Section-1

Sec 1

Q.1 [11831809]

The combo pack containing a brush and a paste is priced at Rs. 44. If the price of brush is decreased by 10% and that of paste is increased by 25%, then the price of the pack is Rs. 48. What is the difference (in Rs.) between the cost of a paste and a brush?

Solution:

Answer key/Solution

Correct Answer : 4

Let the cost of a brush and a paste be b and p respectively.

Then, $b + p = 44$ … (i)

and $0.9b + 1.25p = 48$ … (ii)

Solving (i) and (ii), we get

b = Rs. 20 and p = Rs. 24

Hence, the required difference = 24 – 20 = Rs.4.

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Q.2 [11831809]

Glass I and glass II contain liquid A, liquid B and liquid C in the ratio 2 : 1 : 2 and 1 : 3 : 2 respectively. Some part of the solution from glass I and glass II are thoroughly mixed and put into another class III. Which of the following cannot be the ratio of liquid A, liquid B and liquid C in glass III?

1 ◯ 17 : 21 : 22

2 ◯ 5 : 5 : 6

3 ◯ 3 : 4 : 5

4 ◯ 8 : 9 : 10

Solution:
Correct Answer : 3

Answer key/Solution

Let 'x' be the quantity of solution taken from glass I and 'y' be the quantity of solution taken from glass II.

Quantity of liquid A in glass III $= \frac{2x}{5} + \frac{y}{6} = \frac{(12x + 5y)}{30}$

Quantity of liquid B in glass III $= \frac{x}{5} + \frac{3y}{6} = \frac{(6x + 15y)}{30}$

Quantity of liquid C in glass III $= \frac{2x}{5} + \frac{2y}{6} = \frac{(12x + 10y)}{30}$

So required ratio = (12x + 5y) : (6x + 15y) : (12x + 10y)
If x = y = 1, then required ratio = 17 : 21 : 22. So option (1) is possible.

If $x = \frac{1}{3}$ and $y = \frac{1}{5}$, then required ratio = 5 : 5 : 6. So option (2) is possible.

If $x = \frac{1}{4}$ and $y = \frac{1}{5}$, then required ratio = 8 : 9 : 10. So option (4) is possible.

If $x = \frac{1}{6}$ and $y = \frac{1}{5}$, then required ratio = 3 : 4 : 4. So option (3) is not possible.

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Q.3 [11831809]

How many integral solutions exist for the equation 6x – y = 168, such that the values that 'x' assumes have opposite signs as compared to the corresponding values of 'y'?

1 ◯ 26

2 ◯ 27

3 ◯ 28

4 ◯ 25

Solution:
Correct Answer : 2
6x – y = 168
⇒ x = y/6 + 28
For 'x' to be an integer 'y' must be a multiple of 6.
Since the values that 'x' assumes have opposite signs as compared to the corresponding values of 'y', 'y' will have to be negative.
So all multiples of 6 from – 6 to – 162 (both inclusive).
Hence, the number of integral solutions are 27.

Answer key/Solution

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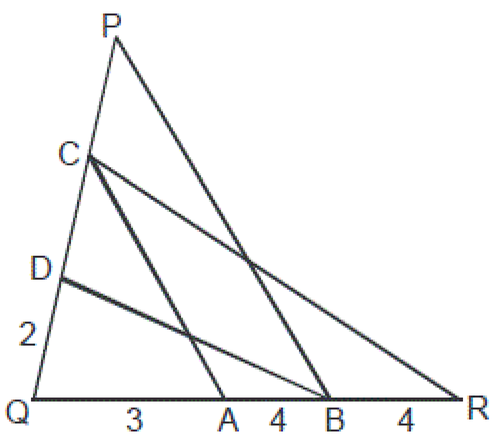
Q.4 [11831809]

In the figure given below, RC is parallel to DB and AC is parallel to BP, QD = 2 units, QA = 3 units and AB = BR = 4 units. The ratio of areas of ΔQDB and ΔPQB is



1 ◯ 4 : 11

2 ◯ 3 : 4

3 ◯ 4 : 7

4 ◯ 3 : 11

Solution:

Correct Answer : 4

Answer key/Solution

Since RC is parallel to DB.
Therefore. triangle DQB is similar to triangle QCR.

