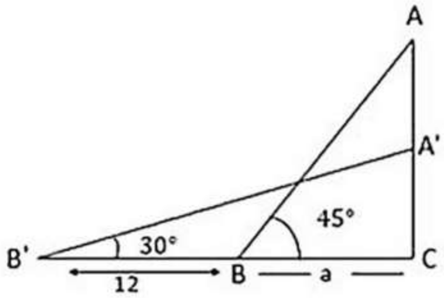
In triangle ΔABD, using Pythagoras' theorem,

$$AB^2 = DB^2 + AD^2 = (8\sqrt{3})^2 + 8^2$$

$$AB^2 = 256$$

$$AB = 16 \text{ km}$$

20. (a)



$$\tan 45° = \frac{AC}{BC} = 1$$

AC = BC= a [say]

$AB = a\sqrt{2}$

As the length of the ladder remains the same, so

$$AB = A'B' = a\sqrt{2}$$

In Δ A'B'C,

$$\cos 30^o = \frac{B'C}{A'B'} = \frac{12+a}{a\sqrt{2}} = \frac{\sqrt{3}}{2}$$

$$24 + 2a = a\sqrt{6}$$

$$a = \left(\frac{24}{\sqrt{6}-2}\right)$$

So,

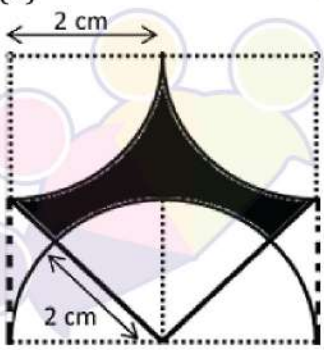
$$AB = a\sqrt{2} = \frac{24\sqrt{2}}{\sqrt{6}-2} \times \frac{\sqrt{6}+2}{\sqrt{6}+2}$$

$$= 12\sqrt{2}(\sqrt{6}+2)$$

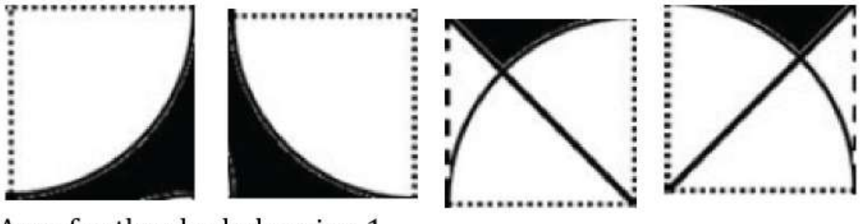
$$= 24(\sqrt{3}+\sqrt{2})$$

Hence, option A is correct.

21. (a)



It is important to complete the figure and visualize that it's a semicircle, two quarter circles and area between them. Also, the outside is a square which can be divided into 4 squares of side 2 cm each. We can deal with 1/4th of a square at a time and reach the required result



Area for the shaded region 1

= Area of square - Area of quarter circle

= 2×2 – 1/4 × π(2×2)

= 4 - π

Area for the shaded region 2 = 1/2 (Area of square - Area of quarter circle)

= 2 - π/2
Total shaded area = 2(6 - 3/2 π) = 12 - 3π

22. (c)
Ratio of number of days taken by Q is to R = 3:5 ...(i)
Since the ratio of efficiency is inversely proportional to the amount of Time taken,
Hence, the ratio of number of days taken by P is to R = 2:3 ...(ii)
From (I) and (ii),
The ratio of time taken by P, Q and R is 10 : 9 : 15
Let P takes 10x days then Q takes 9x and R takes 15x days.
P takes 10 days less than R,
=> 15x – 10x = 10
=> 5x = 10
=> x = 2
Therefore, P, Q and R take 20 days, 18 days and 30 days respectively.
P's 1 day work = 1/20
Q's 1 day work = 1/18
R's 1 day work = 1/30
P, Q and R's 1 day work = 1/20 + 1/18 + 1/30 = 5/36 ...(i)
P, Q and R's work for 4 days = 4 * 5/36 = 5/9 ...(ii)
P and R left after 4 days.
Remaining work to be completed by Q = 1- 5/9 = 4/9
Time taken by Q to complete the work = 18 x 4/9 = 8 days
Hence, Q completes the remaining work in 8 days.

Mock 12

1. (b)
Let divide the journey in 3 different parts.
For first part, let for x hour, any two (let P and Q) travel on a scooter and third person (R) is walking for this period of time. After x hour, P and Q reach at point D, somewhere between point A and point B such that AD < AB.
For second part, let for y hour, either P or Q (let P) return to get the third person (R) after dropping another person (Q) at a point D. After y hour R reaches the point C, where R meets P, somewhere between the point A and D such that, AC < AD < AB.
For third part, for z hour, P and R travel on the scooter and Q is walking towards the point B.

Now, from above assumptions, taking all the three parts together
Distance travelled by P in x, y and z hour is

$$40x - 40y + 40z = 240$$

$$x - y + z = 6$$

Distance travelled by Q in x, y and z hour is

$$40x + 10y + 10z = 240$$

$$4x + y + z = 24$$

Distance travelled by R in x, y and z hour is

$$10x+10y+40z=240$$
$$x+y+4z=24$$

Solving all the three equations, $x=\frac{30}{7}$ h, $y=\frac{18}{7}$ h and $z=\frac{30}{7}$ h

Total required time $=x+y+z=\frac{78}{7}$ h $=11\frac{1}{7}$ h

Hence, the correct answer is "$11\frac{1}{7}$ h"

2. (c)
For real and distinct roots, D > 0, so
$b^2-4ac>0$ or $100-4|k|>0$ or $4|k|<100$ or $|k|<25$
$k=-24,-23,-22,\cdots\cdots,0,1,\cdots\cdots,23,24$
Total number of integers $=24+24+1=49$
Hence, the correct answer is "49"

3. (d)
HCF of sum of the numbers and LCM of the numbers is always equals to the actual HCF of the numbers.
Factor of $234=2\times3\times3\times13$
Factor of $756=2\times2\times3\times3\times3\times7$
HCF of 234 and 756 $=2\times3\times3=18$ = HCF of x and y
So, the numbers are $x=18m$ and $y=18n$, where m and n are coprime numbers.
Now,
$$x+y=234$$
$$18m+18n=234$$
$$m+n=13$$
$$m=13-n \quad \text{-- (i)}$$
Also, $18\times m\times n=756$ or $m\times n=42$ -- (ii)
Putting the value of m from equation (i) in (ii),
$$(13-n)n=42$$
$$n^2-13n+42=0$$
$$(n-6)(n-7)=0$$
$$n=6 \text{ or } 7$$
$$m=13-n$$
$$=7 \text{ or } 6$$
So, the numbers are $x=18m=126$ and $y=18n=108$

The question has asked the value of **x or y**, it could be 126 or 108, so cannot be determined.

4. (d)
Let the price of a magazine $=x$
Then, price of a notebook $=5x$

Total monthly expenditure, m $= 8x + 12 \times 5x = 68x$
After increased, price of a notebook $= 120\%$ of $5x = 6x$
Let number of notebooks purchased after increased in price $= y$
Then,

$$8x + y \times 6x = m$$

$$8x + y \times 6x = 68x$$

$$6y = 68 - 8$$

$$y = 10$$

Required decreased percentage $= \frac{12-10}{12} \times 100 = 16\frac{2}{3}\%$
Hence, the correct answer is "$16\frac{2}{3}\%$"

5. (b)

Let the number be xy
10y + x = 10x + y + 18
=> 9y – 9x = 18
=> y – x = 2
So, y can take values from 9 to 4 (since 3 is already counted in 13)
Number of possible values = 6

6. (a)

$$a^3 + b^3 = (a+b)(a^2 + b^2 - ab)$$

$(250\sqrt{2}x^3 + 24\sqrt{3}y^3) \div (5\sqrt{2}\,x + 2\sqrt{3}\,y)$

$$\frac{(250\sqrt{2}x^3 + 24\sqrt{3}y^3)}{(5\sqrt{2}x + 2\sqrt{3}y)}$$

$$\frac{((5\sqrt{2}x)^3 + (2\sqrt{3}y)^3)}{(5\sqrt{2}x + 2\sqrt{3}y)}$$

= (50$x^2 + 12y^2 - 10\sqrt{6}xy$) *which is equal to* $(Ax^2 + By^2 - C\sqrt{6}\,xy)$
Therefore, A =50, B = 12, C = 10
$\frac{A}{10} + \frac{B^2}{8} + C = (5 + 18 + 10) = 33$
Hence, the correct answer is "33"

7. (c)

For an equilateral trianlge, $s = \frac{a+b+c}{2} = \frac{3a}{2}$ and area $= \frac{\sqrt{3}}{4}a^2$

$$r^2 = \left(\frac{area}{s}\right)^2 = \frac{1}{12}a^2$$

$$R^2 = \left(\frac{abc}{4 \times area}\right)^2 = \frac{1}{3}a^2$$

$$\therefore \frac{\text{Area of Circumcircle}}{\text{Area of Incircle}} = \frac{\pi R^2}{\pi r^2} = \frac{a^2}{3} \times \frac{12}{a^2} = 4$$

8. (d)

Let the required minimum number of tickets to be sold per day $= x$
Then,
Revenue ∝ (Number of ticket sold – x)
Revenue = k (Number of ticket sold – x)

$2400 = k(50 - x)$ -- (i)

$3200 = k(60 - x)$ -- (ii)

Dividing equation (i) with (ii).

$$\frac{2400}{3200} = \frac{k(50-x)}{k(60-x)}$$

or $3(60-x) = 4(50-x)$

or $180 - 3x = 200 - 4x$ or $-3x + 4x = 200 - 180$

or $x = 20$

Hence, the correct answer is "20"

9. (a)
Given,

$\frac{1}{3}$rd of a man 1 hour work = a woman 1 hour work

Man's 1 hour work = Woman's 3 hour work

Man's 8 hour work = Woman's 3×8 hour work

Man's 1 day work = Woman's $\left(\frac{3\times 8}{6} = \right)$ 4 days work

= 4 Women's 1 day work

So,

$$10 \text{ Men} + 20 \text{ Women} = 10 \times 4 \text{ Women} + 20 \text{ Women}$$
$$= 60 \text{ Women}$$
$$8 \text{ Men} + 12 \text{ Women} = 8 \times 4 \text{ Women} + 12 \text{ Women}$$
$$= 44 \text{ Women}$$

Now,

$$W_1 D_1 = W_2 D_2$$
$$60 \times 22 = 44 \times D_2$$
$$D_2 = 30 \text{ days}$$

Hence, the correct answer is "30 days".

10. 64
The product of any two or more numbers is maximum when the difference between the numbers is minimum or zero (all are equal).
[Example- Let a + b =12. ab=36(maximum)when a = b = 6 and for other value of a and b, ab<36]

Here, $a+b+c=15$ *or* $(a-4)+(b+2)+(c-1)=15-4+2-1$ or

$(a-4)+(b+2)+(c-1)=12$

For maximum value of $(a-4)+(b+2)+(c-1)$:

$$(a-4)=(b+2)=(c-1)=\frac{12}{3}=4$$

So, the maximum value of $(a-4)(b+2)(c-1)=4\times4\times4=64$

Hence, the correct answer is "64".

11. (b)

Let the least possible number is x.

Then,

$x=7m+5$

$x=13n+9$

Here, m and n are quotients, respectively.

Now, $7m+5=13n+9$ or $m=\frac{13n+4}{7}$

Putting the value of n= 0,1,2,3.... such that the value of m is an integer.

For n=4,m=8. So, the least such possible number

$x=7m+5=13n+9=61$

LCM of 7 and 13 = 7 x 13= 91

In general form,

x= 91k +61where k= 0,1,2,3....

Smallest and largest numbers in the given range are 243 and 698 for k = 2 and k = 7.

So, required number of such numbers $=7-2+1=6$

Hence, the correct answer is "6".

12. (c)

Let I represent the percentage of pupils that enjoy only one type of activity.

The percentage of pupils who enjoy exactly two activities is called II.

The percentage of pupils who enjoy exactly three activities should be III.

IV is the proportion of pupils who enjoy all four activities equally.

V denotes the proportion of students who enjoy all five activities.

I+II+III+IV+V=100

I+2II+3III+4IV+5V=410

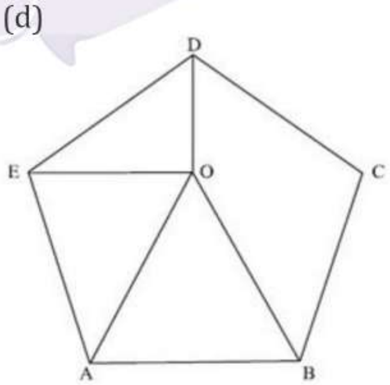
We need to increase the number of pupils who enjoy exactly four activities.

Consider I, II, and III to be 0 and IV+V to be 100 and 4IV+5V to be 410.

V=10, IV=90 is the correct solution when both equations are solved.

Hence, the correct answer is "90"

13. (d)



Join OE and OD.

Internal angle of regular pentagon = 108°

∠EAB = ∠EDC = 108°

∠OAB = 60°

∠EAO = 48°

AO = OB = AB as the triangle is equilateral.
AB = AE as this is a regular pentagon.

Triangle AEO is isosceles as AO = EA.
∠AEO = ∠AOE = x (say)

In triangle AEO,
∠OAE + 2x = 180°
48° + 2x = 180°
2x = 132°, or x = 66°

14. (a)
Valid solutions:
a = 2; b = 32
a = 5; b = 30
.
.
a = 47; b = 2
No. of solutions = 16

15. (d)
Let's start with a budget of 1.
Every quarter, his spending grew by 100%.
Then, after the first quarter, the expenditure=1(1+ 100/100) = 2
After two years, the spending equals $1(1+100/100)^8=256$
Every year, a person's salary decreases by 50 percent.
The salary will be 256 after two years.
Because the current expenses are equal to one,
The current salary is equal to $x \times (1-50/100)^2=256$
⇒x=1024
The current salary and cost ratio for a person is 1024:1
Hence, the correct answer is "1024"

16. (d)
According to the question,
Male = 60% and female = 40%
Ratio of Male to Female = 60 : 40 = 3:2
Let Male = 300 and Female = 200
Out of 300 there are 25% are government employee = 300×25%= 75
Remaining = 300 – 75 = 225
Out of 225 private employee and
= 4 : 5 : ⇒ 4x : 5x = 4×25 : 5×25= 100 : 125
Now
Female = 200, out of 200 60% are Government Employees = 200×60% = 120
Out of 200 40%= 80; Out of 80, 60% are private employees=80×60%= 48
And 40% are unemployed = 80×40% = 32
So, Unemployed
Or, 125 Units – 32 Units = 6,510
Or, 93 Units = 6,510
1 Unit = 70
So, 195 Units = 195×70 = Rupees 13650
Hence, the correct answer is "13650"

17. (a)

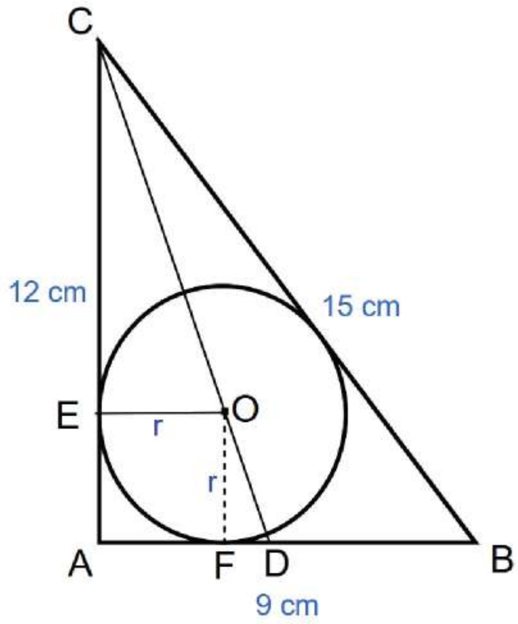
Solution: For a right-angle triangle ΔABC, inradius

$$r = \frac{AB + AC - BC}{2} = 3 \text{ cm}$$

Drawing $OE \perp AC,\ OE = r = 3 \text{ cm}$

Also, $OE = r = OF = EA = 3 \text{ cm}$

So, $CE = CA - EA = 12 \text{ cm} - 3 \text{ cm} = 9 \text{ cm}$



From ΔACD and ΔECO, ∠C=∠C and ∠A = ∠E = 90°

Thus

ΔACD ΔECO

So, AC/EC = DC/OC = 12/9

$DC/3\sqrt{10} = 4/3$

$\therefore DC = 4\sqrt{10}$

$\therefore OD = \sqrt{10}$

Now,

$OD : OC = \sqrt{10} : 3\sqrt{10} = 1:3$

18. 2.

The unit digit of

$$(1!)^1 = 1,\ (2!)^2 = 4,\ (3!)^3 = 6,\ (4!)^4 = 6,\ (5!)^5 = 0$$

The unit digit of $(n!)^n = 0$ and the remainder is zero for $n \geq 5$ as 5! Onwards will contain 5 in it, therefore the remainder will always be zero.

All the unit digits sum $= 1 + 4 + 6 + 6 = 17$

When 17 is divided by 5, gives 2 as remainder.

So, the required remainder =2

Hence, the correct answer is "2".

19. (b)

Let the current population of the village and rate of decrease are x and r, respectively.

The population of the village at the start of second year (after one year) $= x\left(1-\frac{r}{100}\right)^1$

Population of the village at the start of third year (after two year) $= x\left(1-\frac{r}{100}\right)^2$

Given,

$$\frac{x\left(1-\frac{r}{100}\right)^1}{x\left(1-\frac{r}{100}\right)^2} = \frac{20}{19} \text{ or } \frac{1}{\left(1-\frac{r}{100}\right)} = \frac{20}{19} \text{ or } \frac{100}{100-r} = \frac{20}{19} \text{ or } r = 100 - 95 = 5$$

Let the population of the village three year ago was y. Then,

$$x = y\left(1-\frac{r}{100}\right)^3$$

$$20577 = y\left(1-\frac{5}{100}\right)^3$$

$$= y\left(\frac{19}{20}\right)^3$$

$$y = \frac{20577 \times 20 \times 20 \times 20}{19 \times 19 \times 19}$$

$$= 24000$$

Hence, the correct answer is "24000."

20. (a)

$\log_2 x + \log_4 x = \log_{0.25}\sqrt{6}$

We can rewrite the equation as:

$\log_2 x + \frac{\log_2 x}{\log_2 4} = \log_{0.25}\sqrt{6}$

$\log_2 x * \frac{3}{2} = \log_{0.25}\sqrt{6}$

=> $\log_2 x * 3 = 2\log_{0.25}\sqrt{6}$

=> $\log_2 x^3 = -\log_4 6$

=> $\log_2 x^3 = \frac{-\log_2 6}{\log_2 4}$

=> $\log_2 x^3 = \frac{-\log_2 6}{6}$

$\Rightarrow 2\log_2 x^3 = -\log_2 6$

$2\log_2 x^3 + \log_2 6 = 0$

$\log_2 6X^6 = 0$

$6x^6 = 1$

$x^6 = \frac{1}{6}$

$x = \sqrt[6]{\frac{1}{6}}$

21. (d)
Since the volumes of the glasses are not given, it is not possible to find the proportion of milk and water in the third glass.

22. (c)
a = bx
b = a (1 + x), substituting this in the previous equation, we get
x (x + 1) = 1
x2 + x - 1 = 0 or
x is approximately 0.62 or 62%.

