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Prime CAT 04 2022 QA

Section-1

Sec 1

Q.1 [11831809]

Two buses leave from A to B at an interval of 40 minutes. They reach B simultaneously and leave for C which is 160 km away from B. The second bus, having reached C, immediately turns back and travels towards B. If the first and second buses meet at a point 40 km away from C, then find the time taken by the first bus from A to B.

1 ○ 1 hour

2 ○ 1 hour 20 minutes

3 ○ 2 hours 40 minutes

4 ○ 1 hour 40 minutes

Solution:

Correct Answer : 4

Let the speeds of first and second buses be S1 and S2 respectively and the distance between A and B be 'd'.
Then, according to the question,
d/S1 − d/S2 = 2/3   ...(i)
200/S2 = 120/S1
⇒ S2 = 5S1/3   ...(ii)
From (i) and (ii), d/S1 − d/(5S1/3) = 2/3
⇒ d/S1(1 − 3/5) = 2/3
⇒ d/S1 = 5/3 hours or 1 hour 40 minutes.

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Q.2 [11831809]

A square ABCD is inscribed in a circle of center O. (1, 2) and (5, 8) are the co-ordinates of vertices A and C respectively of the square. The number of paths from A to C via center O of the circle, where each step from any point (x, y) is either to (x + 1, y) or to (x, y + 1) is

Solution:

Correct Answer : 100

AC is the diagonal of the square ABCD or the diameter of the circle.
So co-ordinates of the center O is ((1 + 5)/2, (2 + 8)/2) i.e., (3, 5).
Let us first consider travelling from A(1, 2) to O(3, 5):
Travelling from 1 to 3 units in the X-axis = 2 horizontal movements
Travelling from 2 to 5 units in the Y-axis = 3 vertical movements
So the number of paths to travel from A(1, 2) to O(3, 5) = 5!/2! × 3!
Similarly, the number of paths to travel from O(3, 5) to C(5, 8) = 5!/2! × 3!
Hence, the total number of paths from A to C via O = (5!/2! × 3!) × (5!/2! × 3!) = 10 × 10 = 100.

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Q.3 [11831809]

In an arithmetic progression, the 10th term is 12 and the 11th term is 10. How many consecutive terms (starting from the first term) of the arithmetic progression should be considered so as to make their sum equal to zero?

Solution:

Correct Answer : 31

Let $T_n = a + (n - 1) d$
(where a = first term, d = common difference, T_n = nth term)
$T_{10} = a + 9d = 12$ ...(i)
$T_{11} = a + 10d = 10$ ...(ii)
Solving (i) and (ii),
d = −2, a = 30
Assume that 'n' terms are needed so as to make the sum equal to 0.
$\Rightarrow S_n = n/2 [2a + (n - 1)d] = 0$
$\Rightarrow n/2 [60 + (n - 1)(-2)] = 0 \Rightarrow 60 - 2n + 2 = 0$
$\Rightarrow n = 62/2 = 31$
Hence, first 31 terms of the arithmetic progression when added give the sum as zero.

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Q.4 [11831809]

If $\dfrac{1}{2} + \dfrac{1}{3} + \dfrac{1}{7} + \dfrac{1}{n}$ is an integer for a positive integer 'n', then which of the following statements is not true?

1 ○ 2 divides n

2 ○ 3 divides n

3 ○ n > 40

4 ○ 81 < n < 98

Solution:

Correct Answer : 4

Since $\dfrac{1}{2} + \dfrac{1}{3} + \dfrac{1}{7} + \dfrac{1}{n} = \dfrac{41}{42} + \dfrac{1}{n} = \dfrac{41n + 42}{42n}$,
it is very clear that n = 42 makes the expression an integer.
Because n is a positive integer, 1/n must be less than or equal to 1.
Thus, the only integer the expression can take is 1, making the only value for n = 42.
Hence, option (4) is incorrect.

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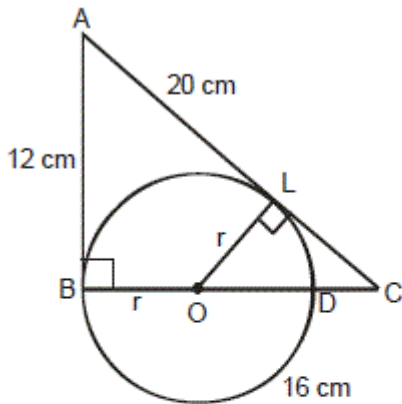

Q.5 [11831809]

In a ΔABC, AB = 12 cm, AC = 20 cm and BC = 16 cm. There is a point D between B and C on BC. If a circle is drawn BD as diameter such that AB and AC are tangents to it, then the length (in cm) of BD is

Solution:

Correct Answer : 12

ΔABC is a right angled triangle.
Let O be the center of the circle.
Then, in ΔABC and ΔOLC,
∠ABC = ∠OLC = 90° and ∠C is common.
So ΔABC is similar to ΔOLC.
Therefore, AB/AC = OL/OC ⇒ 12/20 = r/16 – r
⇒ r = 6 cm
Hence, BD = 2r = 12 cm.