So QC $= \frac{11 \times 2}{7} = \frac{22}{7}$

And triangle QCA is similar to triangle QPB.

PQ $= \frac{7 \times \left(\frac{22}{7}\right)}{3} = \frac{22}{3}$

Area of triangle QDB $= \frac{1}{2} \times 2 \times 7 \sin \angle DQB$

Area of triangle PQB $= \frac{1}{2} \times \frac{22}{3} \times 7 \sin \angle PQB$

Hence, the required ratio = 3 : 11.

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Q.5 [11831809]

Half of a class of 180 students enrolled for exactly one of the three activities namely singing, racing and dancing. Total enrollments were 70 in singing, 65 in racing and 50 in dancing from the class. Out of those students who enrolled only for both racing and singing were 10 more than the students who enrolled only for both racing and dancing. What is the minimum possible number of students who enrolled for at least one of the three activities?

1 ◯ 125

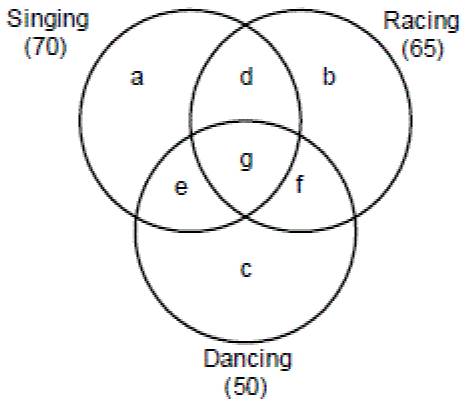
2 ◯ 126

3 ◯ 124

4 ◯ 127

Solution:
Correct Answer : 1

Answer key/Solution



Half of the class = 90 students

$\Rightarrow$ a + b + c = 90 and d = f + 10

Here, a + d + e + g = 70 ... (i)

b + d + f + g = 65 ... (ii)

c + e + f + g = 50 ... (iii)

Adding (i), (ii) and (iii), we get

(a + b + c) + 2(d + e + f) + 3g = 185

$\Rightarrow$ 90 + 2(d + e + f) + 3g = 185

Let (d + e + f) = S

$\Rightarrow$ 2S + 3g = 95, where S is greater than or equal to 10. (because d = f + 10).

Students who enrolled for at least one of the three activities

= (a + b + c) + (d + e + f) + g = 90 + S + g

Thus, we have to minimize the above value.

If 2S + 3g = 95

$\Rightarrow$ 2S + 2g = 95 – g

$\Rightarrow (S + g) = \frac{(95 - g)}{2}$

$\Rightarrow 90 + (S + g) = 90 + \frac{(95 - g)}{2}$

To minimize 90 + (S + g), we have to maximise 'g' so that the expression in the right hand side is minimum.

Thus, 2S + 3g = 95 and $S \geq 10$

$\Rightarrow$ Maximum value of g = 25, when S would be equal to 10.

Hence, the minimum value = 90 + 25 + 10 = 125.

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Q.6 [11831809]

Asha started running from one end of a straight road at 6:30 AM. Beena, standing at the other end of the road, started running towards Asha at 7:00 AM and met Asha at a point O on the road. They continued running till they reached the opposite ends, turned back immediately and coincidently met again at the same point O. If they met at the point O for the first time at 8:00 AM, then the ratio of the speeds of Asha and Beena is

1 ◯ 1 : 2

2 ◯ 1 : √2

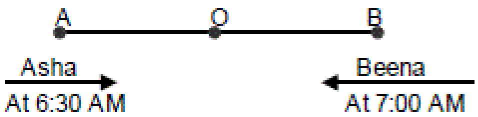
3 ◯ $\sqrt{2} : \sqrt{3}$

4 ◯ $2 : \sqrt{3}$

Solution:

Correct Answer : 3

Answer key/Solution



Let the speeds of Asha and Beena be 'a' and 'b' units respectively.