Mock 13

1. (c)
Total number of pages = 200
Number of digits required to number the book from page 1 to 9 = 9
Number of digits required to number the book from page 10 to 99 = 2 × 90 = 180
Number of digits required to number the book from page 100 to 200 = 3 × 101 = 303
Therefore, total number of digits = 303 + 180 + 9 = 492

2. 40.
Let, PO denotes the distance between the place P and place O.
QO denotes the distance between the place Q and place O.
According to the given information, $PO = \frac{1}{2}QO$ or QO = 2PO
Let, time taken by biker 2 to cover the distance QO be t hours.
So, according to the question, the time taken by biker 1 to cover the distance PO will be $\left(t - \frac{1}{2}\right)$ hours.
Hence, speed of biker 1, $v_1 = \frac{PO}{\left(t - \frac{1}{2}\right)}$ units/hour
And, the speed of biker 2, $v_2 = \frac{QO}{t}$ units / hour

According to the given information, $V_1 = 2v_2$

$$\therefore \frac{PO}{\left(t - \frac{1}{2}\right)} = 2 \times \frac{QO}{t}$$

$$\Rightarrow \frac{PO}{\left(t - \frac{1}{2}\right)} = 2 \times \frac{2PO}{t} \qquad \left[\because PO = \frac{1}{2}QO\right]$$

$$\Rightarrow \frac{\cancel{PO}}{\left(t - \frac{1}{2}\right)} = 2 \times \frac{2\cancel{PO}}{t}$$

$$\Rightarrow \frac{1}{t - \frac{1}{2}} = \frac{4}{t}$$

$$\Rightarrow 4\left(t - \frac{1}{2}\right) = t$$

$$\Rightarrow 4t - 2 = t$$

$$\Rightarrow 4t - t = 2$$

$$\Rightarrow 3t = 2$$

$$\Rightarrow t = \frac{2}{3} \text{ hours}$$

Now,

$$\frac{2}{3} \text{ hours} = \frac{2}{\cancel{3}_1} \times \cancel{60}^{20} \text{ min}$$

$$= 40 \text{ min}$$

Therefore, the time taken by biker 2 to reach place O to place Q is 40 minutes.
Hence , the correct answer is "40"

3. (d)
Let area of the first square be a1, whose side is s1.
Let area of the second square be a2, whose side is s2.
Then,

$$\frac{a_1}{a_2} = \frac{s_1 \times s_1}{s_2 \times s_2}$$

$$\frac{9}{1} = \frac{s_1 \times s_1}{s_2 \times s_2}$$

$$\frac{s_1}{s_2} = \frac{3}{1}$$

So, required ratio of perimeter $= \frac{4s_1}{4s_2} = \frac{s_1}{s_2} = \frac{3}{1}$

4. (d)
Let, the cost prices per kg of X type of tea and Y type of tea be Rs. X and Rs. Y respectively.
When the two types of tea, X and Y are mixed in 3:2 ratio, the cost price of the mixture per kg will

be Rs $\frac{3x+2y}{5}$.

And, when the two types of tea, X and Y are mixed in 2:3 ratio, the cost price of the mixture per kg will be Rs. $\frac{2x+3y}{5}$.

Now, the first type of mixture is sold at 20% profit. So, the selling price of the first mixture will be Rs. $\frac{3x+32}{5}\times\frac{120}{100}$.

Hence, as per the given information, $\frac{3x+3y}{5}\times\frac{120}{100}=60$ ....(1)

Again, the second type of mixture is sold at 10% loss. So, the selling price of the second mixture will be Rs. $\frac{2x+3y}{5}\times\frac{90}{100}$.

Hence, as per the given information, $\frac{2x+3y}{5}\times\frac{90}{100}=40.$ ....(2)

Divide the equation (1) by (2) to obtain the required ratio.

$$\frac{\frac{3x+2y}{5}\times\frac{120}{100}}{\frac{2x+3y}{5}\times\frac{90}{100}}=\frac{60}{40}$$

$$\Rightarrow \frac{(3x+2y)\times 120}{(2x+3y)\times 90}=\frac{60}{40}$$

$$\Rightarrow \frac{(3x+2y)}{(2x+3y)}=\frac{60}{40}\times\frac{90}{120}$$

$$\Rightarrow \frac{(3x+2y)}{(2x+3y)}=\frac{9}{8}$$

$$\Rightarrow 24x+16y=18x+27y$$

$$\Rightarrow 24x-18x=27y-16y$$

$$\Rightarrow 6x=11y$$

$$\Rightarrow \frac{x}{y}=\frac{11}{6}$$

Therefore, the ratio of the cost prices per kg of X and Y is 11:6.
Hence, the correct answer is "11:6"

5. (a)

S TheThe required number of ways is the same as the number of ways in which m + n + p things can be divided into three groups containing m, n and p things, which is $\frac{(m+n+p)!}{m!\times n!\times p!}$.

∴ The required number of different allotments = $\frac{(45)!}{10!\times 15!\times 20!}$

6. (b)

Given that, f(x + 4) = f(x) + f(x + 2) and f(13) = 45
Let, f(15) = a
∴f(17) = f(13 + 4) = f(13) + f(13 + 2) = f(13) + f(15)
So, f(17) = 45 + a

Similarly, f (19) = f (15+4) = f (15) + f (15+2) = f (15) + f (17)
So, f (19) =a+45+a=45+2a
And, f (21) = f (17+4) = f (17) + f (17 + 2) = f (1) + f (19)
So, f (21) =45+a+45+ 2a =90 + 3a
According to the given information, f (21) =471

$$90 + 3a = 471$$
$$\Rightarrow 3a = 471 - 90$$
$$\Rightarrow 3a = 381$$
$$\Rightarrow a = \frac{\overset{127}{\cancel{381}}}{\underset{1}{\cancel{3}}}$$

$$f(15) = f(11+4)$$
$$\Rightarrow f(15) = f(11) + f(11+2)$$
$$\Rightarrow f(15) = f(11) + f(13)$$

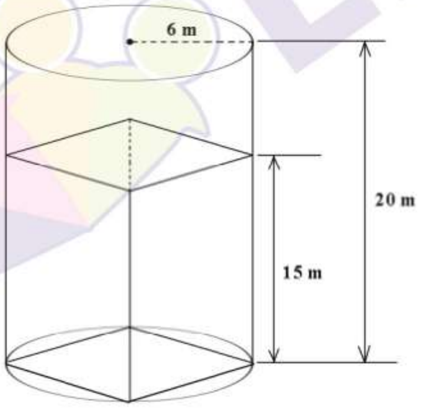
Now, $\Rightarrow f(11) = f(15) - f(13)$

$$\therefore f(11) = a - 45 \quad [\because f(15) = a \text{ and } f(13) = 45]$$
$$= 127 - 45 \quad [\because a = 127]$$
$$= 82$$

Therefore, the value of $f(11)$ is 82.

Hence , the correct answer is "82"

7. (a)



From the given information, it can be said that, the diameter of the circular base of the cylinder will be the diagonal of the square base of the square cuboid.
Now, diameter of the circular base=2 × 6 =12m
So, the diagonal of the square base will be 12 m.
Let, each side of the square base be a.
Hence, the diagonal of the square base $= a\sqrt{2}$

$$= a\sqrt{2} = 12$$
$$\Rightarrow a = \frac{12}{\sqrt{2}}$$

So, $\Rightarrow a = 6\sqrt{2}$ m

That means, the area of the square base = $a^2 = \left(6\sqrt{2}\right)^2 = 72\ m^2$

The height of the square cuboid is 15 m.
Hence, the volume of the square cuboid = Area of the base × Height
$= 72 \times 15 = 1080\ m^3$
Again, the area of the circular base of the cylinder = $\pi\ x(6)^2 = 36\ \pi m^2$
The height of the cylinder is given as 20 m.
So, the volume of the circular cylinder = Area of the circular base Height
$= 36\pi \times 20 = 720\pi m^2$
Therefore, the volume of the liquid= Volume of the cylinder - Volume of the cuboid
$= 720\pi - 1080$
$= 360(2\pi - 3)\ m^2$
Hence, the correct answer is ₙ360(2 π -3),

8. (a)
Given that, $f(x) = \max|2x^2, 102 - 5x|$.
The minimum possible value for the function f(x) can be obtained when $2x^2 = 102 - 5x$.
So,

$$2x^2 = 102 - 5x$$
$$\Rightarrow 2x^2 + 5x - 102 = 0$$
$$\Rightarrow 2x^2 + 17x - 12x - 102 = 0$$
$$\Rightarrow x + (2x + 17) - 6(x + 17) = 0$$
$$\Rightarrow (2x + 17)(x - 6) = 0$$

This implies that, either $2x + 17 = 0 \Rightarrow 2x = -17 \Rightarrow x = -\frac{17}{2}$ or $x - 6 = 0 \Rightarrow x = 6$

As, x is a positive real number, x cannot be equal to $-\frac{17}{2}$. That means, $x = 6$.

So, the minimum possible value of $f(x)$ can be obtained by putting $x = 6$ into $2x^2$ or $102 - 5x$.

Therefore, the maximum value of $f(x) = 2(6)^2 = 102 - 5(6) = 72$.

Hence, the correct answer is "72"

9. (d)
12 is one of the roots of the quadratic equation . $x^2 + px + 48 = 0$.

$$\therefore\ 12^2 + p \times 12 + 48 = 0$$
$$\Rightarrow 144 + 12p + 48 = 0$$
$$\Rightarrow 12p + 192 = 0$$
$$\Rightarrow 12p = -192$$
$$\Rightarrow p = -\frac{\overset{16}{\cancel{192}}}{\underset{1}{\cancel{12}}}$$
$$\Rightarrow p = -16 \ \ ....(1)$$

To have equal root for the quadratic equation $x^2 + px + q = 0$, the value of $p^2 - 4q$ must be equal to 0.

That means, $p^2 - 4q = 0$
$\Rightarrow p^2 = 4q$ ....(2)

From equation (1) and (2),

$(-16)^2 = 4q$

$\Rightarrow q = \frac{16 \times 16}{4}$

$\Rightarrow q = 64$

Therefore, the value of q is 64.

Hence , the correct answer is "64"

10. (c)
Let's think about the power of 3.
To have 3^4 in the LCM of two natural numbers, one of the number will have 3^4 in it and other number may have the power of 3 as 3^0, 3^1, 3^2, 3^3 and 3^4.

So, the ordered pairs for the power of 3 will be all possible arrangements of $(3^4, 3^0)$, $(3^4, 3^1)$, $(3^4, 3^2)$, $(3^4, 3^3)$ and $(3^4, 3^4)$, that is $(3^4, 3^0)$, $(3^0, 3^4)$, $(3^4, 3^1)$, $(3^1, 3^4)$, $(3^4, 3^2)$, $(3^2, 3^4)$, $(3^4, 3^3)$, $(3^3, 3^4)$ and $(3^4, 3^4)$.

That means, the number of ordered pair for $3^4 = [2 \times (4+1)] - 1 = 9$

In similar way, the number of ordered pairs for $4^5 = 2^{10} = [2 \times (10+1)] - 1 = 21$

And, the number of ordered pairs for $13^{12} = [2 \times (12+1)] - 1 = 25$

Hence, the total number of ordered pairs $(x, y) = 9 \times 21 \times 25 = 4275$

Hence, the correct answer is "4275".

11. (a)
Let, the price of LPG is Rs.1/litre and the consumption of the person in August is 100 litre.
So, the person spent Rs.100 for LPG in the month of August.
Now, in September the price increased by 15%.

That means, the price of 100 litre LPG becomes Rs. $\left(100 + 100 \times \frac{15}{100}\right)$ or Rs.115.

But, the person does not want to increase his expenditure for LPG. So, he will buy LPG of Rs.100 in September.

Now, in September, price of 100 litre LPG is Rs.115.

So, in Rs.100, the amount of LPG the person can get is equal to $\left(\frac{100\times100}{115}\right)$ litre.

$$=\frac{100-\left(\frac{100\times100}{115}\right)}{100}\times100\%$$

$$=100-\left(\frac{100\times100}{115}\right)\%$$

$$=\frac{11500-10000}{115}\%$$

$$=\frac{1500}{115}\%$$

Therefore, the percentage reduction in consumption $\approx 13.04\%$

Hence , the correct answer is "13.4%"

12. (b)

Cost price of the orange = Rs. (4x12)=Rs.48
Transportation cost = Rs.32
Total expenditure = Rs.48 + Rs.32 = Rs.80
Let, the price of the orange be marked up by x %.

Hence, the mark price $=\text{Rs.}\left(48+\frac{48x}{100}\right)$

Discount is given by the Ramesh is 5%.

So, the selling price $=\text{Rs.}\left[\left(48+\frac{48x}{100}\right)\times\frac{95}{100}\right]$

Hence, profit percentage $=\frac{\left[\left(48+\frac{48x}{100}\right)\times\frac{95}{100}\right]-80}{80}\times100\%$

According to the given information, $\frac{\left[\left(48+\frac{48x}{100}\right)\times\frac{95}{100}\right]-80}{80}\times100=4$

$$\therefore \frac{\left[\left(48+\frac{48x}{100}\right)\times\frac{95}{100}\right]-80}{80}\times 100 = 4$$

$$\Rightarrow \left[\left(48+\frac{48x}{100}\right)\times\frac{95}{100}\right]-80 = 4\times\frac{80}{100}$$

$$\Rightarrow \left(48+\frac{48x}{100}\right)\times\frac{95}{100} = 3.2+80$$

$$\Rightarrow 48+\frac{48x}{100} = 83.2\times\frac{100}{95}$$

$$\Rightarrow \frac{48x}{100} = \frac{8320}{95}-48$$

$$\Rightarrow \frac{48x}{100} = \frac{8320-(48\times 95)}{95}$$

$$\Rightarrow \frac{48x}{100} = \frac{8320-4560}{95}$$

$$\Rightarrow \frac{48x}{100} = \frac{3760}{95}$$

$$\Rightarrow x \approx 82.45$$

Therefore, Ramesh marked the price of the oranges up by approximately 82.45%.

13. (b)
The following table shows the values of the graph of the functions f(x) and f(-x) at different values of x:

x	0	1	2	3	-1	-3
f (x)	0	0	1	2	0	2
f(-x)	0	0	1	2	0	2

From the above table, we get
f(x) = f(-x)
f(x) - f(-x) = 0

14. (a)
Let, the total work be 1 unit.
A takes 6 days alone to complete the total work.
B takes 8 days alone to complete the total work.
C takes 12 days alone to complete the total work.
So, in 1 day A can complete 1/6 unit work.
Similarly, in 1 day B can complete 1/8 unit work.
And, in 1 day C can complete the 1/12 unit work.
Let, D takes x days alone to complete the total work.
So, in 1-day D can complete the 1/x unit work.

That means,

In a single day, A, B, C and D can complete $\left(\frac{1}{6}+\frac{1}{8}+\frac{1}{12}+\frac{1}{x}\right)$ unit work.

So, in 2 days A, B, C and D together will complete $2\times\left(\frac{1}{6}+\frac{1}{8}+\frac{1}{12}+\frac{1}{x}\right)$ unit work.

According to the given information, $2\times\left(\frac{1}{6}+\frac{1}{8}+\frac{1}{12}+\frac{1}{x}\right)$ unit work will be the total work.

Hence.

$$2\times\left(\frac{1}{6}+\frac{1}{8}+\frac{1}{12}+\frac{1}{x}\right)=1$$

$$\Rightarrow \frac{1}{6}+\frac{1}{8}+\frac{1}{12}+\frac{1}{x}=\frac{1}{2}$$

$$\Rightarrow \frac{1}{x}=\frac{1}{2}-\frac{1}{6}-\frac{1}{8}-\frac{1}{12}$$

$$\Rightarrow \frac{1}{x}=\frac{12-4-3-2}{24}$$

$$\Rightarrow \frac{1}{x}=\frac{3}{24}$$

$$\Rightarrow x=\frac{24}{3}$$

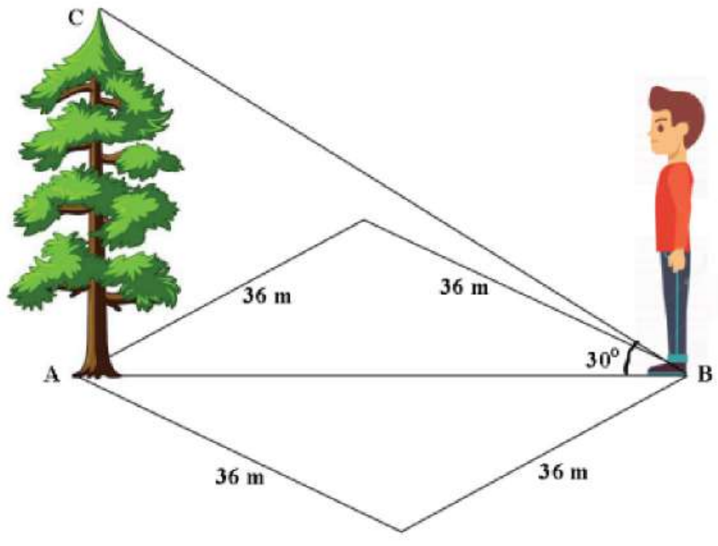
$$\Rightarrow x=8$$

That means, D takes 8 days to complete the total work.
So, in 1 day D complete 1/8 unit work.
And, hence in 2 days D will complete 2/8 unit or 1/4 unit work.
In the question, it is given that they will get Rs.2400 for 1 unit work.

This implies that the remuneration of D for his work will be Rs. $\left(\frac{1}{4}\times 2400\right)=$ Rs. 600

Hence , the correct answer is " Rs 600"

15. (d)



Z

Let, the height of the tree be h m.

The length of the square field is 36 m.

The man and tree are diagonally opposite to each other.

So, the distance between the man and tree = the length of the diagonal of the square field.

It is known that if each side of a square is a, then the diagonal will be $a\sqrt{2}$.

So, as per the given information, the distance between the man and tree, AB $=36\sqrt{2}$ m.

In the triangle ABC, AC is the height, AB is the base and $\angle ABC = 30^\circ$.

$$\therefore \frac{AC}{AB} = \tan 30^\circ$$

$$\Rightarrow \frac{h}{36\sqrt{2}} = \frac{1}{\sqrt{3}} \quad [\because AC = h \text{ and } AB = 36\sqrt{2}]$$

$$\Rightarrow h = \frac{36\sqrt{2}}{\sqrt{3}}$$

$$\Rightarrow h = \frac{36\sqrt{2}\times\sqrt{3}}{\sqrt{3}\times\sqrt{3}}$$

$$\Rightarrow h = \frac{\overset{12}{\cancel{36}}\sqrt{6}}{\underset{1}{\cancel{3}}}$$

$$\Rightarrow h = 12\sqrt{6} \text{ m}$$

Therefore, the tree is $12\sqrt{6}$ m tall.

Hence, the correct answer is " $12\sqrt{6}$ m "

16. (b)

Minimum value of a quadratic equation lies at $-\frac{b}{2a}$. So **at x = 0 equation will attain its minimum value which is** $-\frac{3}{2}$.

17. (b)

If the property was worth Rs. x, the wife got x/2, and the sons got x/6 each. When B dies, his wife gets x/12, and C and D get x/24 each. So, C and D have a property of 5x/24 each. When C dies, his wife gets 5x/48, and D gets the same. So, D's property now is 15x/48. When he dies, the mother gets 15x/96, and D's wife gets 15x/96. So, the mother's property is x/2 + 15x / 96 = 63x/96 = 1575000, x = Rs. 24 lakh.

Ratio of the property owned by the wives of the three sons = (x/12) : (5x/48) : (15x/96)

= 200000 : 250000 : 375000

= 200 : 250 : 375

= 8 : 10 : 15

18. 6

Let, the number of sides of polygon be n .

Therefore, the sum of the internal angles of the polygon $=(n-2)\times 180^{\circ}$

As, the smallest angle is 105º and the common difference is 6º, the sum of the arithmetic progression can be obtained by substituting 105 for a and 6 for d into the formula $S_n = \frac{n}{2}\left[2a+(n-1)d\right]$.

$$\therefore S_n = \frac{n}{2}\left[2\times 105+(n-1)\times 6\right]$$
$$= n(105+3n-3)$$
$$= n(102+3n)$$

As per the given information, $n(102+3n) = (n-2)\times 180$

$$\therefore\ n(102+3n) = (n-2)\times 180$$
$$\Rightarrow 102n+3n^2 = 180n-360$$
$$\Rightarrow 34n+n^2 = 60n-120$$
$$\Rightarrow n^2+34n-60n+120 = 0$$
$$\Rightarrow n^2-26n+120 = 0$$
$$\Rightarrow n^2-20n-6n+120 = 0$$
$$\Rightarrow n(n-20)-6(n-20) = 0$$
$$\Rightarrow (n-20)(n-6) = 0$$

That means, n=20 or n=6.

As, the number of sides of the polygon must be less than 10, so the correct answer will be n=6.

Therefore, the number of the sides of the polygon is 6.

Hence , the correct answer is "6

19. 0.

Given that, $\log_3(7+\log_2 x) = 2$

Simplify the above logarithmic expression to find the value of x .

$$\log_3(7+\log_2 x) = 2$$
$$\Rightarrow 7+\log_2 x = 3^2 \qquad \left[\text{If } \log_a b = M, \text{ then } b = a^M\right]$$
$$\Rightarrow 7+\log_2 x = 9$$
$$\Rightarrow \log_2 x = 9-7$$
$$\Rightarrow \log_2 x = 2$$
$$\Rightarrow x = 2^2 \qquad \left[\text{If } \log_a b = M, \text{ then } b = a^M\right]$$
$$\Rightarrow x = 4$$

Substitute 2 for x into the other logarithmic expression $\log_7(67x+71+\log_x y) = 3$ and find the value of y .

