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Prime CAT 11 2022 QA

Scorecard (procreview.jsp?sid=aaaN5tjtX0b7WgArBjowySun Jan 08 23:50:58 IST 2023&qsetId=2oEWPJEPZ30=&qsetName=Prime CAT 11 2022 QA)

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Qs Analysis (QsAnalysis.jsp?sid=aaaN5tjtX0b7WgArBjowySun Jan 08 23:50:58 IST 2023&qsetId=2oEWPJEPZ30=&qsetName=Prime CAT 11 2022 QA)

Video Attempt / Solution (VideoAnalysis.jsp?sid=aaaN5tjtX0b7WgArBjowySun Jan 08 23:50:58 IST 2023&qsetId=2oEWPJEPZ30=&qsetName=Prime CAT 11 2022 QA)

Solutions (Solution.jsp?sid=aaaN5tjtX0b7WgArBjowySun Jan 08 23:50:58 IST 2023&qsetId=2oEWPJEPZ30=&qsetName=Prime CAT 11 2022 QA)

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Section-1

Sec 1

Q.1 [11831809]

Joshna and Neeraj run around a quadrant shaped track of radius 56 m in the same direction. The speeds of Joshna and Neeraj are 5 m/s and 1 m/s respectively. If they start from the same point and at the same time, then find the shortest distance (in meters) on the track from the starting point when they meet for the 5th time. (Given π = 22/7)

1 ◯ 88

2 ◯ 100

3 ◯ 40

4 ◯ 50

Solution:
Correct Answer : 4

Answer key/Solution

As the ratio of the speeds of Joshna and Neeraj is 5 : 1 respectively, they will meet at 4 different points on the track which will be equidistant from each other.
So when they will meet for the fifth time that will be first point.
They will be equidistant of each other so the shortest distance from starting point will be 1/4th of the track.
Length of circular portion of track = 1/4 of circumference = 1/4 × 2π × 56 = 352/4 = 88 m.
Total length of track = 88 + 2 × 56 = 200 m
Hence, they will meet at a distance of 200/4 = 50 m from the starting point.

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Q.2 [11831809]

If $|x + 17| + |x - 18| - |x + 19| \leq 100$, how many integer values can 'x' take?

1 ◯ 120

2 ◯ 201

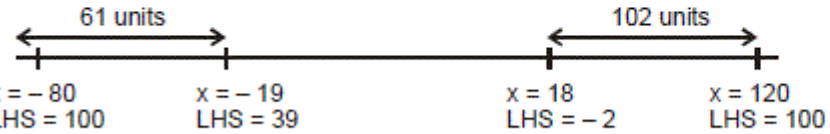
3 ◯ 121

4 ◯ 200

Solution:
Correct Answer : 2

Answer key/Solution

Using the concept of distance, it can be seen that at x = – 19 the value of LHS = 39 and if we move 1 unit to the left from x = – 19
On the number line, the LHS also increases by 1. Therefore, from 39 to 100 that means an increase of 61 hence 61 units to the left of (–19) are all possible values of x.
Similarly, at x = 18 the value of LHS = (–2) and on moving 1 unit to the right of 18 on number line the value of LHS also increases by 1. Therefore, from (–2) to 100 that means an increase of 102 hence 102 units to the right of 18 are all acceptable values of x.



All values of x from (–80) to (120) are acceptable values.
Hence, a total of 201 values i.e., 80 negative values, 120 positive values and a zero.

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Q.3 [11831809]

Renu had a bag with balls in three colours – Yellow, White and Black, in the ratio 5 : 4 : 6 respectively. Renu lost 'x' Yellow balls and because of this the percentage of Yellow balls in the bag reduced to 20% and the percentage of White balls increased by 't' percentage points. After a while, Renu lost '2x' Black balls and because of this the percentage of White balls in the bag increased by 'p' percentage points over its percentage after the first time Renu lost the balls. Find the value of (p – t).

Solution:

Correct Answer : 16

Answer key/Solution

Let the number of Yellow, White and Black balls with Renu be 5a, 4a and 6a respectively. Then,

$$\frac{5a-x}{15a-x}\times 100 = 20$$

$$\Rightarrow x = 2.5a$$

$$t = \frac{4a}{15a-x}\times 100 - \frac{4a}{15a}\times 100 = 32 - 26.67 = 5.33$$

$$p = \frac{4a}{12.5a-2x}\times 100 - \frac{4a}{12.5a}\times 100 = 53.33 - 32 = 21.33$$

Hence, (p – t) = 21.33 – 5.33 = 16.