Since Beena started running at 7:00 AM and they met at 8:00 AM, the ratio of the distance

AO : OB = 1.5a : b ... (i)

It is also given that they met at the same point O, while coming back.

Hence, 2AO : 2OB = b : a ... (ii)

From (i) and (ii), 1.5a : b = b : a

$\Rightarrow a : b = \sqrt{2} : \sqrt{3}$.

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Q.7 [11831809]

Find all the values of b, such that 8 lies somewhere between the roots of the equation $x^2 + 2(b - 4)x + 16 = 0$. ('x' is a real number.)

1 ◯ b > − 1

2 ◯ b > 8

3 ◯ 0 < b < 8

4 ◯ b < − 1

Solution:

Correct Answer : 4

Answer key/Solution

Both the roots will be real as 8 lies between the roots.

$b^2 - 4ac > 0$

or, $4(b - 4)^2 - 4 \times 16 > 0$

or, $b(b - 8) > 0$

or, $b > 8$ or $b < 0$

Secondly, since x = 8 lies between the two roots.

So, $(8)^2 + 2(b - 4) \times 8 + 16 < 0$

Or, $b < -1$.

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Q.8 [11831809]

The number of players in Group A and Group B in a sports academy are in the ratio 3 : 4 in May and 15 : 13 in June. The number of players in Group A and Group B is increased from June to July at a rate that is twice and thrice respectively, of the rate at which it increased from May to June. If the ratio of the aggregate number of players in these two groups in June and May is 8 : 1, then what is the ratio of number of players in Group A and Group B in July?

1 ◯ 16 : 13

2 ◯ 114 : 91

3 ◯ 39 : 31

4 ◯ 207 : 91

Solution:

Correct Answer : 2

Answer key/Solution

Let the number of players in Group A in May = 3x
Let the number of players in Group A in June = 15y.
Total number of players in Group A and Group B in May and June is 7x and 28y respectively.
Therefore, 28y : 7x = 8 : 1 or y : x = 2 : 1 or y = 2x.
From here, we can compile the following table:

	Group A	Group B
No. of players in May	3x	4x
No. of players in June	30x	26x
Rate of increase from May to June	900%	550%
Rate of increase from June to July	1800%	1650%
No. of players in July	570x	455x

Hence, required ratio = 570x : 455x = 114 : 91.

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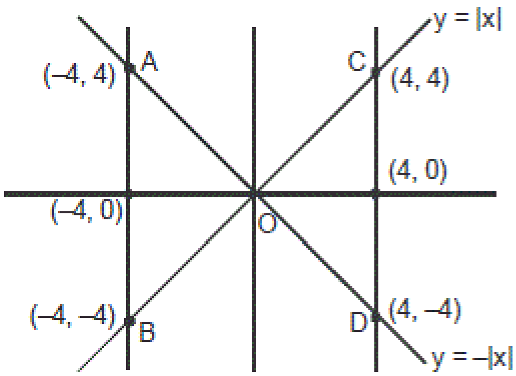
Q.9 [11831809]

The area of bounded regions generated by the curves |x| = 4, y = |x| and y = −|x| is ___ sq. units.

Solution:
Correct Answer : 32

Answer key/Solution



The closed area generated by the three curves is the sum of the areas of the triangles OAB and OCD.

$= 2\left[\frac{1}{2} \times 8 \times 4\right] = 32$ sq. units

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Q.10 [11831809]

Pihu, Quin, Reet, Sita and Tina are working upon a project, which is divided into phases such that only one person works on each phase. The work done per phase by them is inversely proportional to their age in years. Pihu has worked on 4 phases of the project whereas Quin has worked on 5 phases. Tina and Sita have worked on 8 phases each and the rest of the phases were worked upon by Reet, who received the honour of having worked upon 40% of the project. If the ages of these 5 persons are 36 years, 18 years, 9 years, 72 years and 24 years respectively, then how many more/ less phases than Sita did Reet work on?