$\therefore\ \log_7(67x+72+\log_x y)=3$

$\Rightarrow \log_7(67\times4+72+\log_4 y)=3 \qquad [\because\ x=4]$

$\Rightarrow \log_7(268+72+\log_4 y)=3$

$\Rightarrow \log_7(340+\log_4 y)=3$

$\Rightarrow 340+\log_4 y=7^3 \qquad [\text{If } \log_a b=M, \text{ then } b=a^M]$

$\Rightarrow 340+\log_4 y=343$

$\Rightarrow \log_4 y=343-340$

$\Rightarrow \log_4 y=3$

$\Rightarrow y=4^3 \qquad [\text{If } \log_a b=M, \text{ then } b=a^M]$

$\Rightarrow y=64$

$$\left(\sqrt[6]{y}\right)^{\sqrt{x}}-x=\left(\sqrt[6]{64}\right)^{\sqrt{4}}-4 \qquad [\because\ x=4, y=64]$$

$$=2^2-4 \qquad [\because\ 2^6=64]$$

$$=4-4$$

So, now $\qquad =0$

Therefore, the value of $\left(\sqrt[6]{y}\right)^{\sqrt{x}}-x$ is 0.

Hence, the correct answer is "0".

20. (a)

Let, the thief stole x number of diamonds.

Also assume that after giving diamonds to the first and second guard, the number of diamond left with him were a and b respectively.

According to the given information, the number of diamonds received by the first guard $=\frac{x}{2}+1$

That means, $x-\left(\frac{x}{2}+1\right)=a$ ....(1)

Similarly, the number of diamonds received by the second guard $=\frac{a}{2}+1$

That means, $a-\left(\frac{a}{2}+1\right)=b$ ....(2)

And, the number of diamond received by the third guard $=\frac{b}{2}+1$

That means, $b-\left(\frac{b}{2}+1\right)=1$ ....(3)

Solve equation (3) to get the value of b .

$$b-\left(\frac{b}{2}+1\right)=1$$
$$\Rightarrow b-\frac{b}{2}-1=1$$
$$\Rightarrow \frac{b}{2}=1+1$$
$$\Rightarrow b=2\times 2$$
$$\Rightarrow b=4$$

Put $b=4$ into equation (2) and find the value of a .

$$a-\left(\frac{a}{2}+1\right)=4$$
$$\Rightarrow a-\frac{a}{2}-1=4$$
$$\Rightarrow \frac{a}{2}=4+1$$
$$\Rightarrow a=5\times 2$$
$$\Rightarrow a=10$$

Put $a=10$ into equation (2) and find the value of x .

$$x-\left(\frac{x}{2}+1\right)=10$$
$$\Rightarrow x-\frac{x}{2}-1=10$$
$$\Rightarrow \frac{x}{2}=10+1$$
$$\Rightarrow x=11\times 2$$
$$\Rightarrow x=22$$

Therefore, the thief stole 22 numbers of diamond originally.

Hence , the correct answer is " 22"

21. (c)
Let, the length of the head, tail and body of the fish be H,T and B.
And also assume that the length of the fish be F .

Hence, $F = H + B + T$

It is given that the length the head is 15 cm. This implies that, $H = 15\text{ cm}$

And also given that, the length of the tail, $T = H + \frac{1}{3}B$

Substituting 15 for H into $T = H + \frac{1}{3}B$, it can be obtained that $T = 15 + \frac{1}{3}B$

It is given that the length of the body, $B = \frac{1}{2}F$

Now, put $B = \frac{1}{2}F$ into $T = 15 + \frac{1}{3}B$.

$$\therefore\ T = 15 + \frac{1}{3}B$$
$$\Rightarrow T = 15 + \frac{1}{3}\left(\frac{1}{2}F\right)$$
$$\Rightarrow T = 15 + \frac{1}{6}F$$

So, put $H = 15$, $B = \frac{1}{2}F$ and $T = 15 + \frac{1}{6}F$ into $F = H + B + T$.

$$\therefore\ F = 15 + \frac{F}{2} + \left(15 + \frac{1}{6}F\right)$$
$$\Rightarrow F = 15 + \frac{F}{2} + 15 + \frac{F}{6}$$
$$\Rightarrow F - \frac{F}{2} - \frac{F}{6} = 15 + 15$$
$$\Rightarrow F\left(1 - \frac{1}{2} - \frac{1}{6}\right) = 30$$
$$\Rightarrow F \times \left(\frac{6-3-1}{6}\right) = 30$$
$$\Rightarrow F \times \frac{2}{6} = 30$$
$$\Rightarrow F = 30 \times \frac{\overset{3}{\cancel{6}}}{\underset{1}{\cancel{2}}}$$
$$\Rightarrow F = 90\text{ cm}$$

Therefore, the length of the fish is 90 cm.

Hence, the correct answer is "90"

22. (b)

Let total bonus = x and number of workers = n

Each worker gets $\frac{x}{n}$.

Condition (1):

$\frac{x}{n+3} = \frac{x}{n} - 4$ ... (1)

Condition (2):

$\frac{x+90}{n+3} = 25$ ... (2)

Solving (2), we get

x = 25n - 15

From (1), we get $\frac{25n-15}{n+3} = \frac{25n-15}{n} - 4$

25n2 - 15n = 25n2 - 15n + 75n - 45 - 4n2 - 12n

4n2 - 63n + 45 = 0

n = 15 (as n cannot be in fractions)

Total workers now = n + 3 = 18

Mock 14

1. (d)
After replacement of 8 litres thrice,
The ratio of the milk to water in the container A becomes 512:217.
Let the quantity of milk and water in the final mixture be 512y litres and 217y litres, respectively.
So, total quantity of pure milk initially = 512y + 217y = 729y litres
By replacement formula,
Final quantity of pure milk = Initial quantity of pure milk × [1 – amount of replacement done/amount of liquid in container A]^n, where n is the number of attempts of replacement.
$512y = 729y \times [1 - 8/k]^3$, where k is the amount of pure milk in container A initially.
$512y/729y = [1 - 8/k]^3$
$(8/9)^3 = [1 - 8/k]^3$
1 – 8/k = 8/9
8/k = 1/9
k = 72 litres
So, the quantity of mixture in container B = 72 litres
So, required quantity of water in container B = 4/9 × 72 = 32 litres

2. (a)
Sum invested by Rihaan at simple interest = 0.4 × 5x = Rs. 2x
Therefore, interest received by Rihaan = (2x × 30 × 5)/100 = Rs. 3x

Sum invested at compound interest = 3x + 3x/2 = Rs. 4.5x
According to the question
$4.5x(1 + 20/100)^2 = 9720$
Or, 6.48x = 9720
Or, x = Rs. 1500
Therefore, total sum = 5x = Rs. 7500
Therefore, amount received at simple interest = (7500 × 2 × 20)/100 + 7500 = Rs. (3000 + 7500) = Rs. 10500
For I:
(x + 9000) = Rs. (1500 + 9000) = Rs. 10500
Therefore, I can be the answer.
For II:
{(3x/5) + 9600} = {(3 × 1500)/5 + 9600} = Rs. 10500
Therefore, II can be the answer.
For III:
(3x + 3000) = (3 × 1500 + 3000) = Rs. 7500
Therefore, III cannot be the answer.

3. 6.
Possible values of x = 3, 4, 5, 6, 7, 8, 9
When x = 3, there is no possible value of y
When x = 4, the possible values of y = 22
When x = 5, the possible values of y = 21,22
When x = 6, the possible values of y = 20,21,22
When x = 7, the possible values of y = 19,20,21,22
When x = 8, the possible values of y = 18,19,20,21,22
When x = 9, the possible values of y = 17,18,19,20,21,22
The unique values of N = 26,27,28,29,30,31

4. (d)
[1.12 × 1.12 – 1] × X – 0.32 × 2 × 0.60 × X = 648
Or, 0.2544X – 0.384X = 648
Or, 0.1296X = 648
Or, X = 5000

5. (b)
Let total amount of work be 525 units
Amount of work done by 'A' in one day (with increased efficiency) = 525/25 = 21 units
Original efficiency of 'A' = 21/1.40 = 15 units per day
Amount of work done by 'B' in one day (with increased efficiency) = 525/21 = 25 units
Original efficiency of 'B' = 25/1.25 = 20 units per day
Amount of work completed by 'A' and 'B' together in 9 days = 35 × 9 = 315 units
Remaining work = 525 – 315 = 210 units
Desired time = 210/15 = 14 days

6. 17.
$(61)^{118} \times 69$
Now, 61^1 has last two digits as 61.
61^2 has last two digits as 21.
61^3 has last two digits as 81.
61^4 has last two digits as 41.
61^5 has last two digits as 01.
61^6 has last two digits as 61.
Hence, powers of 61 follow a cycle of 5.

Hence, last two digits (61^{118} × 69) = Last two digits (81 × 69)
= 89
Hence, sum of the last two digits is 8 + 9 = 17.

7. (c)
Speed of 'A' = 72 × (5/18) = 20 m/sec
Distance covered by 'A' = 20 × 8 = 160 metres
Speed of 'B' = 90 × (5/18) = 25 m/sec
Distance covered by 'B' = 25 × 8 = 200 metres
Distance to be covered by 'B' = 200 + 160 = 360 metres
Required time taken = 360/25 = 14.4 seconds

8. (a)
Let number of males in village 'A' be 'x'
So, number of males in village 'B' = 1.50 × x = 1.5x
Let number of females in village 'A' be 'y'
So, number of females in village 'B' = y + 432
So, x + 1.4y = 2144............(1)
And, 1.5x × 1.2 + y + 432 = 2832
Or, 1.8x + y = 2400...................(2)
Solving equation (1) and (2), we get
x = 800 and y = 960
So, number of males in village 'B' = 1.50 × 800 = 1200

9. 26.31
Let 2n be the total number of fruits Pam bought, with n fruits bought at each of the price tags
Total cost price = (24/32)n + (40/48)n = (38/24)n
Total selling price = (60/60) 2n = 2n
So gain % = (2n-38n/24)/(38n/24)=500/19%

10. (c)
Let x and y be the distance travelled by the tortoise and the rat before they meet.
The time taken by Tortoise to reach the meeting point
= 4 : 00 PM – 1 : 30 PM = 2.5 hours
∴ The time taken by rat to reach the meeting point
= 4 : 00 PM – 3 : 06 PM = 54 minutes = 0.9 hours
∴ The speed of the tortoise = $\frac{x}{2.5}$
And the speed of rat = $\frac{y}{0.9}$
∴ The time taken by the tortoise to cover the remaining distance
$= \frac{y}{\frac{x}{2.5}} = \frac{2.5y}{x}$ .... (i)
∴ The time taken by the rat to cover the remaining distance
$= \frac{x}{\frac{y}{0.9}} = \frac{0.9x}{y}$ .... (ii)
Equating equations (i) and (ii), we get:
$\frac{2.5y}{x} = \frac{0.9x}{y}$
$\Rightarrow 2.5\left(\frac{y}{x}\right) = 0.9\left(\frac{x}{y}\right)$
$\Rightarrow \frac{x^2}{y^2} = \frac{2.5}{0.9} = \frac{25}{9}$
? $\frac{x}{y} = \frac{5}{3}$
∴ The time taken by either of them to cover their respective remaining distances
$= 2.5 \times \frac{3}{5} = 1.5$ hours or $0.9 \times \frac{5}{3} = 1.5$ hours

$= 1.2 \times \frac{5}{2} = 3$ hours or $7.5 \times \frac{2}{5} = 3$ hours
Hence, they reach their respective destination at
= 4 : 00 PM + 1.5 hours = 5 : 30 PM
Thus, the required "option c) 5 : 30 PM " is correct.

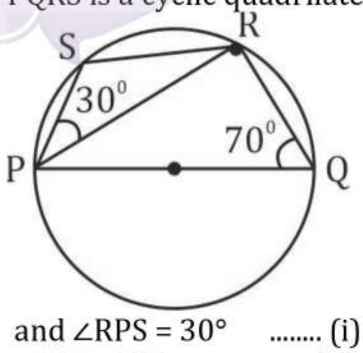
11. (c)
$6^{x/\log_8 6} = 2$
Putting value of x= $\log_8(\log_8 z)$
$6^{\log_6(\log_8 z)} = 2$
Using options, we can see that Z = 64 satisfies the given expression.

12. (a)
Quantity of milk in mixture ‘A’ = 12/19 × 760 = 480 ml
Quantity of water in mixture ‘A’ = 760 – 480 = 280 ml
Quantity of milk in mixture ‘B’ = 13/25 × 500 = 260 ml
Quantity of water in mixture ‘B’ = 12/25 × 500 = 240 ml
Desired ratio = (0.60 × 480 + 0.40 × 260):(0.60 × 280 + 0.40 × 240) = 392:264 = 49:33

13. 65.
Let the four numbers in G.P. be a/r^3, a/r, ar, ar^3
Product of the numbers = $a^4 = 4096$, Hence a = 8.
Again $a/r^3 + a/r + ar + ar^3 = 85$
or $8(r^3 + 1/r^3) + 8(r + 1/r) = 85$
On solving we get r + 1/r = 5/2, hence r =2 or ½.
Hence the Largest of the 4 numbers is = $8.2^3 = 64$
Hence the Smallest of the 4 numbers is = $8.(1/2)^3 = 1$
So sum of Largest + Smallest of the 4 numbers = 64 + 1 =65.

14. (a)
$\alpha^2 (1 - \beta) + 2\alpha\beta + \beta^2(1 - \alpha)$
$= \alpha^2 + 2\alpha\beta + \beta^2(1 - \alpha)$
$= (\alpha + \beta)(\alpha + \beta - \alpha\beta) = 4 \times 7 = 28$
$28 = 1 \times 28 = 2 \times 14 = 4 \times 7$
Note: The roots are integers.
Sum of the roots can be (1 + 28) = 29, (2 + 14) = 16 and (4 + 7) = 11.

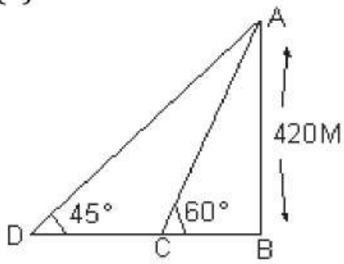
15. (d)
PQRS is a cyclic quadrilateral.



and ∠RPS = 30° .... (i)
∠RQP = 70° .... (ii)
In a cyclic quadrilateral, the opposite angles are supplementary.
Therefore, ∠PSR + ∠PQR = 180°
⇒ ∠PSR = 180° - ∠PQR
⇒ ∠PSR = 180° - 70° [Using (ii)]
⇒ ∠PSR = 110° .... (iii)
In ΔPSR,

∠PSR + ∠PRS + ∠RPS = 180°
⇒ 110° + ∠PRS + 30° = 180° [Using (ii) and (iii)]
⇒ ∠PRS + 140° = 180°
⇒ ∠PRS = 180° - 140°
⇒ ∠PRS = 40°
Thus, the required "option d) 40°"is correct.

16. (b)
Assume the average of 21 students other than Ramesh = a
Sum of the scores of 21 students other than Ramesh = 21a
Hence the average of 22 students = a + 1
Sum of the scores of all 22 students = 22(a + 1)
The score of Ramesh = Sum of scores of all 22 students - Sum of the scores of 21 students other than Ramesh = 22(a+1) - 21a = a + 22 = 82.5 (Given)
=> a = 60.5
Hence, sum of the scores of all 22 students = 22(a + 1) = 22 * 61.5 = 1353
Now the sum of the scores of students other than Gautam = 21 * 62 = 1302
Hence the score of Gautam = 1353 - 1302 = 51

17. (a)


Let AB represent the cliff of height 420 m and C, D represent the two positions of the boat
In triangle ABC
tan60º = (AB/BC)
Or, BC = 420/√3
Also, in triangle ABD,
tan45º = AB/BD
Or, BD = AB = 420m
Distance covered = CD = BD – BC
= 420 – (420/√3) = {420(√3 – 1)/√3} metres
Speed = 6 km/h = (6 × 1000)/60 m/min = 100 m/minute
We know that,
Time = Distance/Speed = {420(√3 – 1)/√3} ÷ 100 = 1.77 ~ 2 min (Taking √3 = 1.732)

18. (b)
Production of pencils = (200/10) × 30 = 600
Number of non-defective pencils = 600 × 0.6 = 360
Production of books = (200/10) × 60 = 1200
Number of non-defective books =1200 × 0.4 = 480
Required difference = 480 – 360 = 120

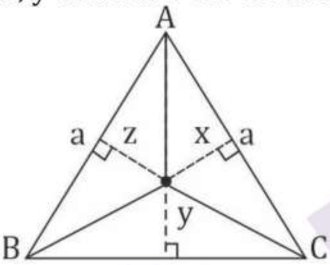
19. 275.
For Quadrilateral 4 points are needed and for triangles 3 points are needed.
Therefore, difference between the number of triangle and the number of quadrilaterals that can be formed by connecting 12 points on the circumference of circle = $^{12}C_4 - {}^{12}C_3$
= 495 – 220 = 275

20. (d)

Let, the length of train ‘A’ and train ‘B’ be 9x metres and 8x metres, respectively.
Let, the speed of train ‘A’ and train ‘B’ be ‘s_1’ m/s and s_2’ m/s, respectively.
$9x + 8x = 18(s_1 + s_2)$
$x = (18/17) \times (s_1 + s_2)$
And,
$9x = 18 \times s_1$
$x = 2 \times s_1$
Put the value of ‘x’ in eq. (i),
$s_1 = (9/17) \times (s_1 + s_2)$
$17 \times s_1 = 9 \times s_1 + 9 \times s2$
$s_1 : s_2 = 9:8$

21. (a)
Each interior angle of n-sided polygon is = {(2n – 4)/n} right angles
Let the number of sides of the polygons be ‘x’ and 2x respectively.
According to the question,
$\{(2x - 4)/x\} \div \{(2 \times 2x - 4)/2x\} = 3/4$
Or, $4x - 8 = 3x - 3$
Or, $x = 5$
Therefore, number of sides of polygon = 5 and 10

22. (a)
P is a point lying inside ΔABC with side $3\sqrt{2}$.
x, y and z are the distances of P from sides BC, AC and AB respectively.



$a = 2\sqrt{3}$

Also, given: $x^2 + y^2 + z^2 = 3$ .... (i)
Now, Area of $\Delta BOC = \frac{1}{2} \times a \times x = \frac{1}{2} \times 2\sqrt{3} \times x = \sqrt{3}x$
Area of $\Delta COA = \frac{1}{2} \times a \times y = \frac{1}{2} \times 2\sqrt{3} \times y = \sqrt{3}y$
Area of $\Delta AOB = \frac{1}{2} \times a \times z = \frac{1}{2} \times 2\sqrt{3} \times z = \sqrt{3}z$
Total Area of $\Delta ABC = ar(\Delta BOC) + ar(\Delta COA) + ar(\Delta AOB)$
$\frac{\sqrt{3}}{4} a^2 = \sqrt{3}(x + y + z)$
$\Rightarrow x + y + z = \frac{1}{4}\left(2\sqrt{3}\right)^2 = 3$ .... (ii)
We have: $x^2 + y^2 + z^2 = 3$
$\Rightarrow (x + y + z)^2 = 9$
$\Rightarrow (x + y + z)^2 = x^2 + y^2 + z^2 + 2(xy + yz + zx)$
$\Rightarrow 9 = 3 + 2(xy + yz + zx)$
$\Rightarrow xy + yz + zx = 3$
Thus, the required "option a) 3" is correct.

Mock 15

1. (a)
Possible Cases:
Apple, Apple, Banana or Apple, Banana, Apple or Banana, Apple, Apple
$\frac{17}{36} = \left[\frac{3}{4} \times \frac{x+2}{2x+2} \times \frac{2}{3}\right] + \left[\frac{3}{4} \times \frac{x}{2x+2} \times \frac{1}{3}\right] + \left[\frac{1}{4} \times \frac{x+2}{2x+2} \times \frac{1}{3}\right]$
$\frac{17}{36} = \frac{x+2}{4x+4} + \frac{x}{8x+8} + \frac{x+2}{24x+24}$
$\frac{17}{36} = \frac{[6x+12+3x+x+2)}{24x+24}$
$\frac{17}{36} = \frac{10x+14}{24x+24}$
17(12x + 12) = 36(5x + 7)
204x + 204 = 180x + 252
24x = 48
x = 2
Hence, option D is the correct answer.