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Q.6 [11831809]

A woman does two-thirds of the work in a day as a man and a child does one-fourths of the work in a day as a man. If a farmer hires 30 pairs of hands - men, women and children in the ratio 7 : 5 : 3 and pays them in all Rs. 23,940 at the end of the day's work. If the wages are proportional to the work done, then what must be the daily wages (in Rs.) of a child?

1 ◯ 180

2 ◯ 720

3 ◯ 270

4 ◯ 540

Solution:

Correct Answer : 3

Given the ratio of men, women and children is 7 : 5 : 3 and total number of men, women and children = 30

So the number of men = 14, women = 10 and children = 6.

Ratio of work done by men : women : children = 1 : 2/3 : 1/4 = 12 : 8 : 3

So ratio of work done by 14 men, 10 women and 6 children = 14 × 12 : 10 × 8 : 6 × 3 = 84 : 40 : 9

Therefore, Rs.23,940 would be divided in this ratio.

Therefore, 6 children earns in a day = 23940 × 9/133 = Rs.1,620.

Hence, one child earns in a day = Rs.1,620/6 = Rs. 270.

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Q.7 [11831809]

Two trains have lengths of 220 m and 260 m. When they run in the same direction, the faster train will take 60 seconds to cross the slower train. When they run in the opposite directions, they will take 10 seconds to cross each other. If the longer train is the faster one, then find the time (in sec.) taken by it to cross a 132 m long tunnel.

1 ◯ 14

2 ◯ 12.5

3 ◯ 19.6

4 ◯ 17

Solution:

Correct Answer : 1

Let the speeds of the trains be x m/sec and y m/sec where x > y.
(220 + 260)/(x + y) = 10 ⇒ x + y = 48   ...(i)
(220 + 260)/(x − y) = 60 ⇒ x − y = 8   ...(ii)
Solving (i) and (ii) for x and y we get, x = 28 m/sec and y = 20 m/sec
Hence, time taken by the faster train to cross a 132 m long tunnel = (260 + 132)/28 = 14 seconds.

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Q.8 [11831809]

P, Q, R and S bought a certain number of Mangoes. S bought 1/2 the number of mangoes bought by the other three. R bought 1/3rd the number of mangoes bought by the other three, while P bought 2/5th the number of mangoes bought by the other three. If each of them bought a distinct number of mangoes, find the ratio of the number of mangoes bought by Q to the total number of mangoes bought by all four.

1 ○ 11 : 84

2 ○ 1 : 12

3 ○ 11 : 73

4 ○ Data inconsistent

Solution:

Correct Answer : 1

If P, Q and R purchase x mangoes, then number of mangoes bought by S = x/2

All four purchased = x + x/2 = 3x/2

Therefore, ratio = x/2 : 3x/2 = 1 : 3

Similarly, we can find for R and P.

Let total number of mangoes purchased by all four be M.

S purchased 1/3 × M, R purchased 1/4 × M, P bought 2/7 × M

So, Q purchased M − (1/3 × M − 1/4 × M − 2/7 × M) = 11/84 × M

Hence, required ratio = 11 : 84.

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Q.9 [11831809]

Two quadratic equations have a common positive root. The equation satisfied by the other two roots is $x^2 - 5x + 6 = 0$. The sum of all possible products of the four roots, taken two at a time is 150. Find the absolute difference between the products of the roots of the two equations.

1 ○ 18

2 ○ 16

3 ○ 8

4 ○ 12

Solution:

Correct Answer : 3

Let the common root be a.
The other roots satisfy $x^2 - 5x + 6 = 0$.
∴ Other roots are 2 and 3.
∴ The four roots are a, 2, a, 3.
The sum of all possible products of the 4 roots taken two at a time is
$(2a + a^2 + 3a) + (2a + 6) + 3a = a^2 + 10a + 6 = 150$ (given)
$\Rightarrow (a + 18)(a - 8) = 0$
As $a > 0$, so $a = 8$.
The product of the roots of one equation $= 8 \times 2 = 16$
The product of the roots of other equation $= 8 \times 3 = 24$
Hence, required absolute difference $= 24 - 16 = 8$.