Solution:
Correct Answer : 3

Answer key/Solution

Name	Pihu	Quin	Reet	Sita	Tina
No. of phases	4	5	x	8	8
Age (in years)	36	18	9	72	24

Since Sita is the eldest, she would do least work per phase.
Let us assume that the work done per phase by Sita = 1.
Then, work done per phase by
Pihu = 2
Quin = 4
Reet = 8
Tina = 3
Total work done by all
$= 4 \times 2 + 5 \times 4 + 8x + 8 \times 1 + 8 \times 3 = 60 + 8x$
Reet did 40% of the work.
$\Rightarrow$ Others did 60% of the work
$\Rightarrow$ 60% of the work = 60
$\Rightarrow$ 40% of the work = 40 = 8x
$\Rightarrow x = 5$
Therefore, Reet worked on 5 phases of the project.
Hence, Reet worked on 3 less phases than Sita.

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Q.11 [11831809]

A shopkeeper has four packets of sugar which he wants to weigh. The aggregate weight of the packets of sugar taken two at a time is 19 kg, 26 kg, 29 kg, 31 kg, 34 kg and 41 kg. If a fifth packet of sugar has to be added such that the average weight now becomes 3 kg higher than the original average, then what is the average (in kg) of the new packet of sugar?

Solution:

Correct Answer : 30

Answer key/Solution

Let a, b, c and d be the weights of the 4 packets of sugar.

$\therefore$ a + b = 19, a + c = 26, a + d = 29, b + c = 31, b + d = 34 and c + d = 41.

$\Rightarrow$ a + b + c + d = 60

Original average weight = 15

New average weight = 18 kg

$\Rightarrow$ (60 + x)/5 = 18

$\Rightarrow$ x = 30 kg.

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Q.12 [11831809]

If $||x - 2| - 1| < 7$ and $||y - 1| - 2| < 9$, where x and y are integers, then which of the following is a possible value of $(x - 2y)$?

1 ◯ 28

2 ◯ 29

3 ◯ −26

4 ◯ −30

Solution:

Correct Answer : 3

Answer key/Solution

$||x - 2| - 1| < 7$

$\Rightarrow -7 < |x - 2| - 1 < 7$

$\Rightarrow |x - 2| < 8$

$\Rightarrow -8 < x - 2 < 8$

$\therefore -6 < x < 10$

Since x is an integer, x can only assume integral values from −5 to 9.

Now, $||y - 1| - 2| < 9$

$\Rightarrow -7 < |y - 1| < 11$

$\Rightarrow |y - 1| < 11$

$\Rightarrow -11 < y - 1 < 11$

$\therefore -10 < y < 12$

Since y is an integer, y can only assume integral values from −9 to 11.

Hence, $-30 < (x - 2y) < 30$.

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Q.13 [11831809]

On giving 3 candies free with every 5 chocolates bought, a shopkeeper makes a profit of 20% and on giving 6 candies free with every 2 chocolates bought, he suffers a loss of 25%. Find the approximate profit percent made by the shopkeeper when he gives 5 candies free with every 7 chocolates bought, if the selling price of 1 chocolate remains the same. (Assume that the candies are identical and the same applies to the chocolates.)

1 ◯ 17%

2 ◯ 20%

3 ◯ 19%

4 ◯ 14%

Solution:

Correct Answer : 1

Answer key/Solution

Let 'x' and 'y' be the cost price of 1 chocolate and 1 candy respectively.
Let the selling price of 1 chocolate be 'z'.
Cost price of 3 candies and 5 chocolates = $5x + 3y$
Therefore, $5z = 1.2(5x + 3y)$ or $z = 0.24(5x + 3y)$.
Also, $2z = 0.75(2x + 6y)$
Or, $2(0.24(5x + 3y)) = 0.75(2x + 6y)$
Or, $5x = 17y$.
Selling price of 7 chocolates = $7z = 1.68(5x + 3y) = 1.68(20y) = 33.6y$
Cost price of 7 chocolates and 5 candies = $7x + 5y = 28.8y$
Hence, profit percent = $[(33.6y - 28.8y)/ 28.8y] \times 100 = 16.67\% \approx 17\%$.