2. (a)
Let BC = '18 – a' cm, then CD = 'a' cm
In ΔABD and ΔFCD;
∠ADB is common
And, ∠ABD = ∠FCD.
Therefore, ΔABD ~ ΔFCD [by AA-similarity]
So, (FC/AB) = (DF/AD) = (DC/BD)
Or, (FC/AB) = (DF/AD) = (DC/BD)
Let FC = 'y' cm
So, (15/y) = (18/a)
Or, 5a = 6y ………… (1)
Similarly, in ΔEDB and ΔFCB;
∠EBD is common
And, ∠EDB = ∠FCB.
Therefore, ΔEDB ~ ΔFCB [by AA-similarity]
So, (EC/ED) = (BF/BE) = (BC/BD)
Or, (9/18) = {y/(18 – a)}
Or, 18 – a = 2y
So, a = 18 – 2y ……. (2)
Using substitution, we have;
5 × (18 – 2y) = 6y
90 – 10y = 6y
Or, 90 = 16y
Or, y = (90/16)
So, y = 5.625 cm
Therefore, FC = 5.625 cm

3. (c)
Volume of the room = 512 cm^3
Length of each edge of the room = $(512)^{(1/3)}$ = 8 cm
Height of the cone = length of edge of the cubical room = 8 cm
And, radius of the cone = (length of edge of the cube/2) = 8/2 = 4 cm
So, volume of the cone = (1/3) × π × $radius^2$ × height
= (1/3) × (22/7) × 4^2 × 8 ~ 134 cm^3
Percentage of the cubical room's volume which is empty = {(512 – 134)/512} × 100 ~ 73.82% ~ 74%

4. 90%

Let the total efficiency of 'A', 'B' and 'C' be 'a' units/day, 'b' units/day and 'c' units/day, respectively.

Let the total work be 120 units.
Total work done by 'B' and 'C' together in one day = (120/5) = 24 units
So, b + c = 24
Or, c = (24 – b)............... (1)
Efficiency of 'A' = (120/40) = 3 units/day
So, a = 3
ATQ;
(a + c) × 2 = b
Or, (3 + 24 – b) × 2 = b
Or, 6 + 48 – 2b = b
Or, 54 = 3b
So, b = 18
So, c = 24 – 18 = 6
Work done by 'A' and 'C' together in 12 days = (6 + 3) × 12 = 108 units
Required percentage = (108/120) × 100 = 90%

5. (b)

We know that a number is divisible by 11 when the difference between the sum of alternate digits of the number is either zero or a multiple of 11.
So, ATQ;
(0 + 4 + a + 2) – (b + 8 + 3) = 0
Or, a – b = 5
So, possible pairs of 'a' and 'b' = (9, 4), (8, 3), (7, 2) and (6, 1)
But, only (8, 3) and (7, 2) satisfy the given conditions. Product of numbers in these two cases = 8 × 3 = 24 and 7× 2 = 14.
Therefore, 24 can be a product of the two numbers.

6. (b)

$x_{18} = 5 + (18 - 1) \times 1$

Or, $x_{18} = 5 + 17 = 22$

So, $x = \frac{1}{5\times6} + \frac{1}{6\times7} + \dots\dots\dots\dots\dots + \frac{1}{22\times23}$

Or, $x = \frac{6-5}{5\times6} + \frac{7-6}{6\times7} + \cdots \dots \dots \frac{23-22}{22\times23}$

Or, $x = \frac{1}{5} - \frac{1}{6} + \frac{1}{6} - \frac{1}{7} + \cdots \dots \dots .. + \frac{1}{22} - \frac{1}{23}$

Or, $x = \frac{1}{5} - \frac{1}{23}$

So, $x = \frac{18}{115}$

Again,

$y_{20} = 2 + (20 - 1) \times 1$

Or, $y_{20} = 21$

So, $y = \frac{1}{2\times3} + \frac{1}{3\times4} + \dots\dots\dots\dots\dots + \frac{1}{21\times22}$

Or, $y = \frac{3-2}{3\times2} + \frac{4-3}{4\times3} + \dots \dots \frac{22-21}{22\times21}$

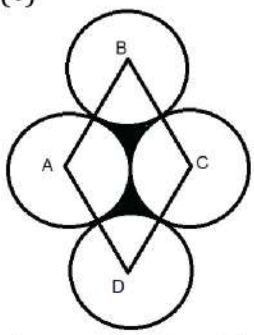
Or, $y = \frac{1}{2} - \frac{1}{3} + \frac{1}{3} - \frac{1}{4} + \dots \dots + \frac{1}{21} - \frac{1}{22}$

Or, $y = \frac{1}{2} - \frac{1}{22}$

Or, $y = \frac{5}{11}$

So, $x \times y = (18/115) \times (5/11) = (18/253)$

7. (c)



If we join 'A' and 'C', then we will have, two equilateral triangle ABC and ADC and length of each side of the two triangles thus obtained will be 4 cm.

So, area of quadrilateral ABCD = 2 × area of each equilateral triangles = $2 \times (\sqrt{3}/4) \times 4 \times 4 = 8\sqrt{3}$ $cm^2 = 8 \times 1.73 = 13.84\ cm^2$

Now, $\angle ABC = \angle ADC = 60^0$

And, $\angle BAD = \angle BCD = 120^0$

So, area of shaded portion = $13.84 - \{2 \times (120/360) \times \pi \times 2^2 + 2 \times (60/360) \times \pi \times 2^2\} = 13.84 - 4 \times 3.14 = 1.28\ cm^2$

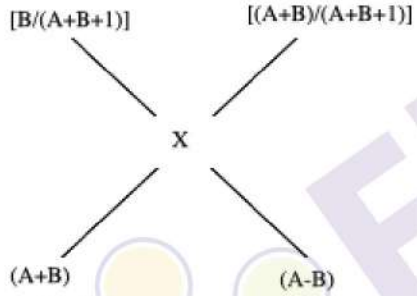
8. (d)

Part of milk in first mixture = $\frac{B}{A+B+1}$

Part of milk in second mixture = $\frac{A+B}{A+B+1}$

Let part of milk in first mixture = X

By the rule of alligation :



$(\frac{A+B}{A+B+1} - X) : (X - \frac{B}{A+B+1}) = (A + B) : (A - B)$

$\frac{(A+B)(A-B)}{A+B+1} - X(A - B) = X(A + B) - \frac{B(A+B)}{A+B+1}$

$\frac{(A+B)(A-B)}{A+B+1} + \frac{B(A+B)}{A+B+1} = X(A + B) + X(A - B)$

$\frac{\{(A+B)(A-B+B)\}}{A+B+1} = X(A + B + A - B)$

$\frac{A+B}{A+B+1} = 2X$

$X = \frac{A+B}{2(A+B+1)}$

According to the question:

$X = \frac{C}{2C+2} = \frac{A+B}{2(A+B+1)}$

A + B = C

Profit percent = $\left[\frac{2C+2-C}{C}\right] \times 100$

$= \frac{100(C+2)}{C}$

$= \frac{100(A+B+2)}{A+B}$

9. (d)

Given - $||x-2|-1| < 7$

Or, $-7 < |x-2|-1 < 7$

Or, $-6<|x-2|<8$, , but $|x-2|\geq 0$

Or, $|x-2|<8$

Or, $-8<x-2<8$

Or, $-6<x<10$

Hence, for x being an integer, it can assume integral values from -5 to 9.

Similarly, for $||y-1|-2|<9$,

Or, $-9<|y-1|-2<9$

Or, $-7<|y-1|<11$, but, $|y-1|>0$

Or, $|y-1|<11$

Or, $-11<y-1<11$

Or, $-10<y<12$

Hence, for y being an integer, it can assume integral values from -9 to 11.

Thus, for (x – 2y), substituting x = -5 and y = 11 for the lowest value and substituting x = 9 and y = -9 for the highest value, we get – -27 < (x – 2y) < 27

Option d. is correct.

10. (c)

Total amount 3 years ago with Vimal = ₹15,00,00,000

Value of land 3 years ago =2/5 × 15,00,00,000 = ₹6,00,00,000

Value of Mansion 3 years ago = 3/10× 15,00,00,000 = ₹4,50,00,000

Value of Jewellery 3 years ago =22/100 × 15,00,00,000 = ₹3,30,00,000

Price of Car 3 years ago = ₹1,00,00,000

Amount donated to Charity Fund = ₹20,00,000

Total value of assets after 3 years = ₹17,25,00,000

Total value of Land, Mansion after 3 years = ₹17,25,00,000- ₹4,30,00,000 =₹12,95,00,000

Required %age = ₹12,95,00,000/10,50,00,000 x 100 ~ 123.3% i.e. 23.3%.

Hence, option c.

11. (d)

Let the marked price of article A = ₹4x

Marked price of article B = ₹5x

According to the question,

4x × (100 – d)% = 5x × (100 – d – 16)%

(100 – d)/25 = (84 – d)/20

2000 – 20d = 2100 – 25d

5d = 100

d = 20%

Discount on article A = 20%

Discount on article B = 36%

Let the cost price of article A = ₹x

Cost price of article B = ₹(3136 – x)

According to the question,

(x × 120% × 100/80):[(3136 – x) × 125% × 100/54 = 4:5

5 × 3x/2 = 4 × (3136 – x) × 125/64

15x/2 = 125/16 × (3136 – x)

120x = 125(3136 – x)

120x = 392000 – 125x

245x = 392000

x = 1600

Cost price of article A = ₹1600

Cost price of article B = ₹1536
Marked price of Article A = 1600 × 120% × 100/80 = ₹2400
Marked price of article B = 1536 × 125% × 100/64 = ₹3000
(i) Discount percentage given on article B.
Required discount percentage = 36%
So it can be answer.
(ii) Total profit earned on article A and article B together.
Required profit = 1600 × 20% + 1536 × 25% = ₹704
So it can be answer.
(iii) Marked price of article A is _____% more than the cost price of article A.
Marked price of article A = ₹2400
Cost price of article A = ₹1600
Difference = ₹800
Required percentage = 800/1600 × 100 = 50%
So it can be answer.
(iv) Difference between the cost prices of articles A and B.
Required difference = 1600 – 1536 = ₹64
So it can be answer.
Hence, option d.

12. 4.
Here, we need to figure out number of ways by which we can make 36 factors.
Number of factors of a given number $N= X^a \times Y^b \times Z^c \times \ldots$ is termed as $(a+1) \times (b+1) \times (c+1) \times \ldots$ where X, Y and Z are prime numbers.
36 factors are possible when the number if of the form X^{35}, $X^{17} \times Y^1$, $X^{11} \times Y^2$, $X^8 \times Y^3$, $X^5 \times Y^5$, $X^8 \times Y^1 \times Z^1$, $X^3 \times Y^2 \times Z^2$ or $X^2 \times Y^2 \times Z^1 \times W^1$.
Smallest numbers having this form will be
2^{35}, $2^{17} \times 3^1$, $2^{11} \times 3^2$, $2^8 \times 3^3$, $2^5 \times 3^5$, $2^8 \times 3^1 \times 5^1$, $2^3 \times 3^2 \times 5^2$ and $2^2 \times 3^2 \times 5^1 \times 7^1$.
Out of these numbers 2^{35}, $2^{17} \times 3^1$, $2^{11} \times 3^2$ will not even four digit numbers therefore can be ignored. For the rest of the numbers,
$2^8 \times 3^3= 6912$, $2^5 \times 3^5=7776$, $2^8 \times 3^1 \times 5^1=3840$, $2^3 \times 3^2 \times 5^2=1800$ and $2^2 \times 3^2 \times 5^1 \times 7^1=1260$.
Least number among this is 1260.
Next number (N+1) will be 1261.
$1261= 13 \times 97$
Number of factors $(1+1) \times (1+1) = 4$
Hence, 4 is the correct answer.

13. (a)
To find intersecting points, linear equations must be solved.

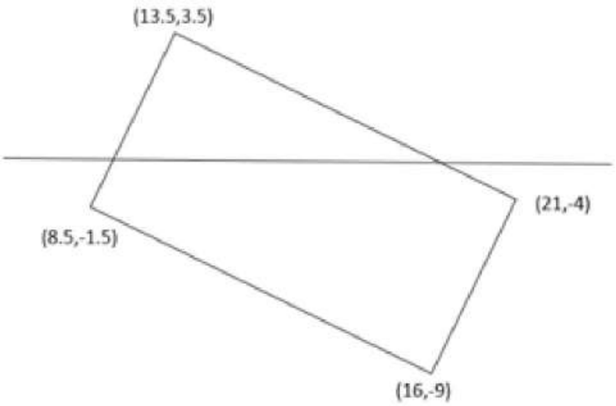
Intersecting point of line L1 and L3 can be found by adding both equations
$x + y = 7$
$x - y = 10$
$2x= 17$
$x= 8.5, y=-1.5$

Intersecting point of line L1 and L4 can be found by adding both equations
$x + y = 7$
$x - y = 25$
$2x= 32$
$x= 16, y=-9$

Intersecting point of line L2 and L3 can be found by adding both equations

x + y = 17
x - y = 10
2x= 27
x= 13.5, y=3.5

Intersecting point of line L2 and L4 can be found by adding both equations
x + y = 17
x - y = 25



2x = 42
X = 21, y = 4m
Therefore, the points are (8.5,-1.5),(16,-9),(13.5,3.5) and (21,-4).

To find midpoint of the diagonal any of the pairs of opposite points can be taken.
Midpoint of diagonal by using (13.5,3.5) and (16,-9)

Midpoint = Midpoint of AB= $\left(\frac{13.5+16}{2}, \frac{3.5-9}{2}\right) = (14.75, -2.75)$

Distance between K (14.75,-2.75) to any of the four points would be the same.
Considering distance of K (14.75,-2.75) from A (21,-4).

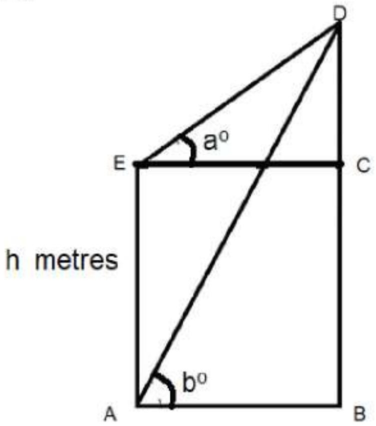
$AB^2 = (14.75-21)^2 + (-2.75+4)^2$
$AB^2 = (-6.25)^2 + (1.25)^2$
$AB^2 = 39.0625 + 1.5625$
$AB^2 = 40.625$
$AB = \sqrt{40.625}$
$AB = [\sqrt{40.625}]$
AB = 6
hence, a is the correct answer.

14. 240.
Using fundamental principal of counting,
Total number of ways to wear saree or t-shirt and jeans = (5 + 3 × 5) = 20
Total number of ways to wear cap or hat = 1 + 2 = 3
Total number of ways to wear shoes or snickers = 1 + 3 = 4
Total number of ways to select her outfit = 20 × 3 ×4 = 240
Hence, 240 is the correct answer.

15. 12.
In such scenario where minimum number of students following all four sports is asked, this can be found by maximizing the students following all three type of sports.

Let us consider each number given in a category as entries. There are 40 entries in cricket, 35 in basketball, 45 in football and 42 in table tennis.
Total entries 40+35+45+42=162 must be divided among 50 students. If all the students follow three sports, $50 \times 3 = 150$ entries will be divided. Still there will be 12 entries left. As each student is already having 3 different entries, one entry each must be given to all the students. There will be 12 students who will get 4 entries each.

16. (d)



Let height of pole = 'AE' = CB = 'h' metres and height of the building = BD
In right triangle DCE;
tana = CD/EC

Or, EC = CD × cota ------ (1)
In right triangle ABD;
tanb = BD/AB
Or, AB = BD × cotb ----- (2)
Since, EC = AB
So, EC = (BC + CD) × cot b
Or, EC = (h + CD) × cotb
From equation (1), we have;
(CD + h) × cotb – CD × cota = 0
Or, CD × (cot a – cotb) = - h × cot b
Or, CD = (h × cotb)/(cota – cotb)
So, height of the building = CD + BC = {hcotb/(cota – cotb)} + h
= {hcotb + hcota – hcotb}/(cota – cotb)
= hcota/(cota – cotb)
So, height of the building = (hcota)/(cota – cotb)

17. 2.
Given, $7x^2 + 2y^2 = 15xy$
Dividing each term by 'xy', we get;
7 × (x/y) + 2 × (y/x) = 15
Now, let (x/y) = a
So, 7a + (2/a) = 15
Or, $7a^2 - 15a + 2 = 0$
Or, $7a^2 - 14a - a + 2 = 0$
Or, 7a(a – 2) – 1(a – 2) = 0
Or, (7a – 1)(a – 2) = 0
So, a = 1/7 or a = 2
Therefore, (x/y) = (1/7) or (x/y) = (2/1)

18. (c)
Given – $f(x-3) = 2\,x^3 + a - bx$,

So, for x =3 , $f(3-3)=2.3^3+a-b.3$, $i.e.\ f(0)=54+a-3b$ ...(1)
And for, $f(x^2-4)=x^2+6a-8b$,
For $x^2=4, f(4-4)=4+6a-8b$, $i.e.\ f(0)=4+6a-8b$ ...(2)
Comparing (1) and (2) – $54+a-3b=4+6a-8b$
i.e.$50=5a-5b$
i.e. $10=a-b$
So, $(a-b+10)=20$
Option c. is correct.

19. (c)
Let the two principals be P_1 and P_2 respectively.
$P_1+P_2=54000$ --- (1)
For P_1, S.I = $P_1 \times 9 \times 3/100 = 0.27\ P_1$
For P_2, C.I = $P_2 \times 1.11^2 - P_2 = 0.2321P_2$
Also, P_2 is invested at 12% p.a. simple interest for one more year.
Hence S.I. = $P_2 \times 12/100 = 0.12\ P_2$
Difference in interests = $0.2321P_2 + 0.12P_2 - 0.27P_1 = 0.3521P_2 - 0.27\ P_1$ = ₹4083--- (2)
Multiplying (1) by 0.27 and adding to (2), we have $0.3521P_2 + 0.27P_2 = 14580 + 4083 = 18663$
Hence P_2 = 18663/0.6221 = ₹30000
Hence P_1 = 54000-30000 = ₹24000
Difference in principals = 30000 - 24000 = ₹6000.
Hence, option c.

20. 240.
Let their speeds be $V1\&V2$ and AB be S metres
Now when they meet for the first time, the distances covered by them would be 960 metres and 2S-960 metres
Now we know that ratio of speeds = ratio of distances (as time is constant)
Therefore $\frac{V1}{V2}=\frac{960}{2S-960}$ (1)
Now, similarly when they meet for the 2 nd time, the distances covered by them would be S 720 metres and 3S-720 metres
now their speed ratio would be : $\frac{V1}{V2}=\frac{S+720}{3S-720}$ (2)
Now we can equate both equations 1&2 as speed ratio will be same
Therefore we get $\frac{960}{2s-960}=\frac{S+720}{3S-720}$
solving we get $S=1200$
Therefore $\frac{V1}{V2}=\frac{960}{1440}=\frac{2}{3}$
Now when they meet for the 6th time total distance covered by them would be (12×1200) (as for every 1 meet they cover $2S=2*1200$ metres together)
Therefore Distance covered by one which is slower $=\frac{2}{5}\times 1200 \times 12 = 5760$ metres
Now $5760=4800+960$
Therefore meet will take place at 960 metres from A or $1200-960=240$ metres from B
Hence answer is 240 metres from B.

21. (a)
Given- $3f(z)=f(z+1)+2f(x-1)$
For $z=1$, $3f(1)=f(2)+2f(0), or\ \ f(2)=4$
For $z=2$, $3f(2)=f(3)+2f(1), or\ \ f(3)=3f(2)-2f(1)=12-4=8$
For $z=3$, $3f(3)=f(4)+2f(2), or\ \ f(4)=3f(3)-2f(2)=24-8=16$
For $z=4$, $3f(4)=f(5)+2f(3), or\ \ f(5)=3f(4)-2f(3)=48-16=32$
For $z=5$, $3f(5)=f(6)+2f(4), or\ \ f(6)=3f(5)-2f(4)=96-32=64$
For $z=6$, $3f(6)=f(7)+2f(5), or\ \ f(7)=3f(6)-2f(5)=192-64=128$
Option a. is correct.

22. (d)

Given- $N = (log_2x)^2 - 6(log_2x) + 12$ ...(1)

Also, $x^N = 256 = 2^8$, hence, taking logarithm on both sides-

i.e.$N\ log_2x = log_2 2^8 = 8$

or, $N = \frac{8}{log_2x}$

Substituting value of N in equation (1)-$8 = log_2x[(log_2x)^2 - 6(log_2x) + 12]$

Or, $(log_2x)^3 - 6(log_2x)^2 + 12log_2x - 8 = 0$

Or,$[log_2x - 2]^3 = 0$

Or,$log_2x = 2$

Or,$x = 2^2 = 4$

Hence, the number of distinct values of x is 1.