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Q.4 [11831809]

Two vessels I and II contain mixture of Soda, Mango juice and Honey in the ratio of 13 : 12 : 9 and 7 : 4 : 3 respectively. If mixtures from both vessels are mixed respectively in the ratio of 17 : 14 into another vessel III, then the total quantity of mango juice in vessel III will be 30 litres. Find the difference between the quantity (in litres) of Soda and Honey in vessel III.

Solution:

Correct Answer : 18

Answer key/Solution

Let 17x and 14x be the quantities of mixtures from vessels I and II respectively.

Then, $17x\times\frac{12}{34} + 14x\times\frac{4}{14} = 30$

$\Rightarrow 6x + 4x = 30$

$\Rightarrow x = 3$

Now, required difference of Soda and Honey in vessel III

$$= \frac{17\times 3\times 13}{34} + 14\times 3\times\frac{7}{14} - 17\times 3\times\frac{9}{34} - 14\times 3\times\frac{3}{14}$$

$$= \frac{39}{2} + 21 - \frac{27}{2} - 9 = 18 \text{ liters.}$$

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Q.5 [11831809]

If a shopkeeper had bought an item at 20% less than usual cost price and sold it at 20% more than usual selling price, his profit percentage would have been three times the usual profit percentage. What is his usual profit percentage?

1 ◯ 25%

2 ◯ 40%

3 ◯ 33.33%

4 ◯ 20%

Solution:

Correct Answer : 3

Answer key/Solution

Let usual cost price and usual selling price be x and y respectively.
Let usual profit percentage be a%.

$\therefore \frac{y}{x} = 1 + \frac{a}{100}$ ...(i)

Then, new cost price = 0.8x, new selling price = 1.2y and new percentage profit = 3a%.

$\therefore \frac{1.2y}{0.8x} = 1 + \frac{3a}{100} \Rightarrow \frac{y}{x} = \frac{2}{3}\left(1 + \frac{3a}{100}\right)$ ...(ii)

Hence, from (i) and (ii), $1 + \frac{a}{100} = \frac{2}{3}\left(1 + \frac{3a}{100}\right) \Rightarrow a = 33.33\%$.

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Q.6 [11831809]

Let f(x) = (x – 2)(x – 1)(x + 3)(x + 5), then which of the following is true regarding the number of integral roots of f(x) > 0 and f(x) < 0 respectively?

1 ◯ Finitely many, Infinitely many

2 ◯ Infinitely many, Exactly 1

3 ◯ Infinitely many, Infinitely many

4 ◯ Finitely many, Exactly 1

Solution:
Correct Answer : 2

Answer key/Solution

$f(x) = (x - 2)(x - 1)(x + 3)(x + 5)$
Note: When $f(x) > 0 \Rightarrow (x - 2)(x - 1)(x + 3)(x + 5) > 0$, clearly for all values greater than 5, $f(x) > 0$, so without going into any further calculations, we can conclude that $f(x) > 0$ have infinitely many integral roots.
Now, when $f(x) < 0$, odd number of terms $(x - 2)$, $(x - 1)$, $(x + 3)$, and $(x + 5)$ must be negative, which is clearly not possible for $x < -5$ and $x > 2$, so whatever possible integral values exist, they exist between $-5 < x < -3$, which will give only one value that is -4.
Hence, the option (2) is correct.

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Q.7 [11831809]
In a parallelogram ABCD, points F and E are on AD and DC respectively. Point F divides AD in the ratio 2 : 1 and point E divides CD in the ratio 1 : 3. If area of triangle DFE is 120 sq. units, then find the area (in sq. units) of triangle BFE.

1 ◯ 480

2 ◯ 400

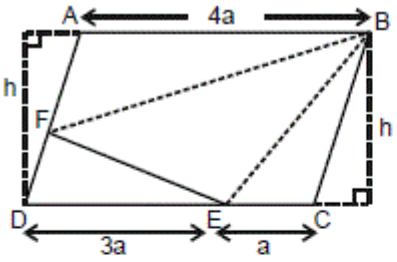
3 ◯ 450

4 ◯ 500

Solution:

Correct Answer : 2

Answer key/Solution



For ΔDFE, height on base DE = $\frac{h}{3}$ [By basic proportionality theorem]

So area of $\Delta DFE = \frac{1}{2} \times 3a \times \frac{h}{3} = 120$ sq. units

$\Rightarrow ah = 240$

Area of $\Delta BEC = \frac{1}{2} \times a \times h = 120$ sq. units

Area of $\Delta AFB = \frac{1}{2} \times 4a \times \frac{2}{3}h = \frac{4}{3} \times 240 = 320$ sq. units

Area of parallelogram ABCD = 4a × h = 960 sq. units

Hence, area of triangle BFE = 960 – (320 + 120 + 120) = 400 sq. units.