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Q.14 [11831809]

ABCD is a rhombus. E, F, G and H are the mid points of sides AB, BC, CD and DA respectively. O is the point of intersection of the diagonals of the rhombus ABCD. M and N are the mid points of FO and OG respectively. Find the ratio of the area of the pentagon MNGCF to area of the quadrilateral EHNM.

1 ◯ 7 : 9

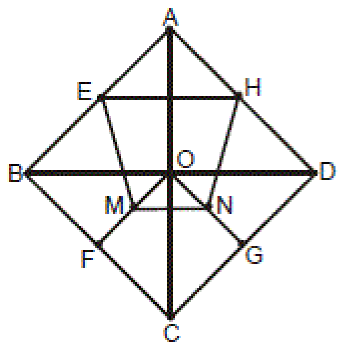
2 ◯ 2 : 3

3 ◯ 8 : 9

4 ◯ 5 : 6

Solution:
Correct Answer : 1

Answer key/Solution



Let the length of BD and AC be x and y respectively.

Area of the $\Delta OGC = \frac{1}{2} \times \frac{1}{2}(OC) \times (OD) = \frac{xy}{16}$

Area of the $\Delta BDC = \frac{1}{2}(BD) \times (OC) = \frac{1}{2} \times x \times \frac{y}{2} = \frac{xy}{4}$

Area of $\Delta FGC = \frac{1}{4}\Delta BDC = \frac{xy}{16}$

Area of $OFCG = 2\Delta OGC = \frac{xy}{8}$

Area of $\Delta OFG = \frac{xy}{8} - \frac{xy}{16} = \frac{xy}{16}$

$\Delta OMN = \frac{1}{4}\left(\frac{xy}{16}\right) = \frac{xy}{64}$

Area of MNGCF $= \frac{xy}{8} - \frac{xy}{64} = \frac{7xy}{64}$

EHNM is a trapezium

Height of the trapezium $EHNM = \frac{y}{4} + \frac{y}{8} = \frac{3y}{8}$

Area of $EHNM = \frac{1}{2}(EH + MN) \times \frac{3y}{8} = \frac{3y}{16}\left(\frac{x}{2} + \frac{x}{4}\right) = \frac{9xy}{64}$

Hence, required ratio $= \frac{7xy}{64} \times \frac{64}{9xy} = \frac{7}{9}$.

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Q.15 [11831809]

Two pipes A and B can completely fill a water tank in 6 hours and 7 hours respectively and pipe C can empty a tank filled completely with water in 5 hours. Initially the tank is empty and all the pipes are closed. Pipe A is opened first at time t = 0 and pipe C is opened at the instant when the tank is exactly half filled with water. Pipe B is opened after pipe C and at the instant when the tank is exactly one-fourth filled with water. Find the total time (in hours) taken to fill the tank completely counting from t = 0.

1 ○ $13\frac{3}{17}$

2 ○ $17\frac{8}{23}$

3 ○ $16\frac{3}{23}$

4 ○ $18\frac{2}{3}$

Solution:
Correct Answer : 2

Answer key/Solution

Initially pipe A is opened:
Time taken till the tank is half filled with water = 3 hours.
Then, pipe A and pipe C both are open:
Time taken from the instant pipe C is opened till pipe B is opened
= ((6 × 5)/4) × (6 – 5) = 7.5 hours.
Pipes A, B and C are open:
Time taken from the instant pipe B is opened till the tank is completely filled
= ((3 × 6 × 7 × 5)/4) × (30 + 35 – 42) = 315/46 hours.

Hence, total time taken to completely fill the tank = 3 + 15/2 + 315/46 = 399/23 hours = $17\frac{8}{23}$ hours.

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Q.16 [11831809]
Let M be a three-digit number denoted by 'ABC' where A, B and C are numerals from 0 to 9. Let N be a number formed by reversing the digits of M. It is known that M – N + 198C is equal to 990. How many possible values of M are there which are greater than 505?