Option d. is correct.

23. (c)

Let N be the amount of money he spent in buying x apples and y oranges.

Thus, $10x + 15y = N$

Also, it has been given that, had he bought $1.5y$ apples and $\frac{4}{3}x$ oranges, he would have spent 40% more than he did.

Thus,$1.5y \times 10 + \frac{4}{3}x \times 15 = 1.4N$

Dividing ii by i, we get,

$\frac{15y+20x}{10x+15y} = 1.4$

$\Rightarrow 15y + 20x = 14x + 21y$

Thus, $x = y$

Thus, $10y + 15y = N$

or, $25y = N$

So, N must be a multiple of 25 .

Also, as $\frac{4}{3}x$ and $1.5y$ are natural numbers, it implies that x is a multiple of 3 and y is a multiple of 2 .

So, N must be a multiple of $25 \times 6 = 150$

Hence, option C is the correct answer.

Mock 16

1. (d)

The number of ways of selecting 3 stamps out of 10 = $^{10}C_3$ = 120

The number of ways of selecting 2 stamps lying next to each other = 9

The number of ways selecting the 3rd stamp such that the 3rd stamp does not lie adjacent to the first 2 stamps

= 2×7+66×7

= 56

The number of ways selecting 3 stamps such that all the 3 stamps lie next to each other = 8

Thus, the total number of ways of selecting 3 stamps such that none of the 2 were lying next to each other

= 120-56-8

= 56

Hence, the probability = 56/120
= 7/15
Hence, option D is the correct answer.

2. (b)
We are given that, a + b + c = 7 and we need to find the maximum value of $a^3b^2c^4$, in this case we can use AM-GM.
First, we need to rearrange the given equation, we can write
a + b + c = 7 as: a/3 + a/3 + a/3 + b/2 + b/2 + c/4 + c/4 + c/4 + c/4 = 7
Now we can apply AM-GM here:
$(a/3 + a/3 + a/3 + b/2 + b/2 + c/4 + c/4 + c/4 + c/4)/9 \geq [(a^3 \times b^2 \times c^4) / (3^3 \times 2^2 \times 4^4)]^{1/9}$
$(7/9)^9 \geq (a^3 \times b^2 \times c^4) / 3^3 \times 2^{10}$
Hence answer is (b).

3. 3.
x + y = 60 and y + z = 50
As we are looking for the range of x and z, we need to find the minimum and the maximum value of both x and z.
x will be minimum when y will be maximum, and y will be maximum when z will be minimum.
It is given that x > y > z
$y_{max} = 29$ and hence, $x_{min} = 31$ and $z_{min} = 21$
Again, x will be maximum when y will be minimum, and y will be minimum when z will be maximum.
$y_{min} = 26$ and hence, $x_{max} = 34$ and $z_{max} = 24$
Range of x = $x_{max} - x_{min} = 34 - 31 = 3$ and
Range of z = $z_{max} - z_{min} = 24 - 21 = 3$
Therefore, the required answer is 3.

4. 18.
Lets us take the efficiency of each person to be A, AB, C, D, E, F respectively.
So, Taking two people at a time from 6 = ${}^6C_2 = 15$
Below are the pairs of people who will work day by day
A+B
A+C
A+D
A+E
.
.
.
E+F

In 15 days, the total work done will be 5(A+B+C+D+E+F) = 7/12

But, work done by these 6 set of people in One day will be = 7/60

Now, 5/12 work is still left.

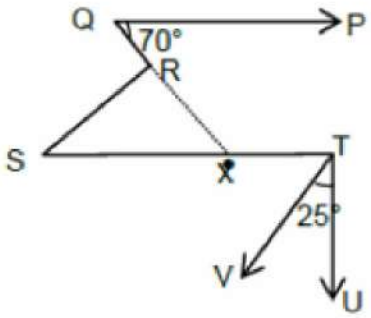
So, in 1 day, 7/60 work is done
In in x days, 5/12 work will be done.

$$x = \frac{60}{7} \times \frac{5}{12}$$

$$x = \frac{25}{7}$$

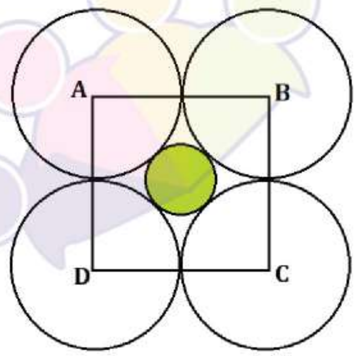
$$\text{Total days} = 15 + \frac{25}{7} = 18.57$$

5. (c)



Extend QR to intersect ST at X.
Angle RXS = Angle PQR = 70°
Also, angle STV = angle RSX (Alternate angles)
But, STV= 90° - 25° = 65°
Angle RSX = 65°
Angle QRS = Angle RSX + Angle RXS = 70° + 65° = 135°

6. (b)
Let A, B, C and D be the centres of the Four circles. ABCD forms a Square of side 20 cm
If AB=AD= 20, then BD= $20\sqrt{2}$ cm
BD = radius of larger circle + diameter of smaller circle + radius of larger circle.
BD = 10 +d + 10
$20\sqrt{2}$ = 20 +d
d= $20(\sqrt{2}-1)$ cm
Or the radius of the smaller circle = $10(\sqrt{2}-1)$ cm



$$\text{Area of smaller circle} = \frac{22}{7} \times 100(\sqrt{2}-1)^2$$

$= 54cm^2$ approximately. So, B is the right answer.

7. 180.
Let's assume the length of the track = L m
So,
LCM(L/3, L/5) = 60
=> L = 60

So, the length of the track is 60m

While finding "when the people meet at the starting points" directions do not matter until they are running along the circular tracks.

So, they will meet for the first time in the starting point after LCM(4, 5, 3) Seconds = 60 Seconds.

So, they will meet after 180s for the 3rd time.

8. (a)
Let the initial quantity of apple juice, pineapple juice, and cranberry juice be 30x, 40x, 20x
After adding 10 ml of apple juice and 20 ml of pineapple juice the ratio changes to 7:11:3 or we can assume quantity to be 70y, 110y and 30y
So we can say that $30x + 10 = 70y$ and $40x + 20 = 110y$.
By using these two equations we will get 28, 44, and 12 litres of apple, pineapple, and cranberry juice after adding the juices. We need $12 + z = 24\%$ of $(84+z)$. Solve and get the answer, $z = 10.74$ ml

9. (c)
Given, $V \propto w^2$;
$V = kw^2$
Let the weights be x, 2x and 3x and the respective values be V_1, V_2 and V_3.
Total weight = 6x and Total Value be V.
$V = k(36x^2) = 10368$
or, $kx^2 = 288$
$V_1 = kx^2$;
$V_2 = k(4x^2)$;
$V_3 = k(9x^2)$
Therefore,
$V_1 + V_2 + V_3 = 14kx^2$ and
$V = k(36x^2)$
Loss $= 36kx^2 - 14kx^2 = 22kx^2 = 22 \times 288 = 6336$.

10. (c)
If a+b = c then the D(D(a)+D(b)) = D(c) where D(a) is the digital sum of a.
D(1) = 1
D(11) = 2
..
D(1111.. upto 20 terms) = 2
So, D(1) + D(11) +... D(1111.. upto 20 terms) = (1+2+3+..+9) + (1+2+3...+9) + (1+2) = 93
D(93) = D(12) = 3
Only Option C has a digital sum of 3. Thus, C is the right answer.

11. (c)

(a+ b+ c) ^{3} = $a^3+b^3+c^3+3(a+b)(b+c)(a+c)$ ....(1)

Since a+ b+ c = 0

Therefore a+ b = -c, b+ c = -a and a + c =-b

Putting this in equation (1)

0 = $a^3+b^3+c^3+3(-c)(-a)(-b)$

Or $a^3+b^3+c^3=3abc$

We need to find

$\frac{13abc}{a^3+b^3+c^3}$

Putting $a^3+b^3+c^3=3abc$ we get

$\frac{13abc}{3abc}$ or 13/3.

12. (c)

Let the total distance from Bhopal to Mumbai is 390km.
Time taken by him to complete the entire journey = 390/39 = 10 hours.
The distance between Bhopal to Indore is 5/8 times the distance between Indore and Mumbai.
So, the distance between Bhopal and Indore = 390*5/13=150km
And the distance between Indore and Mumbai = 390*8/13 = 240km
Let the average speed between Bhopal and Indore be S.
Then the average speed between Indore and Mumbai will be 2S.

Time taken = distance / speed

10 = $\frac{150}{S}+\frac{240}{2S}$

1 = $\frac{15}{S}+\frac{12}{S}$

S=27 km/hr.

Therefore 2S= 27*2 = 54km/hr.

13. (b)

As the ratio of their speeds is given, assume Suresh's speed = 3x and Mukesh's speed = 4x

Also, let the escalator's speed = y steps per second.

Case 1:

When Suresh took 60 steps, the escalator had moved 60y/ 3x

So, the total number of steps = 60 + 60y / 3x————Eq. 1

Case 2:

When Mukesh took 64 steps, the escalator had moved 60y/ 4x

So, the total number of steps = 64 + 64y / 4x————Eq. 2

Equating both equations, it is obtained that, y = x

Now by putting this value in any of the equations, the total number of steps can be calculated.

So, the total number of steps = 64 + 16 = **80 steps**.

14. 0.

The sum of all the 4-digit numbers formed by 3423 is given by = $1111\times(3+4+2+3)\times\frac{(4-1)!}{2!}$

= $1111\times(12)\times3$=39996

Now, total number of possible arrangements of 3423 = $\frac{4!}{2!}=12$

Arithmetic Mean = 39996/12 = 3333

Remainder when 3333 is divided by 11 = 0

15. 33.

log (132) – log (4) = log (x-y) + log (21+xy)

⇨ 33 = (x-y)(21+xy)

As x, y are positive integers we can say that (21+xy) > 21

The only factor 33 which is more than 21 is 33

So,

21+xy = 33

⇨ xy = 12 ...(i)

Also (x-y) = 1 ....(ii)

We can write equation (i) as
xy = 12 = 3*4
x= 4
y = 3
5xy – 9y = y(5x-9) = 3*(20-9) = 33
So, answer is 33.

16. (c)

$g(1) = \sum_{k=1}^{n} x_k - x_1,$
$g(2) = \sum_{k=1}^{n} x_k - x_2$
$g(3) = \sum_{k=1}^{n} x_k - x_3$
....
$g(n) = \sum_{k=1}^{n} x_k - x_n$
Therefore,
$\frac{g(1)}{x_1} = \frac{S_n - x_1}{x_1} = \frac{S_n}{x_1} - 1$
$\frac{g(2)}{x_2} = \frac{S_n}{x_2} - 1$
....
$\frac{g(n)}{x_n} = \frac{S_n}{x_n} - 1$
Since, $x_1, x_2, \ldots, x_n$ are in HP.
Therefore, $\frac{1}{x_1}, \frac{1}{x_2}, \ldots, \frac{1}{x_n}$ are in AP.
Thus, $\frac{S_n}{x_1}, \frac{S_n}{x_2}, \ldots, \frac{S_n}{x_n}$ are in AP.
That is, $\frac{S_n}{x_1} - 1, \frac{S_n}{x_2} - 1, \ldots, \frac{S_n}{x_n}$-1 are in AP.

Therefore, $\frac{x_1}{g(1)}, \frac{x_2}{g(2)}, \frac{x_3}{g(3)}, \cdots, \frac{x_n}{g(n)}$ are in HP.
Hence, option (c) is correct.

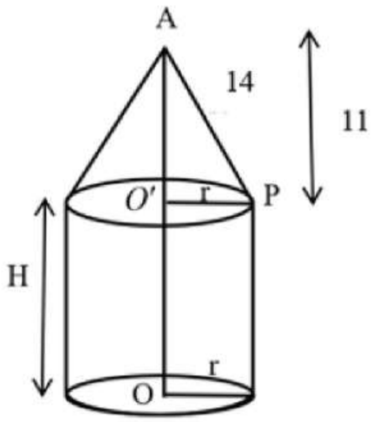
17. (d)
We have total number of friends = 5
Total number of spouses = 5
Hence total number of people in picture = 5 + 5 + 2 (the hosts)
= 12
Hence, they can be arranged in 12! Ways
When Mr and Mrs Ambani are together, assume both as a group. Now total people = 11
Number of arrangements, when Mr and Mrs Ambani are together = 11! × 2!
So, Number of ways arrangement when Mr and Mrs Ambani are not together in the photograph
= 12! – 11! × 2!
= 12 × 11! – 11! × 2
= 10 × 11!
Therefore, option (D) is the correct answer.

18. (c)
Let p = 45
So,
$F(x) = p^{2x}/(p^{2x}+p)$
⇨ $F(1-x) = p^{2(1-x)}/(p^{2(1-x)}+p)$
⇨ $F(1-x) = p/(p^{2x}+p)$
⇨ $F(1-x) + F(x) = p/(p^{2x}+p) + p^{2x}/(p^{2x}+p)$
⇨ $F(1-x) + F(x) = 1$

F(1/2021) + F(2/2021) +F(3/2021) +...+F(2020/2021)
= {F(1/2021) + F(2020/2021)} + {F(2/2021) + F(2019/2021)} + {F(3/2021) + F(2018/2021)} + ...+ {F(1010/2021) + F(1011/2021)}
= 1010
Hence, option C is the right answer.

19. (b)
p(x)=p(x+1).p(x-1)
∴ p(x+1) = p(x)/p(x-1)
Let p(x)=m & p(x-1)=n
∴ p(x+1) = m/n ....(i)
Similarly, p(x+2) = p(x+1)/p(x) = $\frac{m/n}{m} = \frac{1}{n}$
p(x+3) = $\frac{\frac{1}{n}}{\frac{m}{n}} = \frac{1}{m}$
p(x+4) = $\frac{1/m}{1/n} = \frac{n}{m}$.....(ii)
From (i) and (ii),
p(x+1). p(x+4) = 1
$p(x).[p(x-1)]^{-1}.p(x+4) = 1$
Hence, k=4

20. 17.



Let the radius of the cone (cylinder) is r inches.
It is given that the height of the cone is $AO' = 11$ inches and
the slant height $AP = 14$ inches.
Therefore, $O'P = \sqrt{(AP)^2 - (AO')^2}$
$= \sqrt{14^2 - 11^2}$
$= 5\sqrt{3}$ inches
That is, $r = 5\sqrt{3}$ inches
Now, let the height of the cylinder be H inches.
Note that, the total volume of the solid
= Volume of the cylinder + Volume of the cone
$= \pi \times (5\sqrt{3})^2 \times H + \frac{1}{3} \times \pi \times (5\sqrt{3})^2 \times 11$
$= 75 \times 3.14 \times H + 3.14 \times 25 \times 11$
$= 235.5\, H + 863.5$
Therefore, according to the condition,
$235.5\, H + 863.5 = 2276.5$
$H = 6$
Hence, the total height of the solid = Height of the cone + height of the cylinder
$= 11 + 6$
$= 17$ inches

21. (b)

Let's assume Mansee invested the amount for 'N' months.

Therefore, total investment made by Mansee = N lakh

Total investment made by Prerna = (0.75 × 12) lakh = 9

Hence the ratio in which profit will be divided between Mansee and Prerna = N: 9

Hence, N/9 = 13/18

=> N = 13 × 9/18

=> N = 13/26 = 6.5
Therefore, we can say that Mansee invested after 5.5 months.

22. (d)
Units completed by Arjun in one day = 1/p
Similarly, units completed by Karan in one day = 1/q
Two days work = 1/p + 1/q
So, 20(1/p + 1/q) = 1

Or 1/p + 1/q = 1/20
(p +q)/pq = 1/20
20p +20q = pq
Or pq -20p -20q = 0
p(q-20) -20(q-20) = 400
(p-20)(q-20) = 400
400 can be written as product of two numbers as 400 ×1 or 1×400,
200×2 or 2 × 200 , 100×4 or 4×100 , 80×5 or 5×80, 50×8 or 8×50, 40×10 or 10× 40, 25 ×16 or 16×20 and 20×20.
Thus, 15 pairs are possible.
Hence, option (d) is correct.

Mock 17

1. 10.
We know that,
Total work = Efficiency × Time
Let efficiency of first and second printing machine be x and y respectively, then
⇒ Total work = (x+y) x 8 ....(1)
If 1/5 of work left, then done work = 1-1/5 = 4/5
According second condition
Total work × 4/5 = (6x + 8y)
⇒ Total work = (6x+8y) × 5/4 ......(2)
From equation (1) and equation (2)
(x + y) x8 = (6x + 8y) × 5/4
⇒ 30x + 48y = 32x + 32y
⇒ 2x = 16y
⇒ x/y = 4/1
⇒x: y=4:1
Total work = (4+1) × 8 = 40 unit
Faster machine can complete the work in = 40/4 = 10 minutes

2. (a)
Since AB = AD = BD, then Δ BDA is equilateral.
Thus, ∠ABD = ∠ADB = ∠DAB = 60 ∘ .
Also, ∠DAE = 180 ∘ − ∠ADE − ∠AED = 180 ∘ − 60 ∘ − 90 ∘ = 30 ∘ .
Since CAE is a straight line, then ∠CAD = 180 ∘ − ∠DAE = 180 ∘ − 30 ∘ = 150 ∘ .
Now AC = AD so 4CAD is isosceles, which gives ∠CDA = ∠DCA.
Since the sum of the angles in 4CAD is 180 ∘ and ∠CDA = ∠DCA, then
∠CDA =1/2(180 ∘ − ∠CAD) = 1/2(180 ∘ − 150 ∘) = 15 ∘
Thus, ∠CDB = ∠CDA + ∠ADB = 15 ∘ + 60 ∘ = 75 ∘

3. (c)
According to the question, we can form this equation:
$[n/2(2a + (n-1)d)] / [n/2(2a_1 + (n-1)d_1)] = (6n + 4) / (2n + 1)$, where a and d is first term and common difference of first series and a_1 and d_1 are first term and common difference of 2^{nd} series.
Therefore, $(2a + (n-1)d) / (2a_1 + (n-1)d_1) = (6n + 4) / (2n + 1)$
Rearranging the terms on LHS, we get
$[nd + (2a - d)] / [nd_1 + (2a_1 - d_1)] = (6n + 4) / (2n + 1)$
Comparing both sides we get, d = 6, a = 5, d_1 = 2 and a_1 = 1.5
Ratio of 11^{th} term = $(a + 10d) / (a_1 + 10d_1)$ = (5 + 10*6) / (1.5 + 10*2) = 65/21.5
Hence, required ratio = 130/43

Hence, option (c) is correct.

4. (d)

If a number is odd, the number raised to any power will be odd. The same holds true for even numbers as well.

Let us evaluate the cases.

$f(x,y) = x^2 + y^2 + 5x^3y^2$

When one among I and

is odd and the other is even the value of the expression will be odd+ even +even = odd.

When both X and Y are odd, the value of the expression will be odd + odd + odd = odd.

When both x and y are even, the value of the expression will be even + even + even = even.

We know that the value of the function is odd. Therefore, there are 3 cases in total.

x-odd y - even

X -odd y - odd

X - even y - odd

'x' is odd in 2 of the 3 cases. Therefore, the required probability is 2/3.

Hence, option D is the right answer.

5. 72.

Let's assume that the speed of the boat is u kmph on still water and the speed of the stream on a regular day is v kmph.

Shraboni and Bhavna are at Gandhi Ghat & Babu Ghat respectively. River Hooghly flows between these two places. They left for Babu Ghat & Gandhi Ghat respectively at the same time by taking boats having the same speed on still water. After meeting with each other, Shraboni reached her destination in 8 hours and Bhavna reached in 2 hours.

So, we can say that

$(u + v)^2/(u-v)^2 = 8/2$

⇨ $(u + v)/(u - v) = 2$

⇨ $u/v = 3$

⇨ $u = 3v$

Let's assume that the distance between Gandhi Ghat & Babu Ghat is d km

Thus, the distance between the two places = (Distance travelled by Shraboni after meeting Bhavna + Distance travelled by Bhavna after meeting Shraboni)

⇨ $d = 8(u - v) + 2(u + v) = 16v + 8v = 24v$

During rainy season the Shraboni travels a total distance of $(24v/2v)*(3v - v*1.5) = 18v$

So,

$(24v - 18v) = 18$

⇨ $v = 3$

So, the distance between Gandhi Ghat & Babu Ghat is 3*24 km = 72 km

6. 4.