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Q.8 [11831809]

A work was started by one of the workers of a group that consists of 12 equally efficient workers. The pth worker (where $2 \le p \le 12$) joined the work (p – 1)x days after the (p – 1)th worker joined. The work was completed in 12x days after the 12th worker joined. The 1st worker received Rs. 28,500 out of the total wages paid to the group for completing the work. Find the total wages (in Rs.) for completing the work.

Solution:

Correct Answer : 237500

Answer key/Solution

Total time taken to complete the work = x + 2x + 3x + 4x + ... + 12x = (12x)(12 + 1)/2 = 78x

Let the work done by each worker per day be 'n' units.

Total work = Work done by the 1st worker + work done by the 2nd worker + work done by the 3rd worker + ... + work done by the 12th worker

= n(x + 2x + 3x + 4x + ... + 12x) + n(2x + 3x + 4x + ... + 12x) + n(3x + 4x + ... + 12x) + ... + n(12x)

= n(x) + n(2)(2x) + n(3)(3x) + ... + n(12)(12x)

= nx ($1^2 + 2^2$ + ... + 12^2) = [nx(12)(12 + 1)(24 + 1)]/6 = 650nx

Let the total wages be Rs.T.

Part of the total wages obtained by the 1st worker = (78nx)/(650nx) = 3/25

$\Rightarrow$ 3/25 = 28500/T $\Rightarrow$ T = Rs.2,37,500.

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Q.9 [11831809]

If $\log_a 36 = 1.44$, and $\log_2 a = 3.2$, then find the value of $\log_2 32a + \log_a 144$.

1 ◯ 9.64

2 ◯ 10.265

3 ◯ 10.015

4 ◯ 9.9525

Solution:

Correct Answer : 2

Answer key/Solution

$\log_2 32a + \log_a 144 = \log_2 32 + \log_2 a + \log_a (36 \times 4)$
$= 5 + 3.2 + 1.44 + 2 \log_a 2$
$= 9.64 + 2/3.2 = 9.64 + 0.625 = 10.265.$

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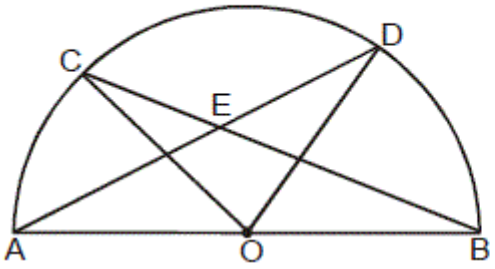
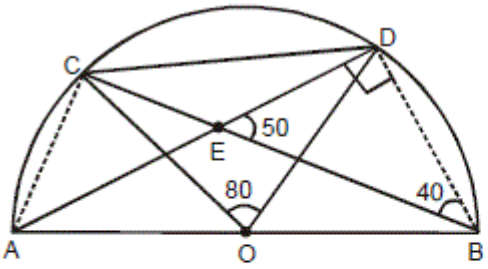
Q.10 [11831809]

In the diagram given below, AB is a diameter of the circle of center O. If ∠COD is 80°, then the value of ∠CED (in degrees) is



Solution:
Correct Answer : 130

Answer key/Solution



As AB is diameter, $\angle ADB = 90°$
And angle made by chord CD at circumference will be half of what it make at centre.

So $\angle CBD = \frac{1}{2}\angle COD$

$\Rightarrow \angle CBD = 40°$

Hence, $\angle DEB = 50°$ and $\angle CED = 180° - 150° = 130°$.

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Q.11 [11831809]

At 6:00 PM, Abhishek begins writing down natural numbers, starting from 1, in a row from left to right, on a board whereas Ruchika starts to erase these digits at 6:15 PM. Abhishek writes at the rate of 40 digits per minute and Ruchika erases at the rate of 60 digits per minute. What will be the last digit that is written down by Abhishek and erased by Ruchika simultaneously?

Solution:
Correct Answer : 6

Answer key/Solution

In 15 minutes, Abhishek would have written 600 digits.
We know that every minutes, Ruchika cleans 20 digits more than what Abhishek writes.