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Q.10 [11831809]

When 15 is added to a list of integers, the average is increased by 2. When 1 is added to the enlarged list, the average of the enlarged list is decreased by 1. How many integers were in the original list?

Solution:

Correct Answer : 4

Let x be the sum of the integers and y be the number of elements in the list.
Initial average $= x/y$

If 15 is added to the existing list of integers, then $\dfrac{x+15}{y+1} = \dfrac{x}{y} + 2$ ...(i)

And, if 1 is added to the enlarged list of integers, then $\dfrac{x+16}{y+2} = \dfrac{x}{y} + 1$ ...(ii)

Solving (i) and (ii), we get $5y = x$
For $(x, y) = (5, 1), (10, 2), (15, 3), (20, 4)$ and so on.
For $(20, 4)$, the conditions given is satisfied.
Hence, there were 4 integers in the original list.

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Q.11 [11831809]

Aman purchased two items A and B and invested Rs. 50 and Rs. 75 on their maintenance respectively. If he suffers a loss of 10% on A and 12% on B, overall loss suffered by him is Rs. 84. But if he earns 20% on A and 10% on B, overall profit earned by him is 14% of total price of items. Find initial total purchasing price (in Rs.) of both the items.

1 ○ 675

2 ○ 725

3 ○ 750

4 ○ 625

Solution:

Correct Answer : 4

Let the price at which Aman purchased the items A and B be Rs. (x − 50) and Rs. (y − 75) respectively.
After investing Rs. 50 and Rs. 75 in maintenance the cost price will be Rs. x and Rs. y respectively.
According to the question,

$0.1x + 0.12y = 84$

$\Rightarrow 5x + 6y = 4200$

$0.2x + 0.1y = 0.14(x + y)$

$\Rightarrow x = \dfrac{2y}{3}$

So, x = 300 and y = 450.
Hence, initial total purchasing price of both the items = 250 + 375 = Rs. 625.

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Q.12 [11831809]

If [x] denotes the greatest integer function less than or equal to x, then the value of x for which 5(x − 1)[x − 1] = 259 is

1 ○ 7.4

2 ○ 8.6

3 ○ 8.4

4 ○ 7.6

Solution:

Correct Answer : 3

5(x − 1)[x − 1] = 259 ⟹ (x − 1)[x − 1] = 51.8
When x = 8, (x − 1)[x − 1] = 7 × 7 = 49
When x = 9, (x − 1)[x − 1] = 8 × 8 = 64
So x must lie in between 8 and 9 ⟹ [x − 1] = 7
Hence, (x − 1) = 51.8/[x − 1] = 51.8/7 = 7.4
⟹ x = 7.4 + 1 = 8.4.

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Q.13 [11831809]

A road roller is 3 m long and has a diameter of 0.28 m. It takes exactly 2000 rotations of the road to level a mud path. If the cost of using the roller is Rs.5 per m², then find the total cost (in Rs.) of leveling the path.

1 ◯ 24,300

2 ◯ 25,800

3 ◯ 22,480

4 ◯ 26,400

Solution:

Correct Answer : 4

Radius of the roller = 0.28/2 = 0.14 m
Length of the roller = 3 m.
Curved surface area of the roller = 2πrh = 2 × 22/7 × 0.14 × 3 = 2.64 m².
In 1 rotation the roller covers 2.64 m².
In 2000 rotations, the roller covers 5280 m².
Hence, the required cost = 5280 × 5 = Rs.26,400.

🔍 Answer key/Solution

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Q.14 [11831809]

A fuel merchant purchased 30 litres of petrol at Rs.50 per litre and sold 22 litres of it at Rs.55 per litre. To the remaining petrol, he added 40% kerosene, the cost of which is Rs.15 per litre. If he sold this new mixture at the same rate at which he sold the first 22 litres, the total profit (in Rs.) made by him would be

Solution:

Correct Answer : 278

🔍 Answer key/Solution

The merchant added 8 litres petrol with 40% × 8 = 3.2 litres of kerosene i.e, he sold a total of 33.2 litres of petrol at Rs. 55 per litre.
Total Cost price = 30 × 50 + 3.2 × 15 = Rs. 1,548
Total Selling price = 33.2 × 55 = Rs. 1,826
Hence, profit obtained = 1826 − 1548 = Rs. 278.