In a circular track, if two people met at the same point every time they pass each other, then that point has to be their starting point. If they meet at any other point other than the starting point, there will be atleast 2 different meeting points.

As they are meeting at the starting point for every time and each of the joggers have a speed greater than 0, they should be jogging in the same direction. If they jog in the opposite directions then they should meet each other at a point which is different from the starting point which is not possible.

So, Trisha & Bhavna can only jog in the same direction. As they meet at the starting point in every 20 s, the relative speed is (40m/20s) = 2 m/s.

Now let's assume that Trisha's speed is 10x m/s

So, $2x = 2$

⇨ $x = 1$

Hence, Trisha's speed is 10 m/s.

So, she will be able to complete 1 round of the track in 40 m/(10 m/s) = 4s.

7. 2.

Number of zeroes in 100!

$\frac{100}{5} = 20, \ \frac{20}{5} = 4$

$\therefore$ 24 zeroes

Number of zeroes in 80!

$\frac{80}{5} = 16, \ \frac{16}{5} = 3$

$\therefore$ 19 zeroes

$\therefore$ Trailing zeroes in first expression = 24-19=5

Number of zeroes in 60!

$\frac{60}{5} = 12, \ \frac{12}{5} = 2$

$\therefore$ 14 zeroes

Number of zeroes in 50!

$\frac{50}{5} = 10, \ \frac{10}{5} = 2$

$\therefore$ 12 zeroes

$\therefore$ Trailing zeroes in second expression = 14-12=2

Since we have to take the lowest value of zeroes in the number, 2 trailing zeroes will be there.

8. (d)

Let the both will complete work in x hours.
Their combine efficiency =
Titu's work = x + 10
and her efficiency = 1/(x+10)
Sonu's work = x+7.5
and Sonu's efficiency = 1/(x+7.5)
Thus, the total efficiency is
1/(x+10) +1/(x+7.5) =1/x
1/(x+7.5) = 1/x -1/(x+10)
1/(x+7.5) = 10/x(x+10)
x^2=75
x= 9 (approx.)
Hence, the time required by Sonu alone to complete the design is
=9+7.5
=16.5 hr.
Option (d) is correct.

9. (d)

$(1+\log_4 x)\ [1+ (\log_4 x)^2 + (\log_4 x)^4 + \ldots]$
$1+ \log_4 x + (\log_4 x)^2 + (\log_4 x)^3 + (\log_4 x)^4 + \ldots.. = 2$
$\text{Log}_4 x + (\log_4 x)^2 + \ldots. = 1$
a = $\log_4 x$ and r = $\log_4 x$
$\log_4 x$ / 1-$\log_4 x$ = 1 (for infinite GP series sum= a/ 1-r)
$\log_4 x = 1- \log_4 x$

$2\log_4 x = 1$
$\log_4 x = ½$
$x = 4^{1/2}$
x= 2.
Option (d) is correct.

10. 96.
Only two-digit, three-digit, four-digit or five-digit numbers can satisfy the two given conditions. For each of the above cases, there are possibilities for the leftmost digit, namely 3, 5 and 7 and two possibilities for the rightmost digit, 4 and 9. Hence, in spite of the number of digits, we will have six different combinations for the 1st and last digits taken together.
For a 5-digit number, there are $^3C_3 \times 3!$ Possible arrangements for the remaining three digits. Hence, a total of 6 × 6 = 36 arrangements is possible.
For a 4-digit number, for each of the above 6 combinations, there will be $^3C_2 \times 2!$ possibilities for the remaining 2 digits. Hence, a total of 6 × 6 = 36 numbers is possible.
For a 3-digit numbers, we will have $^3C_1 \times 1!$ Possible arrangements for the remaining digit. Hence, a total of 6 × 3 = 18 numbers is possible.
For a 2-digit number, six arrangements are possible. Hence, a total of 36 + 36 + 18 + 6 = 96 combination is possible.

11. 9.
Unit's digit of $(1^1 + 2^2 + 3^3 +...+ 2020^{2020} + 2021^{2021} + 2022^{2022})$ is y (let's say).
We need to first find out the last digit of $(1^1+2^2+ ...+ 20^{20})$ as the last digit of 3^{23} is same as 3^3
The last digit of $(1^1+2^2+ ...+ 20^{20})$ = 1+4+7+6+5+6+3+6+9+0+1+6+3+6+5+6+7+4+9 = 4
Now $(1^1+2^2+ ...+ 20^{20})$ will be repeated 101 times in $(1^1 + 2^2 + 3^3 +...+ 2020^{2020})$.
So, the last digit of $(1^1 + 2^2 + 3^3 +...+ 2020^{2020})$ is 101×4 = 4
So, $y = 4+ 1^1+2^2 = 9$
Last digit of $P = (1^1 + 2^2 + 3^3 +...+ 2020^{2020} + 2021^{2021} + 2022^{2022})$ is 9.
So P^2 will be an odd number.
Hence, $9^{\text{odd number}}$ will have 9 as unit's digit.

12. 1166.
Let's first find the smallest number which when divided by 7, 13 gives a remainder of 4, 9 respectively.
The number will be in the form of 13n+9
While dividing 13n+9 the remainder obtained will be 6n+2.
The smallest value of n for which (6n+2) will have a remainder of 4 when divided by 7 will be 5
So, the smallest number which when divided by 7, 13 gives a remainder of 4, 9 respectively is 13X5+9 = 74
All the numbers which when divided by 7, 13 gives a remainder of 4, 9 respectively will be in the form of 74 + LCM (7,13) × k, where k is any whole number.
When we are dividing 74+91k by 5 the remainder will be k+4
The smallest value of k+4 which when divided by 5 gives a remainder of 1 will be 2
So, the smallest number which when divided by 5, 7, 13 gives a remainder of 1, 4, 9 respectively is 91 X 2 + 74 = 256
The smallest 4-digit number which when divided by 5, 7, 13 gives a remainder of 1, 4, 9 respectively is 256 + 455p where p is a whole number.
The smallest 4-digit number which when divided by 5, 7, 13 gives a remainder of 1, 4, 9 respectively is 455 × 2 + 256 = 1166.

13. 1.

$3x^2 - 7x + 4 \geq 2$

$3x^2 - 7x + 2 \geq 0$

$(3x - 1)(x - 2) \geq 0$

$\therefore$ the range for this function will be

$\left(-\infty, \frac{1}{3}\right) \cup (2, \infty)$

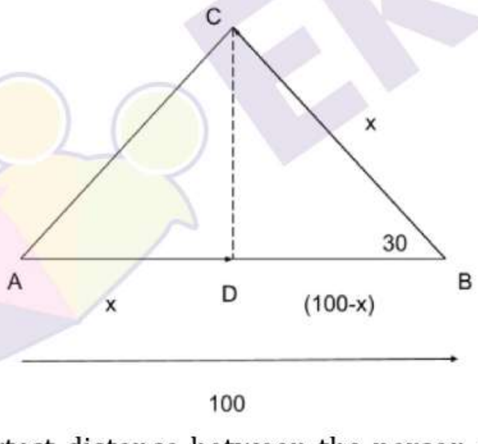
$\therefore 1$ would be the only integer which will not satisfy the equation.

$1^7 = 1$

14. 1350

CP of one item = CP of other item = Rs.1500
Now, for one item:
profit% = $(SP_1 - CP_1)/CP_1 \times 100$ =
$60 = (SP_1 - 1500)/1500 \times 100$
$SP_1 = 2400$
For another item:
profit%= $(SP_2 - CP_2)/SP_2 \times 100$
$60 = (SP_2 - 1500)/SP_2 \times 100$
$SP_2 = 3750$
Therefore, difference between selling price of both the items
$= SP_2 - SP_1$
= 3750 -2400
= Rs. 1350

15. (b)



The shortest distance between the person and the bird will be the perpendicular distance as shown in the figure above.
If the speed are in the ratio 1:1, their distance travelled will also be same.
In triangle BDC
CD:DB:BC = 30º, 60º, 90º
Sides will be in the ratio = $1:\sqrt{3}:2$

$\frac{DB}{BC} = \frac{\sqrt{3}}{2}$

$\frac{(100-X)}{X} = \frac{\sqrt{3}}{2}$

$x = \frac{200}{2+\sqrt{3}}$

16. (d)

When we are given with the length of three medians, the area of that triangle can be calculated as:
4*(Area of triangle with sides equal to these median length)/3
Hence area of this triangle = 4*√[{(15+18+21)/3}*(27-15)*(27-18)*(27-21)]/3
= 4*√(27*12*9*6)/3 = 72√6.

17. (b)
Let radius be 'r' and slant height be 'l', according to question:
(r + l) = 8(2r – l)
r + l = 16r – 8l
9l = 15r
l/r = 15/9 = 5/3, or we can say radius and slant are 3x and 5x
Therefore, the height of the cone = $[(5x)^2 – (3x)^2]^{1/2}$ = 4x
Total surface area of πr(r + l) = 3456π
π*3x*(3x + 5x) = 3456π
Hence, x = 12
Thus radius = 36, height = 48 and slant height = 60
Volume of cone = $\pi r^2 h/3 = \pi(36)^2 48/3 = 20736\pi$
Volume/8 = 2592π cm^3

18. (d)
Since the original cube is cut into 216 smaller cubes, let each side of the original cube be of length 6 units.
Each smaller cube is of length 1 unit.
Now, let the division of these 216 cubes be such that there are x^3 cubes in the first group, y cubes in the second group and z^3 cubes in the third group. $x^3+y^3+z^3=216 = 6^3$.
The only possible integer solution is $3^3 +4^3 +5^3 = 6^3$. The sides of the new larger cubes are 3, 4 and 5 units. The sum total of the outer surface areas of the three new cubes
= $(6 \times 3^2) + (6 \times 4^2) + (6 \times 5^2)$ = 300 sq. units Total surface area of the original larger cube = 6 * 6^2 = 216.
Time required to paint the outer surface of all the three new cubes = 18*300/216=25 Mins.

19. 240
Let the volume of Jaggery and Orange peel used be 2x and 5x.
Let the price of orange peels be p,
Price of jaggery = 3p
Total Cost = (2x)(3p) + (5x)(p) = 520 – 80
6xp + 5xp = 11xp = 440
xp = 40
Thus, value of Jaggery = 6xp = 240

20. 18.
Given that,
Speed of upstream = 18 km/hr
Speed of flow of river = 6 km/hr
We know that,
Downstream Speed = Speed of sailor + Speed of water
Upstream Speed = Speed of sailor - Speed of water
Let the distance from one side be D.
According to the formula used,
18 = Speed of Captain Damera's boat - 6
Speed of Captain Damera's boat = 24 km/hr
Downstream Speed = 24 + 6 = 30
According to the question

D/18+D/30 = 1.6 hr
⇒ 8D = 144
⇒ D = 18 km
Hence, the required distance = 18 km.

21. (c)
The given equation can be written as
$x^2-(x-f)-5x+4=0$, where f is representing the fraction portion.
$\Rightarrow (x^2-4x+4)-f=0$
$\Rightarrow f=x^2-4x+4$
Now, the fraction f is such that $0\leq f<1$.
Therefore, $0\leq x^2-4x+4<1$
First consider, $x^2-4x+4=0$
Then, $(x-2)^2=0$
$\Rightarrow x=2,2$
Again, let $x^2-4x+4<1$
Then, $x^2-4x+3<0$
$x^2-3x-x+3<0$
$(x-3)(x-1)<0$
$\Rightarrow\ 1<x<3$
Hence, we have $[x]=1$ or 2.
If $[x]=1$, then the given equation becomes
$x^2+1-5x+4=0$
$x^2-5x+5=0$
$\therefore x=\frac{5\pm\sqrt{25-20}}{2}$
$=\frac{5+\sqrt{5}}{2},\frac{5-\sqrt{5}}{2}$
$\approx 3.62, 1.38$
So, $x\neq\frac{5+\sqrt{5}}{2},\ x=\frac{5-\sqrt{5}}{2}$
Again, if $[x]=2$, then the given equation becomes
$x^2+2-5x+4=0$
$x^2-5x+6=0$
$(x-3)(x-2)=0$
$\Rightarrow x\neq 3,\ x=2$
Hence, the number of solutions to the equation is 2.
Thus, option (C) is correct.

22. (d)
We are given that
$kx^2-8x+4k=0$ .... (1)
Therefore, the discriminant $D=64-16k^2$For distinct real roots,
$64-16k^2>0$
$16k^2<64$
$k^2-4<0$
$(k+2)(k-2)<0$
$k\in(-2,2)$ .... (2)
Since, r_1,r_2 are the roots of the equation (1), so
$r_1+r_2=\frac{8}{k}$ and
$r_1r_2=4$
Again, it is provided that
$|r_1-r_2|<2$
$(r_1-r_2)^2<4$
$(r_1+r_2)^2-2r_1r_2<4$

$64 - 8k^2 < 4k^2$

$12k^2 > 64$

$k^2 > \frac{16}{3}$

$\left(k + \frac{4}{\sqrt{3}}\right)\left(k - \frac{4}{\sqrt{3}}\right) > 0$

$\therefore k \in \left(-\infty, -\frac{4}{\sqrt{3}}\right) \cup \left(\frac{4}{\sqrt{3}}, \infty\right)$ .... (3)

Combining (2) and (3), it is concluded that,

$$k \in \phi$$

Thus, option (D) is the correct answer.

Mock 18

1. (a)

For Rik,

Expenditure on food = 80/100 × X = Rs. 0.8X

⇒ Expenditure on entertainment = 10/100 × 0.8X = Rs. 0.08X

⇒ X – (0.8X + 0.08X) = 12000

⇒ X = Rs. 100000

For Nik,

Expenditure on food = 70/100 × Y = Rs. 0.7Y

Savings = 20/100 × Y = Rs. 0.2Y

⇒ Y – (0.7Y + 0.2Y) = 8000

⇒ Y = Rs. 80000

Person	Expenditure (food) (in Rs.)	Expenditure (entertainment) (in Rs.)	Savings (in Rs.)	Income (in Rs.)
Rik	80000	8000	12000	100000
Nik	56000	8000	16000	80000

Income of Rik next year = 100000 × 110/100 = Rs. 110000

⇒ Expenditure of Rik next year = 110000 – 12000 = Rs. 98000

Income of Nik next year = 80000 × 120/100 = Rs. 96000

⇒ Expenditure of Nik next year = 96000 – 16000 = Rs. 80000

Difference between expenditure next year = 98000 – 80000 = Rs. 18000

Difference between expenditure in present year = (80000 + 8000) – (56000 + 8000) = Rs. 24000

∴ Required ratio = 18000 : 24000 = 18 : 24 = 3:4

Hence, option 1 is correct.

2. (a)

2 5 7 **Divisors**

1 4 6 **Remainders**

So, the smallest number that satisfy the given condition is {(5×6)+4}×2+1 = 69.

The general form of numbers that satisfy the given condition is got by adding the LCM of divisors, which is 70, to 69.

i.e., the general form is 70k+69, k = 0, 1, 2, 3, ...

Therefore, the smallest number is 69.

Now, when 69 is divided by 4, quotient obtained as 17 and leaves remainder as 1.
When 17 is divided by 2, quotient obtained as 8, remainder as 1.
When 8 is divided by 8, quotient obtained as 1, remainder as 0.

3. 121.
If the speed of Amar, Akbar & Anthony are a, b, c respectively, then they complete one circle in (30/a) s, (30/b) s, (30/c) s respectively.
These numbers are all distinct integers. So, the possible values that time taken will be 3s, 5s & 15 s as no one can finish the one complete circle in less than 1.5 seconds.
Then the speed of Amar, Akbar & Anthony are 10 m/s, 6 m/s & 2m/s
Amar finishes the race in 300/10 s = 30 s
So, Akbar will run the race for less than 30 s
In 30s, Akbar travels 30*6 m= 180 m
So, a minimum of (300 – 180 +1) m = 121 m headstart is needed.

4. (c)
To find the number of days we need to know,
a) the relative efficiencies of a man, a woman and a boy, which is given in statement 2
b) the time for which the people work, which is given in statement 1
c) a sample relation between the work done, time taken and the number of people working which is given in 3
Therefore, all the 3 statements are necessary.

5. (a)
Let 90 be the no. staffs in the bank.
Therefore, total female staffs = (90×2)/9 = 20
[Since, 200/9% = 2/9]
As no. of females married = 45% of 20 = 9
No. of married females having children = 100/3 % of 9 = 3
No. of married females not having children = 9 –3 = 6
Now, total male staffs = total – no. of female staffs = 90 – 20 = 70
$77\frac{1}{7}\%$ of male staff are married = $77\frac{1}{7}\%$ of 70 = 54
No. of married male staff having children = 250/9 % of 54 = 15
No. of married male staff not having children = 54 – 15 = 39
Now, total married staffs not having children in the bank
= no. of unmarried male and female staffs + male and female staff not having children
= (70-54) + (20-9) +6+39
=72
Required fraction = 72/90
Hence, option (1) is correct.

6. (d)
Case i:
Person goes directly:
Number of ways = 2
If he returns either directly without taking the same path or through B, then number of ways = 1 + 3 × 4 = 13
Total number of ways = 2 × 13 = 26
Case ii:
Person goes through B:
Number of ways = 3 × 4 = 12
If he returns either directly or through B without taking the same path, then number of ways = 2 + 2 x 3 = 8

Total number of ways = 12 × 8 = 96
Hence, total number of ways in both cases = 26 + 96 = 122

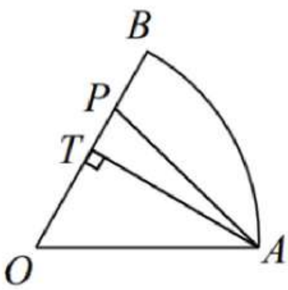
7. 20.
Selling price (SP) of 45 kg apples = Cost price (CP) of 54 kg apples
SP of 45 kg = CP of 54 kg
CP of 45 kg + Profit of 45 kg = CP of 54 kg
Profit of 45 kg = CP of 54 kg - CP of 45 kg
Profit of 45 kg = CP of 9 kg = k (Let)
CP of 45 kg = 5k
Profit percent = (Profit/CP) × 100
= (k/5k) × 100
= 20%

8. (d)
Assuming capacity of each canister is 2700 litres.
So, Canister 1 has 1/3 × 2700 = 900 litres of honey and Canister 2 has 1/3 × 2700 = 900 litres of tea.
After first transfer,
Canister 1 has (900 – 900 × 1/3) = 600 litres of honey and Canister 2 has 900 litres Tea and 300 litres honey.

After second transfer,
1/3rd of the second canister i.e., 300 litres tea and 100 litres honey will get transferred to canister 1.
So, Canister 1 has (600+100) = 700 litres honey and 300 litres tea and
Canister 2 has (900 – 900 × 1/3) = 600 litres tea and (300 – 300 × 1/3) = 200 litres honey.

After third transfer,
1/3rd of the first canister i.e., 700/3 litres honey and 300/3 = 100 litres tea go to second canister.
So, second canister has (600 + 100) = 700 litres tea and (200 + 700/3) = 1300/3 litres honey.
Required ratio = 1300/3: 700
= 1300: 2100
= 13: 21

9. (b)
Since the pizza sector OAB is 1/6 of a whole pizza (circular) with radius 18, its area will be $1/6(\pi \cdot 18^2)$ or 54π.
For the line AP to divide this sector into two pieces of equal area, each piece has area 1/2(54π) or 27π.
We determine the length of OP so that the area of ΔP OA is 27π.
Since sector OAB is 1/6 of a circle, then ∠AOB =1/6(360 ∘) = 60 ∘ .
Drop a perpendicular from A to T on OB.



The area of ΔPOA is 1/2 × OP × AT.

ΔAOT is a 30° - 60° - 90° triangle.

Since, AO = 18, then AT = $\sqrt{\frac{3}{2}}$ × AO = $9\sqrt{3}$

For the area of ΔPOA to equal 27π, we have $1/2 \times OP \times 9\sqrt{3} = 27\pi$, which gives OP = $\frac{54\pi}{9\sqrt{3}} = 2\sqrt{3}\pi$

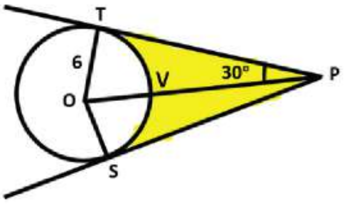
10. 43150
The amount on the first investment of Messi = 18,000 × (1.09) = 19,620
So, the interest on this investment is 19,620 - 18,000 = 1620.
The amount on the second investment of Messi = $P[1+(r/2)/100]^{2t}$ = 11,875 × $(1.04)^2$ = 12,844
So the Interest on this investment is 12,844 - 11,875 = 969.
So the total interest on these returns = 1620 + 969 = 2589.
Mbappe has to get this as Simple Interest by investing X rupees at 7.5%
That means, X × 0.06 = 2,589
X = 43,150
So, Mbappe has to invest 43,150 rupees.