So Ruchika will clear the 600 digits on the board after = $\frac{600}{20}$ = 30 minutes

So Abhishek would have written digits for 15 + 30 = 45 minutes
Number of digits written = 45 × 40 = 1800 digits.
Number of digits used for writing 1 digit numbers = 1 × 9 = 9 digits
Number of digits used for writing 2 digit numbers = 2 × 90 = 180 digits
Remaining number of digits = 1800 – 9 – 180 = 1611 digits, which are formed from 3 digit numbers.

3 digit numbers written = $\frac{1611}{3}$ = 537 numbers

The last number to be written by Abhishek, and cleaned by Ruchika will be the 537th 3 digit number.
Since 3 digit numbers start from 100, the 537th such number will be = 636
Hence, the last digit to be cleaned will be 6.

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Q.12 [11831809]

A train starts from a station A and travels to another station B. There is a tunnel PQ of fixed length between A and B. A tiger is at point M in the tunnel such that PM : MQ = 1 : 2. When the train starts from A, if the tiger starts running towards P, he will meet the train at P. But if he starts running towards Q, the train will meet the tiger at Q. The ratio of the speed of the train to the speed of the tiger is

1 ◯ 3 : 1

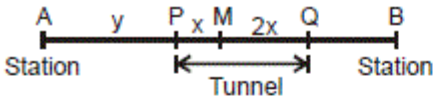
2 ◯ 2 : 1

3 ◯ 4 : 1

4 ◯ 5 : 2

Solution:
Correct Answer : 1

Answer key/Solution



Let the speeds of the train and the tiger be S1 and S2 respectively.
When the train travels from A to P and the tiger from M to P, time taken by both are equal and they meet at P.

$$\frac{y}{S1}=\frac{x}{S2}\Rightarrow\frac{S1}{S2}=\frac{y}{x} \quad \ldots (i)$$

When the train travels from A to Q and the tiger from M to Q, time taken by both are equal and they meet at Q.

$$\frac{y+3x}{S1}=\frac{2x}{S2}\Rightarrow\frac{S1}{S2}=\frac{y+3x}{2x} \quad \ldots (ii)$$

From (i) and (ii),

$$\frac{y}{x}=\frac{y+3x}{2x}$$

$\Rightarrow y = 3x$

Hence, S1 : S2 = 3x : x = 3 : 1.

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Q.13 [11831809]

A group has 268 persons out of which 148 can speak Hindi, 127 can speak English, and 136 can speak Bengali. Also, 64 persons can speak both Hindi and English, 29 can speak both Bengali and English, while 68 can speak both Hindi and Bengali. If every person can speak at least one language, then what is the number of persons who can speak only Hindi?

1 ◯ 23

2 ◯ 34

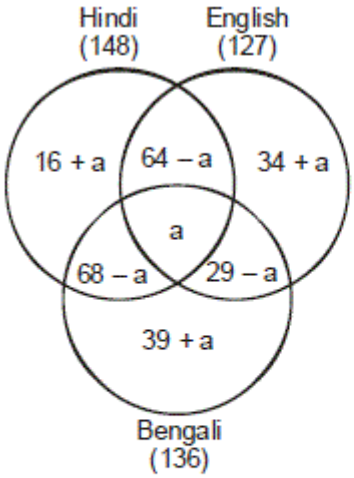
3 ◯ 29

4 ◯ 36

Solution:

Correct Answer : 2

Answer key/Solution



Total number of persons in the group = 268

$\Rightarrow 16 + a + 34 + a + 39 + a + 64 - a + 29 - a + 68 - a + a = 268$

$\Rightarrow 250 + a = 268$

$\Rightarrow a = 18$

Hence, the number of persons who can speak only Hindi = 16 + a = 16 + 18 = 34.

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Q.14 [11831809]

What is the sum of all possible values of x that satisfy the equation $x|x| - 10x - 24 = 0$?

Solution:

Correct Answer : 2

Answer key/Solution

If $x > 0$, $x^2 - 10x - 24 = (x - 12)(x + 2)$

$\Rightarrow x = 12$ (x can't be –2 since $x > 0$.)

If $x < 0$, $-x^2 - 10x - 24 = 0$

$\Rightarrow x^2 + 10x + 24 = (x + 6)(x + 4)$

$\Rightarrow x = -6$ or -4

Hence, the sum of the three possible values of $x = 12 - 6 - 4 = 2$.