Solution:
Correct Answer : 49

Answer key/Solution

M = ABC and N = CBA
⇒ M – N + 198C = (100A + 10B + C) – (100C + 10B + A) + 198C
⇒ M – N + 198 C = 99(A – C + 2C)
⇒ 99(A + C) = 990
⇒ A + C = 10
When A = 5, C = 5; For M > 505, B can take 9 values from 1, 2, ..., 9.
When A = 6, C = 4; For M > 505, B can take 10 values from 0, 1, 2, ..., 9.
When A = 7, C = 3; For M > 505, B can take 10 values from 0, 1, 2, ..., 9.
When A = 8, C = 2; For M > 505, B can take 10 values from 0, 1, 2, ..., 9.
When A = 9, C = 1; For M > 505, B can take 10 values from 0, 1, 2, ..., 9.
Hence, the total number of values greater than 505 that M can take are 49.

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Q.17 [11831809]

Given that $\log_x(\log_y(\log_z p)) = 0$, where each of x, y and z can assume distinct values among 7, 49 and 2401 only. If the product of all possible values of ‘p’ is represented in the form of 7^n, then what is the value of ‘n’?

1 ◯ 8400

2 ◯ 7490

3 ◯ 7520

4 ◯ 9360

Solution:

Correct Answer : 2

Answer key/Solution

Obviously for all values of ‘p’, $\log_y(\log_z p) = 1$ or

$\log_z p = y$ or $p = z^y$

We can now proceed to find the possible values of ‘p’.

For combinations of values of x, y and z, the possible values of p are 7^{49}, 49^7, 7^{2401}, 2401^7, 49^{2401}, 2401^{49}

Therefore, the product of all possible values of ‘p’

$= 7^{49} \times 49^7 \times 7^{2401} \times 2401^7 \times 49^{2401} \times 2401^{49} = 7^{(49 + 14 + 2401 + 28 + 4802 + 196)}$

Hence, n = 7490.

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Q.18 [11831809]

If x + (x + 1) + (x + 2) + ... + (x + k) = 98, where x and k are positive integers, then how many such pairs (x, k) exist?

1 ◯ 1

2 ◯ 3

3 ◯ 4

4 ◯ 2

Solution:
Correct Answer : 4
There are a total of k + 1 terms, average of these k + 1 terms is (2x + k)/2.
So, $(k + 1)(2x + k) = 196 = 2^2 \times 7^2$.
Since x, k are positive integers, the only possible values of k + 1 are 4 and 7 for which the values of x are 23 and 11 respectively.
Hence, (x, k) = (23, 3), (11, 6).

Answer key/Solution

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Q.19 [11831809]
If 4096 is added to the product of the 13th, 14th, 15th and 16th term of an arithmetic progression, then a perfect square is obtained. If each term of this arithmetic progression is a positive integer, then find the common difference of the arithmetic progression.

Solution:
Correct Answer : 8

Answer key/Solution

Let the 13th, 14th, 15th and 16th of this AP be:
$a - 3d$, $a - d$, $a + d$ and $a + 3d$ respectively.
Here, 2d is the common difference.
$(a^2 - d^2)(a^2 - 9d^2) + x$ is a perfect square for all 'a' … and we have to find the value of 'd'
i.e., $a^4 - 10a^2d^2 + 9d^4 + x$ is a perfect square...
$\Rightarrow (a^2 - 5d^2)^2 + x - 16d^4$ is a perfect square for all 'a'
$\Rightarrow (2d)^4 = x$
Here, $x = 4096 \Rightarrow 2d = (4096)^{1/4} \Rightarrow 2d = 8$.

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Q.20 [11831809]
Prem and Ram walk up a moving up escalator at constant speeds. For every 8 steps that Prem takes, Ram takes 3 steps. How many steps would each have to climb when the escalator is switched off, given that Prem takes 32 and Ram takes 24 steps to climb up the escalator moving up respectively?