11. (c)
Total surface area of cylinder before cutting
$= 2\pi r(h+r)$
$= 2 \times \frac{22}{7} \times 10.5(10.5+22)$
= 2145 cm^2

After cutting:
T. S. A of half cylinder part = $\pi r(h+r) + 2rh$
= 22/7 × 10.5(22+10.5) + 2 × 10.5 × 22
= 1534.5 cm^2
T.S.A of both cylindrical part
= 2 × 1534.5
= 3069 cm^2
% increased = (Increased value) / (Initial value) × 100
= 924/2145 × 100
= 43.08%

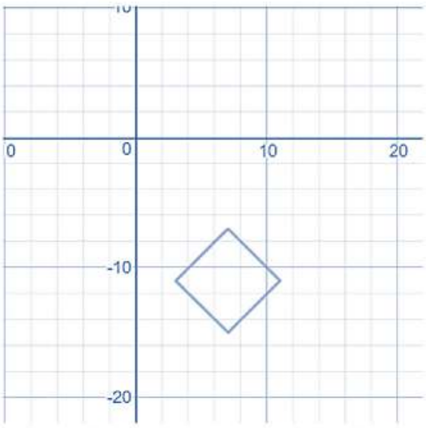
12. (d)
It is given that, $\frac{1}{\sqrt{log_e \frac{9x-x^2}{14}}}$ is a real number.
Therefore, $log_e \frac{9x-x^2}{14} > 0$
$\frac{9x-x^2}{14} > 1$
$9x - x^2 > 14$
$x^2 - 9x + 14 < 0$
$(x-2)(x-7) < 0$
$x \in (2, 7)$

13. (a)



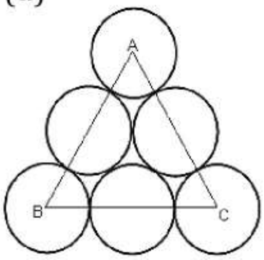
It is known that, the tangent to a circle makes 90^o angle with the radius at the point of contact.
So, ΔOTP is a right-angled triangle.
Therefore, OT/OP = sin 30^o = 1/2
OP = 2 × 6 = 12 cm
Now, let ∠TOP = x
Then, in ΔTOP,
cos x = OT/OP
cos x = 6/12 = 1/2
x = 60^o
So, ∠TOS = 2 × 60^o = 120^o
Therefore, the area of the sector TOSV
= $120^o/360^o \times 22/7 \times 6^2$
= 264/7 cm^2
Now, in ΔOTP,
OT/TP = tan 30^o = $1/\sqrt{3}$
TP = $6\sqrt{3}$
Therefore, the area of the ΔOTP
= 1/2 × TP × OT
= $1/2 \times 6\sqrt{3} \times 6$
= $18\sqrt{3}$ cm^2
Hence, the area of the quadrilateral OSPT
= 2 × area of the ΔOTP
= $2 \times 18\sqrt{3}$
= $36\sqrt{3}$ cm^2
Hence, the area of the yellow portion = $36\sqrt{3}$ - 264/7
= 36 × 1.73 – 264/7
= 24.58 (approx.)

14. (b)
Let x= 13 cos θ, y= 13 sin θ
So, the given expression = $\log_{13}\{13(5\cos\theta + 12\sin\theta)\}$
As 5cos θ +12sin θ ≤ 13
Thus, the maximum value = $\log_{13}169$ = 2=n (given)
Then, the given equation becomes $|x - 7| + |y + 11| = 2^2$
i.e., $|x - 7| + |y + 11| = 4$
Now, if we draw the diagram for this equation, we will get a figure like this were, it will form a square with side measuring $4\sqrt{2}$:



Therefore, the area of the bounded region is $4\sqrt{2} \times 4\sqrt{2} = 32$.
Alternatively, Area of bounded region when such equation is given is $= 2n^2/ab$, where n is constant on RHS, and a and b are constants part of x and y modulus respectively, therefore area $= 2\times4^2/1\times1 = 32$.

15. (d)



Draw a triangle running through the centres of the circles as shown above. Since the circles are of equal radii, ΔABC will be an equilateral triangle with side 4r.
Area bounded by but not included in the circles (A) = Area of the equilateral triangle – (Area of 3 semicircles + Area of 3 sectors of angle 60° each)

$= \frac{\sqrt{3}}{4}(4r)^2 - \frac{3}{2}\pi r^2 - \frac{1}{2}\pi r^2$

$= 4\sqrt{3}r^2 - 2\pi r^2$

Height of triangle ABC $= \sqrt{(4r)^2 - (2r)^2} = 2\sqrt{3}r$

Height of the stack (B) $= 2\sqrt{3}r + 2r$

A + Br $= 4\sqrt{3}r^2 - 2\pi r^2 + (2\sqrt{3}r + 2r)r$

$= r^2(2 + 3\sqrt{12} - 2\pi)$

16. (c)
$0<p<1$. So, $0< \sin^2 p<1$
Then, $\sin^2 p+\sin^4 p+\sin^6 p+\ldots\infty=\sin^2 p/(1-\sin^2 p) = \tan^2 p$
Therefore, $S=3^{\tan^2 p}$
Now, the given quadratic equation is $x^2-6x-27=0$
$x=9, -3$
Given that, S satisfies the given quadratic equation.
But, $S= 3^{(\tan^2 p)} \neq -3$
So, $S= 3^{(\tan^2 p)} = 9 = 3^2$
Therefore, $\tan^2 p = 3$
$\tan p = \sqrt{3}$
Now, $(2\sin p-5\cos p)/(4\cos p-5\sin p)$
$= (2\tan p - 5)/(4 - 5\tan p)$
$= (2\sqrt{3} - 5)/(4-5\sqrt{3})$
$=1/\sqrt{2}$

17. (a)

Let the roots be $\alpha = \sqrt{6\sqrt{6\sqrt{6 \ldots \infty}}}$ and $\beta = \sqrt{6 + \sqrt{6 + \sqrt{6 + \cdots \infty}}}$

So, $\alpha^2 = 6\alpha$

⇨ $\alpha = 6$

So, $\alpha = 6,\ \beta = 3$

⇨ $\alpha + 2 = 8,\ \beta + 2 = 5$

Also,

$\beta = \sqrt{6 + \sqrt{6 + \sqrt{6 + \cdots \infty}}}$

⇨ $\beta^2 = 6 + \beta$

⇨ $\beta^2 - \beta - 6 = 0$

⇨ $\beta = -2, 3$ [β cannot be -2 as $\sqrt{6 + \sqrt{6 + \sqrt{6 + \cdots \infty}}}$ is > 0]

So, the quadratic equation whose roots are 8 and 5 is

(x-8)(x-5) = 0

The minimum value of (x-8)(x-5) will appear at (8+5)/2 = 6.5

So, (6.5 – 8)(6.5 – 5) = -2.25 = -9/4

Thus, the answer is – 9/4.

18. 4704.

Let the number of sweets that these children receive is a, b and c

So, a +b +c = 100

Now, they get at least one sweet, so giving 1 sweet to each of them we get

a' +b' +c' = 97

Number of integral solutions = $^{99}C_2$ = 4851

But this also includes the cases where they do not get distinct number of sweets

All three cannot have same number of sweets.

Let two persons get same number of sweets while the other child gets a distinct number of sweets.

So, 2x +y = 100

The possible solutions are (1,98), (2,96),……..(49,2)

Thus there are 49 solutions. Also they can be arranged in 3 ways. So number of such pairs = 3×49 = 147

So, possible number of ways = 4851 -147 = 4704

19. 16

It is given that the scores of Dwayne, Depp and Musk after review were in the ratio 13: 12: 9

So, let their values be 13x, 12x and 9x respectively.

It is known that their score increased by 6 after review.

So, scores before review = 13x-8, 12x-8 and 9x-8 respectively

Now, from the data given

(13x - 8 + 12x - 8) × 1/3 = 9x - 8

25x - 16 = 27x - 24

8 = 2x

x = 4

So, marks after revision are 52, 48 and 36 respectively.

Therefore, Dwayne's score exceeded Musk's by 52 - 36 = 16 marks

20. 4.

The last digit of 981^{8789} is same as the last digit of 1^{8789}, which is 1.

The last digit of 782^{54} is same as the last digit of 2^{54}, which is $2^{\text{Rem}\left[\frac{54}{4}\right]}$, i.e., $2^2 = 4$. [Since the cyclicity of 2 is 4.]

Also, the unit digit of 8762^{6759} is same as the unit digit of 2^{6759}, which is the unit digit of $2^{\text{Rem}\left[\frac{6759}{4}\right]}$, i.e., $2^3 = 8$ [Since the cyclicity of 2 is 4.]
The last digit of 564^{5641} is same as the last digit of 4^{5641}, which is 4. [Since 4 to the power any odd number produces a number whose unit digit is always 4.]

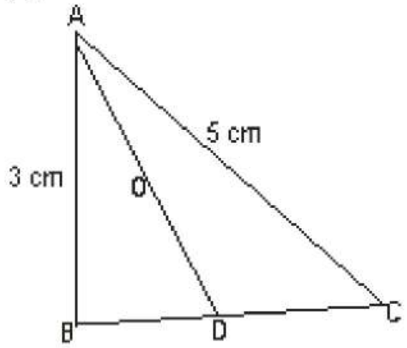
The last digit of 987^{453} is same as the last digit of 7^{453}, which is $7^{\text{Rem}\left[\frac{453}{4}\right]}$, i.e., 7. [Since the cyclicity of 7 is 4.]
Hence, the last digit of $981^{8789}(782^{54} + 8762^{6759}) + 564^{5641}(987^{453} + 1)$
= The last digit of $1(4+8)+4(7+1)$
= 4

21. 800
Let the number of headphones purchased be n. Then the cost price is 7n. The total expenses incurred would be 7n + W, where W refers to the wage.
Then SP in the first case = $11 \times 100 + 10 \times (n — 100)$
Given profit is $200.
<u>In this case:</u>
$1100 + 10n – 1000 - 7n - W = 200$
⇨ $3n – W = 100$
<u>In second case:</u>
$1100 + 8n – 800 - 7n - W = -200$ (Loss).
=> $W-n = 500$.
Adding the two equations: $2n = 600$
$n = 300$.
Thus, W = 500 + 300 = $800

22. 36.
It is given that $f(2) > 1$ and $f(xy) = f(x) f(y)$
So, $f(2) = f(2) f(1)$.
As, x and y are positive integers, only possible value for $f(1) = 1$
$f(2) > 1$
Now we know, $f(48) = 162$
So, $f(2)^2 f(3) f(4) = 162$
$f(3) f(2)^4 = 162$
Now we know, $162 = 2 \times 3^4$
Therefore, $f(2) = 3$, $f(3) = 2$ and $f(1) = 1$
Now, we need to find the value of $f(36)$
$f(36) = f(18) \times f(2) = f(2) \times f(9) \times f(2) = f(2)^2 \times f(3)^2$
$f(36) = 3^2 \times 2^2$
$f(36) = 36$

Mock 19

1. (a)



Let BD = DC = x cm
If AD is a median in a triangle ABC then,
$AB^2 + AC^2 = 2(AD^2 + DC^2)$
$3^2 + 5^2 = 2(AD^2 + x^2)$
$AD^2 + x^2 = 17$
$x^2 = 17 - AD^2$
In triangle ABC, AB + BC > AC
3 + 2x > 5
2x > 2
Or, x > 1
$x^2 > 1$,
Or, $17 - AD^2 > 1$
Or, $16 > AD^2$
AD < 4

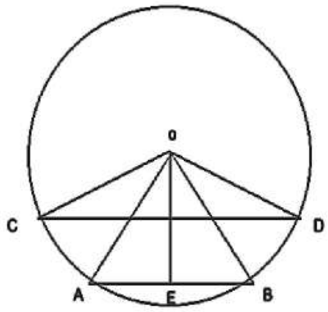
2. 88.
For 'X' and 'Y'
Distance covered by 'X' = 1000 metres
Distance covered by 'Y' = 1000 – 50 = 950 metres
For 'Y' and 'Z'
Distance covered by 'Z' = 1000 – 40 = 960
If 'Y' covers 950 metres, then distance covered by 'Z' = (960/1000) × 950 = 912 metres
Therefore, 'X' can give 'Z' a head start of = 1000 – 912 = 88 metres

3. (c)
For Australian team:
Case I: 4 batsmen, 1 wicket keeper and 6 bowlers are there in the team
So the number of ways = $^8C_4 \times {}^3C_1 \times {}^7C_6 = 1470$
Case II: 5 batsmen, 1 wicket keeper and 5 bowlers are there in the team
So the number of ways = $^8C_5 \times {}^3C_1 \times {}^7C_5 = 3528$
Case III: 6 batsmen, 1 wicket keeper and 4 bowlers are there in the team
So the number of ways = $^8C_6 \times {}^3C_1 \times {}^7C_4 = 2940$
Case IV: 7 batsmen, 1 wicket keeper and 3 bowlers are there in the team
So the number of ways = $^8C_7 \times {}^3C_1 \times {}^7C_3 = 840$
So the total number of ways = 1470 + 3528 + 2940 + 840 = 8778 ways
For Indian team:
Case I: 5 batsmen, 1 wicket keeper and 5 bowlers are there in the team
So the number of ways = $^9C_5 \times {}^2C_1 \times {}^6C_5 = 1512$
Case II: 6 batsmen, 1 wicket keeper and 4 bowlers are there in the team

So the number of ways = ${}^9C_6 \times {}^2C_1 \times {}^6C_4 = 2520$
So the total number of ways = 1512 + 2520 = 4032
So, the desired difference = 8778 – 4032 = 4746 ways
Hence, option c.

4. (d)
Total quantity of mixture = 120/0.75 = 160 litre s
Quantity of water in the mixture = 160 – 120 = 40 litres
Let 'x' litres of water is added to the mixture
According to the question,
120/(40 + x) = 4/3
Or, x = 90 – 40 = 50 litres.

5. (d)



Let radius of the circle be 'r' units
According to the question, AB = a units
And, CD = b units
Therefore,
In triangle OCD, angle COD = 90^o
Therefore, $CD^2 = OC^2 + OD^2$
Or, $b^2 = r^2 + r^2$
Or, $b^2 = 2r^2$…….. (1)
In triangle OAB,
OE is perpendicular to AB
Angle OAB = 60^o
Therefore, AE = a/2
Or, $\cos 60^o$ = AE/OA
Or, 1/2 = {(a/2)/r}
Or, a = r…… (2)
From equation (1) and (2), we get
$b = \sqrt{2}a$

6. (b)
According to the question,
$(x + 1/x) = \sqrt{3}$
On cubing both sides
$\{x^3 + 1/x^3 + 3(x + 1/x)\} = 3\sqrt{3}$
Or, $x^3 + 1/x^3 = 0$
Or, $(x^6 + 1) = 0$….. (1)
Also, $x^{206} + x^{200} + x^{90} + x^{84} + x^{18} + x^{12} + x^6 + 1$
$= x^{200}(x^6 + 1) + x^{84}(x^6 + 1) + x^{12}(x^6 + 1) + (x^6 + 1)$
From equation (1)
$x^{200}(x^6 + 1) + x^{84}(x^6 + 1) + x^{12}(x^6 + 1) + (x^6 + 1) = 0$

7. 270.
Let the distance between point 'A' and point 'B' be 'x' km.

Total time taken by the man while going from point 'A' to point 'B' = (x/60) hours
And, time taken by the man while returning from 'B' to 'A' = {(0.5x/37.5) + (0.5x + 15)/60} hours
Then according to question,
{(0.5x/37.5) + (0.5x + 15)/60} – (x/60) = 96/60
Or, x/75 – x/120 + 1/4 – x/60 = 1.6
Or, x/200 = 27/20
Or, x = 270 km
So, the distance between point 'A' and point 'B' is 270 km.

8. (c)
20 men = 25 women
4 men = 5 women
8 men = 10 women
20 men = 36 boys
5 men = 9 boys
10 men = 18 boys
Let x men must be associated.
20 × 15 × 9 = (x + 8 + 10) × 10 × 10
27 = x + 18
x = 9 men

9. 21740
Amount earned by the person in 2 years = 28750 × $(1.12)^2$ = Rs.36064
Compound interest earned by the man = 36064 – 28750 = Rs.7314
Simple interest earned by the man = (36064 × 20 × 2)/100 = Rs.14425.60
Total interest earned = 7314 + 14425.6 = Rs.21739.60= Rs. 21740

10. (d)
Required probability = $({}^3C_2 \times {}^9C_1 + {}^3C_3)/{}^{12}C_3$ = (3 × 9 + 1)/220 = 7/55

11. 84.
Amount of water transferred in container C from container A = (9/20) × 120 = 54 litres
Amount of milk transferred in container C from container A = (11/20) × 120 = 66 litres
Amount of water transferred in container C from container B = (7/20) × 120 = 42 litres
Amount of milk transferred in container C from container B = (13/20) × 120 = 78 litres
Let, amount of water and milk present in container C initially be 5x litres and 9x litres respectively
So, (5x + 54 + 42)/(9x + 66 + 78) = 7/11
(5x + 96)/(9x + 144) = 7/11
55x + 1056 = 63x + 1008
8x = 48
x = 6
Amount of mixture present in the container C initially = 5x + 9x = 14x = 84 litres

12. (c)
Since, we're dividing the hemisphere in four similar pieces. So, we will basically get 4 sectors.
So, flat surface area of each piece = 3 × area of sector.
Area of sector = (θ/360) × π × r^2 [where θ is angle of each sector and 'r' is the radius]
ATQ;
θ = 90^o and 'r' = 7
So, required area = 3 × {(90/360) × (22/7) × 7 × 7 = 115.5 cm^2

13. 25.