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Q.15 [11831809]

PQRS is a square of area 24 sq. cm. T and V are the midpoints of PQ and RS, respectively. X and Y are points on the line joining T and V such that $\angle PXQ = \angle RYS = 120°$. Find the area (in sq. cm) of the hexagon PXQRYS.

1 ◯ $4(2\sqrt{3} - 1)$

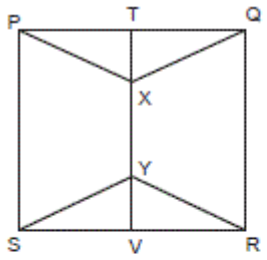
2 ◯ $2(6 - 2\sqrt{3})$

3 ◯ $12(2 + \sqrt{3})$

4 ◯ $4(6 - \sqrt{3})$

Solution:
Correct Answer : 4

Answer key/Solution



Triangles RVY and SVY have a common side VY.
$\angle YVS = \angle YVR = 90°$
Also, V is the midpoint of RS
$\therefore$ SV = VR
$\therefore$ By RHS property, the two triangles are congruent.
$\therefore \angle VYR = \angle RYS/2 = 120°/2 = 60°$
$\tan \angle VYR = \sqrt{3} = VR/YV$
$\Rightarrow YV = VR/\sqrt{3} = (SR/2)/\sqrt{3} = SR/(2\sqrt{3})$
$\therefore$ Area of $\Delta SYR = 1/2\ YV \times SR = SR^2/(4\sqrt{3})$
Similarly, the area of $\Delta PXQ = PQ^2/(4\sqrt{3}) = SR^2/(4\sqrt{3}) = 24/(4\sqrt{3}) = 2\sqrt{3}$ sq. cm.
$\therefore$ Sum of the areas of ΔSYR and $\Delta PXQ = 4\sqrt{3}$ sq. cm.
Hence, area of hexagon PXQRYS = Area of PQRS – (Sum of the areas of ΔSYR and ΔPXQ)
$= 24 - 4\sqrt{3} = 4(6 - \sqrt{3})$ sq. cm.

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Q.16 [11831809]
Let $a_{n+1} = 1 + a_n \times a_{n-1} \times \ldots \times a_1$, for all $n \geq 1$. If $a_5 = 43$, find the number of factors of a_6.

1 ◯ 2

2 ◯ 4

3 ◯ 8

4 ◯ 10

Solution:
Correct Answer : 2

Answer key/Solution

$a_5 = 1 + a_1 \times a_2 \times a_3 \times a_4$
$\Rightarrow 43 = 1 + a_1 \times a_2 \times a_3 \times a_4$
$\Rightarrow a_1 \times a_2 \times a_3 \times a_4 = 42$
Therefore, $a_5 = 1 + a_5 \times (a_1 \times a_2 \times a_3 \times a_4)$
$= 1 + 43 \times 42 = 1807 = 13 \times 139$
Factors of 1807 are 1, 13, 139, 1807.
Hence, number of factors = 4.

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Q.17 [11831809]

Three friends Paras, Rajat, and Sanjay can paint a wall individually in 180 minutes, 150 minutes and 60 minutes respectively. The three of them started painting the wall at 12 noon. At 12:20 PM Sanjay left and after another half an hour Rajat also left, leaving Paras alone to do the remaining work. At what time did Paras finish the job?

1 ◯ 1:05 PM

2 ◯ 1:08 PM

3 ◯ 12:55 PM

4 ◯ 1:00 PM

Solution:
Correct Answer : 4

Answer key/Solution

Sanjay alone could have painted it in 60 minutes.
He left after 20 minutes meaning he did 1/3rd of the total work.
Rajat alone could have painted it in 150 minutes, but he works for 50 minutes only.
This means that he also did 1/3rd of the total work.
Remaining 1/3rd of the work was left for Paras.
Paras can do the total job in 180 minutes or 1/3rd of the work in 60 minutes.
Paras has already been working for 50 minutes.
So he will need 10 more minutes to finish.
Hence, the work will be completed at 1:00 PM.

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Q.18 [11831809]

Kishan is a business man who goes on offshore visits. The number of offshore visits made by Kishan in 2014 was 5 and it kept increasing at a rate of 100% for next four years over the previous year due to a drastic increase in his business. What is the total number of offshore visits made by Kishan from 2014 to 2018?

1 ◯ 150

2 ◯ 160

3 ◯ 170

4 ◯ 155

Solution:
Correct Answer : 4

Answer key/Solution

Number of offshore visits made by Kishan in given year are in GP of which first term is 5 and common ratio is 2.