Solution:
Correct Answer : 40
Let the speed of the escalator be E steps per second.
Let Prem's speed be 8 steps/sec and Ram's be 3 steps/sec.
Relative speed is the speed of (person + stairs).
Prem walks 32 steps in 4 seconds. In 4 seconds, the escalator moves 4E steps.
Total length = 32 + 4E
Ram walks 24 steps in 8 seconds. In 8 seconds, the escalator moves 8E steps.
$\Rightarrow$ 32 + 4E = 24 + 8E $\Rightarrow$ E = 2
Hence, the total length of the escalator is 32 + 4 × 2 = 40 steps.

Answer key/Solution

Bookmark FeedBack

Q.21 [11831809]

If f(x) is a real function such that 3f(x) = f(x + 1) + 2f(x − 1) for all x ≥ 1 and f(0) = 1, f(1) = 2 and then f(7) is equal to _______.

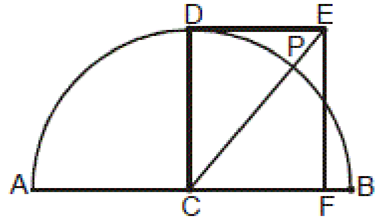
Solution:
Correct Answer : 128
Given: 3f(x) = f(x + 1) + 2f(x − 1)
Put x = 1, 3f(1) = f(2) + 2f(0) $\Rightarrow$ f(2) = 4
Put x = 2, 3f(2) = f(3) + 2f(1) $\Rightarrow$ f(3) = 8
Put x = 3, 3f(3) = f(4) + 2f(2) $\Rightarrow$ f(4) = 16
Put x = 4, 3f(4) = f(5) + 2f(3) $\Rightarrow$ f(5) = 32
Put x = 5, 3f(5) = f(6) + 2f(4) $\Rightarrow$ f(6) = 64
Put x = 6, 3f(6) = f(7) + 2f(5) $\Rightarrow$ f(7) = 128.

Answer key/Solution

Bookmark FeedBack

Q.22 [11831809]

A semicircle with center at C and radius equal to 4 units is drawn with AB as the diameter as shown in the figure given below. CDEF is a rectangle such that the ratio of area of the semicircle to the area of the rectangle is 2π : 3. CE cuts the semicircle at P. Find the length of the line segment PB.



1 ◯ $\frac{8}{5}\sqrt{5}$ units

2 ◯ $\frac{5}{3}\sqrt{5}$ units

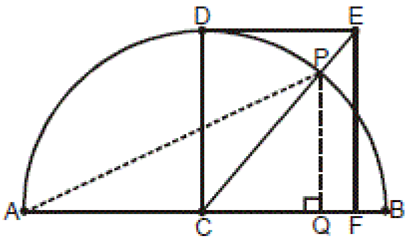
3 ◯ $\frac{17}{9}\sqrt{5}$ units

4 ◯ $\frac{9}{5}\sqrt{5}$ units

Solution:

Correct Answer : 1

Answer key/Solution



Join AP and draw $PQ \perp AB$.

$$\frac{2\pi}{3} = \frac{\pi \times 4^2}{2 \times 4 \times DE}$$

$\Rightarrow DE = 3$ units $= CF$

$\therefore CE = \sqrt{CD^2 + DE^2} = 5$ units

Let CQ = x units

$\therefore QB = CB - CQ = (4 - x)$ units

$\Delta CPQ \sim \Delta CEF$

$$\therefore \frac{CP}{CE} = \frac{CQ}{CF}$$

$$\Rightarrow \frac{4}{5} = \frac{x}{3}$$

$\Rightarrow x = \frac{12}{5}$ units.

$\Rightarrow QB = \frac{8}{5}$ units

Also,

$\Rightarrow \frac{PQ}{EF} = \frac{CP}{CE} \Rightarrow PQ = \frac{CP}{CE} \times EF = \frac{4}{5} \times 4 = \frac{16}{5}$ units.

Hence, $PB = \sqrt{PQ^2 + QB^2} = \sqrt{\frac{256}{25} + \frac{64}{25}} = \frac{8\sqrt{5}}{5}$ units.

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