According to the question,
Before restructuring:
Number of cows in each row = 15
Total number of cows in 24 rows = 24 ×15 = 360
Total cows in 40 sheds = 40 × 360 = 14400
Now, after restructuring:
Number of cows in each shed = 24 × 20 = 480
Therefore, number of sheds required = Total number of cows/number of cows in each shed
Or, number of sheds required = 14400/480 = 30
Therefore, required percentage decrease = {(40 – 30)/40} × 100 = 25%

14. (d)
Let the cost price of the article for ‘A’ be Rs.‘y’
Price at which ‘B’ bought the article = y × 1.3 = Rs.‘1.3y’
Price at which ‘C’ bought the article = 1.3y × 0.9 = Rs.‘1.17y’
Price at which ‘D’ bought the article = 1.17y × 1.2 = Rs.‘1.404y’
ATQ;
1.404y – y = 202
Or, 0.404y = 202
Or, y = 500
Therefore, price at which ‘B’ bought the article = 500 × 1.3 = Rs.650

15. 720.
Suresh alone can do the work in 16/0.4 = 40 days
Let, total work be LCM of 36 and 40 = 360 units
Units of work done by Ramesh in a day = 360/36 = 10
Units of work done by Suresh in a day = 360/40 = 9
Units of work done by Suresh on 10 days = 9 × 10 = 90
Remaining work = 360 – 90 = 270 units
Let, Mahesh can do ‘x’ units work per day
So, 270/(10 + x) = 12
270 = 120 + 12x
12x = 150
x = 12.5
Required time taken = 360/(9 + 12.5) = 720/43 days
Required answer= 720

16. (a)
Let the speed of boat in still water and speed of stream is ‘x’ km/h and ‘y’ km/h respectively.
According to question;
9/(x + y) = 7/(x – y)
9x – 9y = 7x + 7y
2x = 16y
Or, x = 8y
And, 126/(x + y) + 126/(x – y) = 8
126/(8y + y) + 126/(8y – y) = 8
14/y + 18/y = 8
32 = 8y
y = 4
So, x = 8 × 4 = 32
Desired distance = 32 × 7.5 = 240 km

17. (b)
Since, O is the in-centre, ∠QOR = 90^{o} + {(1/2) × ∠QPR}

ATQ;
$125^{\circ} = 90^{\circ} + (1/2) \times \angle QPR$
Or, $\angle QPR = 70^{\circ}$
$\angle QSR = 90^{\circ} - \{(1/2) \times \angle QPR\}$
$\angle QSR = 90^{\circ} - (70/2)$
$\angle QSR = 55^{\circ}$

18. (d)
Let the number of boys and girls in the group be 5y and 3y, respectively.
Number of (boys + girls) = 5y + 3y = 8y
Let the average age of boys be 'b' years
According to the question,
$\{5y \times b + 3y \times (x + 4)\}/8y = x$
Or, $5yb + 3yx + 12y = 8xy$
Or, $5b = 5x - 12$
Or, $b = (x - 2.4)$ years

19. (d)
Area of shaded region = area of minor sector AOB – Area of triangle AOB.
Area of sector = $(\theta/360) \times \pi r^2$ (Where 'r' is the radius of the circle and θ = angle made by the sector)
Circumference of circle = $2\pi r$
ATQ;
$39.6 = 2 \times (22/7) \times r$
Or, r = 6.3 cm
So, area of sector ABO = $(60/360) \times (22/7) \times 6.3 \times 6.3 = 20.79$ cm^2
Area of triangle AOB = $(1/2) \times \sin 60^{\circ} \times 6.3 \times 6.3 = 17.18$ cm^2
Required area = $20.79 - 17.18 = 3.61$ cm^2

20. (b)
Given, $16(\sin^2 x - \cos^2 x) = 8$
Or, $\sin^2 x - \cos^2 x = (8/16)$
Or, $1 - \cos^2 x - \cos^2 x = (1/2)$
Or, $2\cos^2 x = (1/2)$
Or, $\cos^2 x = (1/4)$
Or, $\cos x = (1/2)$
Or, $\cos x = \cos 60^{\circ}$
Or, $x = 60^{\circ}$
Therefore, $\tan x + \operatorname{cosec} x = \tan 60^{\circ} + \operatorname{cosec} 60^{\circ} = \sqrt{3} + (2/\sqrt{3}) = (5/\sqrt{3}) = (5\sqrt{3}/3)$

21. 800.
Let the total work be 'w' units and efficiency of each worker be 1 units/day.
$\{(1 \times 16 \times x) \div w\} = \{(1 \times 10 \times (x + 30) \div w\}$
Or, $8x = 5x + 150$
Or, $x = 50$
So, total time taken by one worker to finish the entire work alone = $(50 \times 16)/1 = 800$ days

22. (b)
Since ABC is a right-angled triangle,
So, $AB^2 = AC^2 - BC^2$
So, $AB^2 = 45^2 - 27^2$
Or, $AB^2 = 2025 - 729 = 1296$
Or, AB = 36 cm
ED = BF = $(1/3) \times 27 = 9$ cm

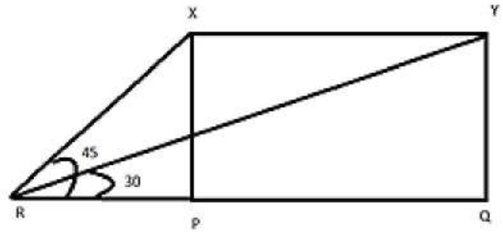
Area of triangle DFC = (1/2) × DF × FC
FC = BC – BF = 27 – 9 = 18 cm
In ΔABC and DFC:
∠ABC = ∠DFC (Since BEDF is a rectangle)
∠ACB is common angle
Therefore, ΔABC ~ ΔDFC
So, (DF/AB) = (FC/BC)
So, (DF/FC) = (AB/BC)
Or, (DF/18) = (36/27)
So, DF = 24 cm
Required area = (1/2) × 24 × 18 = 216 cm^2

Mock 20

1. (C)
m-5+x+m = 15
x= 20-2m
Let total work = 300 units
Anil can do 10 units in one day.
Aman can do 12 units in one day.
Anuj can do 15 units in one day.
Anil, Aman and Anuj will do 37(m-5) units of work in (m-5)days.
Aman and Anuj will do 27(20-2m) units of work in (20-2m)days.
Anuj will do 15(m) units of work in (m)days.
37(m-5) +27(20-2m) + 15(m) = 300
37m – 185 + 540 – 54m + 15m = 300
2m =55
m = 27.5 days

2. (a)
5sinx - 7cosx ≥ -p.
Let sin A = $5/\sqrt{74}$
hence, cos A = $7/\sqrt{74}$
The equation becomes
- $\sqrt{74}$ (cosAcosx – sinAsinx) ≥ -p
i.e., cos (A + x) ≤ $p/\sqrt{74}$
As, -1 ≤ cos(angle) ≤ 1
So, the maximum value of p would be at
$\frac{p}{\sqrt{74}} = 1 \Rightarrow p = \sqrt{74}.$

3. (c)
Let the airplane be at the point X which is exactly 20 kms above the point P on the ground and then later after 5 seconds let it be at point Y which is exactly 20 kms above the point Q on the ground i.e. X P =YQ = 20 kms. The diagram can be shown as below –



Now, X will be at an angle of 45° and Y will be at an angle of 30°. Let the speed of the airplane be 'a' m/s.
Now,
Since, angle XRP = 45°, therefore, XP = RP = 20 kms = 20000 m
Now, distance moved by airplane in 5 seconds will be 5a meters i.e., XY = PQ = 5a
Then, in triangle YRQ, angle YRQ = 30° and angle YQR= 90°
tan 30° = YQ/RQ

$$i.e. \frac{1}{\sqrt{3}} = \frac{20000}{20000+5a}$$

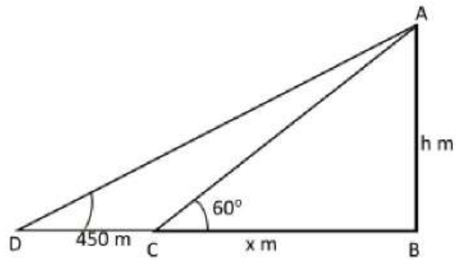
$$20000 + 5a = 20000\sqrt{3}$$

$$5a = 20000(\sqrt{3}-1)$$

$$i.e. a = 4000(\sqrt{3}-1)$$

i.e., speed of airplane is $4000(\sqrt{3} - 1)$

4. (c)



In triangle ΔABC,

$$\tan 60^\circ = \frac{AB}{BC}$$

$$\sqrt{3} = \frac{h}{x} \Rightarrow x = \frac{h}{\sqrt{3}} \ldots\ldots (I)$$

Now, In triangle ΔABD

$$\tan 45^\circ = \frac{AB}{BD}$$

$$1 = \frac{h}{(x+450)}$$

$$h = x + 450 \ldots\ldots (II)$$

From equation I,

$$h = \frac{h}{\sqrt{3}} + 450$$

$$h - \frac{h}{\sqrt{3}} = 450$$

$$\frac{h(\sqrt{3}-1)}{\sqrt{3}} = 450$$

$$h = \frac{450\sqrt{3}}{\sqrt{3}-1} = \frac{450\sqrt{3}(\sqrt{3}+1)}{(\sqrt{3}-1)(\sqrt{3}+1)}$$

$$= \frac{450(3+\sqrt{3})}{3-1} = 225(3+\sqrt{3})m$$

5. 462.

Since the above figure consists of 3 semicircles with radii 14 cm, 7cm, and 7 cm respectively. So, the area of the whole figure is

$=\frac{1}{2}\pi\times(14)^2+\frac{1}{2}\times\pi\times\left(\frac{14}{2}\right)^2+\frac{1}{2}\times\pi\times\left(\frac{14}{2}\right)^2$

$=\frac{1}{2}\pi\left[14^2+49+49\right]$

$=\frac{1}{2}\times\frac{22}{7}\times[196+98]$

$=\frac{1}{2}\times\frac{22}{7}\times 294$

$=462\,\text{cm}^2$

6. (b)

Volume of 10 cm cube = 10^3 = 1000 cm^3

Weight of 1 cm^3 = 60/1000 =0.06 kg

Volume of 180 kg cube $=\frac{180\times1}{0.06}=3000$ cm^3

Side of 180 kg cube $=\sqrt[3]{3000}=10\sqrt[3]{3}$ cm

7. (a)

Using I alone, since the length of the longest diagonal of the cube is known, the length of the side of the cube can be calculated. Since we have to find the largest possible sphere, Side of cube = diameter of sphere. The surface area of the sphere can thus be calculated.

Similarly using II alone, the length of the side of we have to the cube can be calculated.

The surface area of the sphere can thus be calculated.

Using III alone, this information alone is insufficient to answer the question.

Hence, [1].

8. (c)

There will be 343 small cubes (side = 7)

There are $(n-2)^3$ small cubes which have no sides painted. Other cubes will have at least one side painted.

Here, n = 7

i.e., $(n-2)^3 = 125$

∴ Number of required cubes = 343 – 125 = 218

9. (b)

The volume of cube = The volume of the rectangular container with a length of 9 cm, breadth of 16 cm, and height of the water level rise = x cm (say)

So, $12^3 = 9 \times 16 \times x$

⇒ 1728 = 144 × x

⇒ x = 1728/144 = 12 cm

∴ The rise of water level is 12 cm.

10. 36.

n one day, Aisha can make = 48/36 = 4/3 parts

In one day, Disha can make = 48/72 = 2/3 parts

Number of parts done in six days = (4/3 + 2/3) × 6 = 12 parts

Remaining parts = 48 – 12 = 36

When Aisha returns, only 12 parts are left to be made.

Therefore, Disha alone did 36 – 12 = 24 parts.

Let 'x 'be the number of the days taken by Disha to make 24 parts

2/3 × x = 24
⇨ x = 36 days

11. 55.
Let us assume that the capacity of the tank is 120 unit.
P can fill at 120 unit/20min = 6 unit/min
Q can fill at a rate of 120 unit/30 min = 4 unit/min
R can fill at a rate of 120 unit/60 min = 2 unit/min
Total amount of water filled in first minute is (6 + 4 + 2) unit = 12 unit.
A can empty at 120 unit/30 min = 4 unit/min
B can empty at 120 unit/40 min = 3 unit/min
C can empty at 120 unit/120 min = 1 unit/min rate
Total water emptied in a minute is (4 + 3 + 1) unit = 8 unit.
Hence, total volume filled in 2 minutes = (12 unit – 8 unit) = 4 unit.
Total time needed to fill 108 unit is = (108*2/4) = 54 minute.
In the 55th minute the volume filled will be 108 unit + 12 unit = 120 unit.
Thus, in 55 minute the tank will be filled.

12. (d)
Let the escalator speed = e steps/s.
Let Sohan's speed = 3x steps/s. Let Mohan's speed = 2x steps/s.
So Mohan's speed in the up-up escalator is 2x + e and Sohan's speed in down-up escalator is 3x - e.
Time taken by Mohan in up-up escalator = 8 seconds. Time taken by Sohan in down-up escalator
= 12 seconds.
Since ratio of time taken by Mohan to go in up-up escalator and Sohan to go in down-up escalator
= 2:3
Ratio of speed of Mohan and Sohan in their respective ways = 3:2 [reciprocal of the time taken].
Therefore, ratio of speed = ratio of distance

$$\frac{2x+e}{3x-e}=\frac{3}{2}$$

$$\Rightarrow 4x+2e=9x-3e$$

$$\Rightarrow 5e=5x$$

$$\Rightarrow e=x$$

Mohan's speed in up-up escalator = 3x. Sohan's speed in down-up escalator = 2x
Effective speed of Sohan in up-up escalator = 3x + x = 4x
Ratio of speed of Sohan in down-up escalator: Ratio of speed of Sohan in up-up escalator
2x:4x = 1:2
Ratio of time taken by Sohan in down-up escalator: Ratio of time taken by Sohan in up-up escalator = 2:1
As we know that Sohan takes 12 seconds to go down-up escalator,

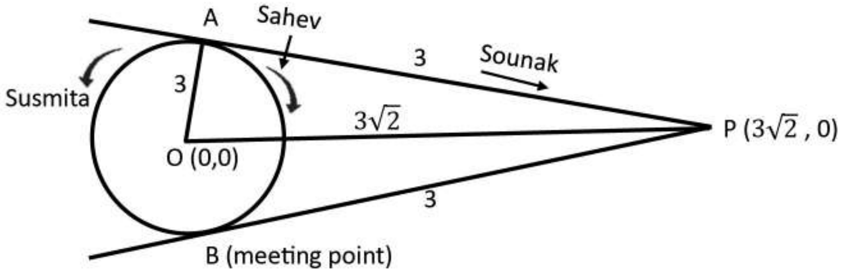
$$\frac{T_1}{T_2}=\frac{12}{x}$$

We know that the ratio of the time taken is 2:1 for the same, so

$$\frac{T_1}{T_2}=\frac{2}{1}$$

Hence, x = 6
Thus, Sohan will take 6 seconds to go in the up- Escalator.

13. (c)



Distance travelled by Sahev, s = r θ = π × r/2
= 3 π/2 units
Distance travelled by Susmita = 6π - 3π/2
= 9π/2 units
Distance travelled by Sounak = 3+3 = 6 units
Since all of them reach to B at the same time, so the ratio of speeds of Sounak, Sahev and Susmita is
= 6: 3 π/2: 9π/2
= 4: π: 3 π
Option (C) is correct.

14. 500.
Let us assume that the variable cost per chocolate is $x/pc
When Sunita produced 1000 chocolates, her profit is 50% while selling at $6/pc. This means her cost price is $6/1.5 = $4/pc. Out of which $x is variable cost and fixed cost is ($4-$x)/pc
When Sunita produced 2000 chocolates, her profit is 100% while selling at $6/pc. This means her cost price is $6/2 = $3/pc. Out of which $x is variable cost and fixed cost is ($3-$x)/pc
Total fixed cost is the same for all the days.
Hence,
(4-x)*1000 = (3-x)*2000
=> 4-x = 6-2x
=> x = 2
So, the variable cost per pc is $2
Then the total fixed cost is $(3-2)*2000 = $2000
So,
When Sunita sells chocolate at no profit no loss, then her total cost of production = selling price = $6. Out of which $2/pc is variable cost and ($6-$2) = $4/pc is fixed cost per chocolate.
Total fixed cost is $2000. Hence the number of chocolates produced by Sunita in the no profit no loss state is ($2000/$4) = 500
Hence, option C is correct.

15. 20000
Total CRIB for the organization at the main branch (in thousands)
= (32 – x)(3x + 24) = 3(32 – x)(x + 8)
= $3(256 + 24x - x^2) = 3[400 - 144 + 24x - x^2] = 3[400 - (x-12)^2]$
Maximum possible total CRIB will occur when x = 12.
Average CRIB per employee = (32 – 12) thousand = Rs. 20,000

16. (b)
Total cost price = 50 X 100 = 5000. Out of 50 books, n books are sold at price 100 + 2n and the remaining '50 - n' books are sold at price '200 - 2n'.
Therefore, the total selling price= $n(100 + 2n) + (50 - n)(200 - 2n) = 4n^2 - 200n + 10000$
Therefore, profit = $4n^2 - 200n + 10000 - 5000 = 4n^2 - 200n + 5000 = 4(n^2 - 50n + 1250)$
Now, $n^2 - 50n + 1250 = (n - 25)^2 + 625$. Therefore, the minimum profit is obtained when n = 25 and that is equal to Rs. 625 x 4 = Rs. 2500.

The value of $(n - 25)^2$ is maximum when n = 0 or n = 50. Therefore, the maximum value of profit = 4 x $(25^2 + 625)$ = Rs. 5000
Hence, [B] is correct.

17. (a)
Let x, y and z in Rs. be respective shares of Asmita, Sushmita and Gourav (as per the agreement)
x=2/3 of y
=> x : y = 2: 3
Further,
z = (1 + 1/3)y
=> y = ¾ z
=> y : z = 3 : 4
Thus x : y : z = 2 : 3 : 4
Now total bill they pay = 3310 + 5220 + 6230 = 14760
As per the agreement,
Asmita's share = 2/9 × (14760) = Rs. 3280
Sushmita's share = 3/9 × (14760) = Rs. 4920
Gourav's share = 4/9 × (14760) = Rs. 6560
Now,

	Asmita	Sushmita	Gourav
Share of each as per agreement	3280	4920	6560
Bill amount paid	3310	5220	6230
Amount paid more	30	300	---
Amount paid less	--	--	330

Hence, Gourav pays Rs. 30 to Asmita and Rs. 300 to Sushmita for the final settlement of their accounts.

18. (c)
Let the number of erasers, sharpeners and compass be x, y and z.
Then x > y > z and x ≥ 8, y ≥ 8, z ≥ 8
But y < 12, therefore, y = 8 or 9 or 10 or 11
Possible values of (x, y, z) = (14, 9, 8) ; (13, 10, 8); (12, 10, 9); (12, 11, 8).
i.e., the number of compasses purchased is either 8 or 9.

19. 26.
Let the 8 numbers in the arithmetic progression is a_1, a_2, a_3, ..., a_7 and a_8 respectively.
average of 8 numbers =
$\frac{1}{8}(a_1 + a_2 + a_3 + a_4 + a_5 + a_6 + a_7 + a_8) = 16$
so, sum of these numbers= 16 x 8= 128
from the question,
$a_1 + a_2 + a_3 = 18$ ......(1)
$\frac{a_4+a_5+a_6}{3} = 18$
or, $a_4 + a_5 + a_6 = 3 \times 18 = 54$ ..... (2)
Adding equation (1) and equation (2), we get
$a_1 + a_2 + a_3 + a_4 + a_5 + a_6 = 18 + 54 = 72$
The sum of the last two numbers = $a_7 + a_8 = 128 - 72 = 56$ .... (3)

Average of the last two numbers = 56/2 = 28
so, the last number, a_8 = 28 +2 = 30
put this value of a_8 in equation (3) we get
$a_7 = 56 - a_8$
⇨ $a_7 = 56 - 30 = 26$
Thus, the seventh number of the arithmetic progression is 26.

20. 19531.
We have,
Amount spent on sending one letter = ₹ 1/5
Amount spent when first set of 5 letter is sent = ₹1
Amount spent when second set of 5 × 5 = 25 letter is sent = ₹5
Amount spent when third set of 5 × 5 × 5 letter is sent = ₹25
Clearly 1, 5, 25, ………….. is a G.P with first term 1 and common ratio 5.
Sum of 7 terms = $1[\frac{5^7-1}{5-1}] = \frac{1}{4}(5^7-1) = 19531$
Hence the amount spend is ₹19531.

21. 58.
Using the formula for sum of an arithmetic progression in elevator A,
600 = 10/2 × (2a + 9d)
where a is the weight of the lightest person and d is the common difference of the AP.
We know that a is an integer. Therefore, d has to be even.
∴ d = 2
∴ a = 51
Similarly,
Using the formula for sum of an arithmetic progression in elevator B,
800 = 16/2 × (2b + 15e)
where b is the weight of the lightest person and e is the common difference of the AP.
As b is an integer, e has to be even.
∴ e = 2 and b = 35
∴ The weight of the heaviest person in elevator B = 35 + 15(2) = 65
∴ Required average = (51 + 65)/2 = 58

22. 4.
$(\log_{10} y)^2 + 1 = (\log_{10} 2)^2 - \log_{10} y^2$
⇨ $(\log_{10} y)^2 + \log_{10} y^2 = (\log_{10} 2)^2 - 1$
⇨ $(\log_{10} y)^2 + \log_{10} y^2 + 1 = (\log_{10} 2)^2$
⇨ $(\log_{10} y + 1)^2 = (\log_{10} 2)^2$
So, $\log_{10} y + 1 = \log_{10} 2$ or, $\log_{10} y + 1 = -\log_{10} 2$
$\log_{10} y - \log_{10} 2 = -1$ or, $\log_{10} y + \log_{10} 2 = -1$
$\log_{10} 92/y) = 1$ or, $\log_{10}(1/2y) = 1$
2/y = 1 or, 1/2y = 10
y = 2/10 or, 1/20
i.e., y = 1/5 or, 1/20
So, the sum of the possible values of y = 1/5 + 1/20 = ¼ = K (Given)
So, 16K = 16 × ¼ = 4

OUR IIM CONVERTS

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IIM AHMEDABAD

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JATIN SAXENA
IIM CALCUTTA,
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IIM BODHGAYA

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UTKARSH SINHA
IIM–SIRMAUR
IIM SAMBALPUR

94.01%ile
PRIYANK PUJARA
IMT GHAZIABAD,
IIM BODHGAYA

93.18%ile
AKSHAR THAKKAR
IIM SIRMAUR

92.68%ile
PADMANABH CHAVDA
GREAT LAKES

91.75%ile
MIJAIN PARMAR
IIM AMRITSAR

91.62%ile
SHIVAM KARIA
IIM AMRITSAR

91.42%ile
MAHIN MARU
IIM AMRITSAR

94.49%ile
PURVI PATEL
IIM AMRITSAR

93.31%ile
JENIL TRIVEDI
IIM MUMBAI