Hence, total number of offshore visits made by him during the given period = $\frac{5(2^5-1)}{2-1} = 155$.

Alternate solution:
As number of visits made in each year is a multiple of 5, so sum also should be multiple of 5, so sum will be a multiple of 5 and the number will be odd too. Since the first term is odd and other four are even. So, from the given options 155 is an odd multiple of 5.

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Q.19 [11831809]
If A = 5! + 10! + 15! +... + 50! and B = $2^2 \times 3^2 \times 5^2$, then find the remainder when A is divided by B.

Solution:
Correct Answer : 120

Answer key/Solution

Since $10! = 2^8 \times 3^4 \times 5^2 \times 7$
Therefore, all the terms of A, except the first term are divisible by B.
So to find the remainder when A is divided by B, just divide 5! by B.

$\therefore \frac{5!}{2^2 \times 3^2 \times 5^2} = \frac{120}{2^2 \times 3^2 \times 5^2}$

Hence, the required remainder is 120.

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Q.20 [11831809]
Mr. Gupta invested one half of his savings in an Insurance Policy that paid simple interest for 2 years and received Rs.18,000 as interest. He invested the remaining in a Mutual fund that paid compound interest, calculated annually, for 2 years at the same rate of interest and received Rs.19,350 as interest. What amount (in Rs.) of his savings did he invest in the Insurance Policy?

1 ◯ 1,20,000

2 ◯ 45,000

3 ◯ 60,000

4 ◯ 50,000

Solution:

Correct Answer : 3

Answer key/Solution

Mr. Gupta received an extra amount of Rs.1,350 = (19,350 – 18000) on his Mutual fund.
Interest for the first year is the same for S.I. and C.I.
Interest for first year = 18000/2 = Rs.9,000
∴ Rate of interest = (1350 × 100)/9000 = 15%
Let the amount invested at S.I. be Rs. x.
∴ 18000 = x × 15 × 2/100
⇒ x = Rs.60,000.

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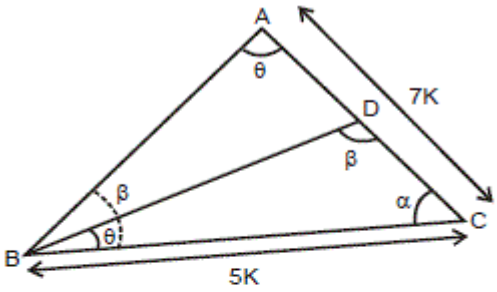
Q.21 [11831809]

In triangle ABC, D is a point on AC between points A and C. If area of triangle DBC = 25 sq. units, ∠BAC = ∠DBC and AC : BC = 7 : 5, then what is the area (in sq. units) of triangle ADB?

Solution:

Correct Answer : 24

Answer key/Solution



ΔABC is similar to ΔBDC.

$\Rightarrow \frac{AC}{BC} = \frac{7}{5}$ (Corresponding sides)

So $\frac{\text{Area } \Delta ABC}{\text{Area } \Delta BDC} = \left(\frac{AC}{BC}\right)^2 = \frac{49}{25}$

So area of ΔABC = 49 sq. units
Hence, area of ΔADB = 49 – 25 = 24 sq. units.

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Q.22 [11831809]

If $f(x) = px^2 - qx + 4$ is a quadratic function and the roots of f(x) = 0 are the reciprocals of the roots of another quadratic equation g(x) = 0, then what is the quadratic function g(x)?

1 ◯ $4x^2 + qx - p$

2 ◯ $4x^2 - qx - p$

3 ◯ $4x^2 - qx + p$

4 ◯ $4x^2 + qx + p$

Solution:

Correct Answer : 3

Answer key/Solution

Let 'a' and 'b' are the roots of f(x) = 0. Thus, '1/a' and '1/b' will be roots of g(x) = 0.

$a + b = \frac{q}{p}$ and $ab = \frac{4}{p}$

$\frac{1}{a}+\frac{1}{b}=\frac{a+b}{ab}=\frac{q}{4}$ and $\frac{1}{a}\times\frac{1}{b}=\frac{1}{ab}=\frac{p}{4}$

So, $g(x) = x^2 - x$(Sum of roots) + Product of roots

$= x^2 - x\left[\frac{q}{4}\right] + \frac{p}{4}$

Hence, $g(x) = 4x^2 - qx + p$.

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