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Q.15 [11831809]

A person deposited a sum of Rs.50,000 in a bank for a period of t1 years at a rate of 20% p.a. compounded annually. The same person deposited a sum of Rs.57,600 in another bank for a period of t2 years at a rate of 25% p.a. simple interest. The amounts received from the two banks are equal and the total amount is Rs.1,72,800. Find the difference between t1 and t2 (in years).

Solution:

Correct Answer : 1

Amounts received from the two investments are equal = 172800/2 = Rs.86,400
So 50000 × (1.2)^{t1} = 86400 ⟹ t1 = 3 years
Similarly, 57600 × 0.25 × t2 = 28800 ⟹ t2 = 2 years
Hence, required difference = 3 − 2 = 1 year.

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Q.16 [11831809]

In triangle ABC, AE is the median from A to BC. In triangles AEB and AEC, AD and AF are the medians to EB and CE, respectively. In triangle ACE, EG is the median to AC. What is the ratio of the area of triangle ACF to that of quadrilateral GEDA?
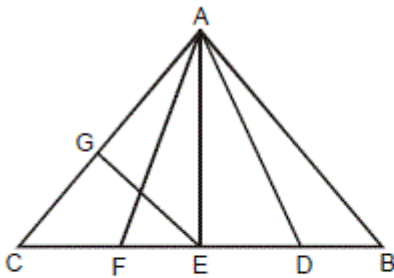
1 ◯ 3 : 2

2 ◯ 4 : 3

3 ◯ 3 : 1

4 ◯ 1 : 2

Solution:

Correct Answer : 4

Let the area of triangle ABC be 8.
Area of triangle ACE = Area of triangle ABE = 4.
Area of triangle ACF = 4/2 = 2 = Area of triangle ADB
Area of triangle CGE = 4/2 = 2
Area of quadrilateral GEBA = 8 − 2 = 6
Area of quadrilateral GEDA = 6 − 2 = 4
Hence, required ratio = Area of triangle ACF : Area of Quadrilateral GEDA = 2 : 4 = 1 : 2.

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Q.17 [11831809]

Let abc10 and abc12 be two 5-digit numbers such that abc10 + abc12 = 123422, then what is the value of a + b + c?

Solution:

Correct Answer : 14

abc10 + abc12 = 123422
abc10 + abc10 = 123420   ...(i)
abc00 + abc00 = 123400   ...(ii)
From (i) and (ii),
abc + abc = 1234
⇒ 2 × abc = 1234
⇒ abc = 1234/2 = 617
Hence, a = 6, b = 1, c = 7, then a + b + c = 14.

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Q.18 [11831809]

Nina was to get a 50% hike in her pay but the computer operator wrongly typed the figure as 80% and printed the new pay slip. She received this revised salary for 3 months before the mistake was rectified. What percentage of her correct new salary will she get in the 4th month, if the excess paid to her in the previous 3 months is to be deducted from her 4th month?

Solution:

Correct Answer : 40

Let the salary of Nina be x, before pay hike.
Expected pay hike = 0.5x
Expected salary to be received = 1.5x
Wrong pay hike = 0.8x
Wrongly received salary = 1.8x
In 3 months, she received = 5.4x, but she should have received 4.5x.
Excess salary received = 5.4x − 4.5x = 0.9x
In 4ᵗʰ month Nina will receive = 1.5x − 0.9x = 0.6x

Hence, Nina will only receive $\frac{0.6x}{1.5x}$ × 100 = 40% of her correct new salary after the deduction.

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Q.19 [11831809]

If $\log_4 a + \log_8 a = \frac{1}{3}\log_{0.5}\sqrt{10}$ and a > 0, then the value of 'a' is

1 ○ $10^{-1/5}$

2 ○ $10^{1/5}$

3 ○ $5^{-1/2}$

4 ⃝ $10^{-3/5}$

Solution:

Correct Answer : 1

$$\log_4 a + \log_8 a = \frac{1}{3}\log_{0.5}\sqrt{10} \Rightarrow \frac{\log_2 a}{\log_2 4} + \frac{\log_2 a}{\log_2 8} = \frac{1}{3} \times \frac{\log_2 \sqrt{10}}{\log_2 2^{-1}}$$

$$\Rightarrow \log_2 a\left(\frac{1}{2}+\frac{1}{3}\right) = -\frac{1}{3}\log_2\sqrt{10} \Rightarrow 5\log_2 a = -2\log_2\sqrt{10}$$

$$\Rightarrow \log_2 a^5 = -\log_2 10 \Rightarrow \log_2 a^5 \times 10 = 0$$

$$\Rightarrow a^5 \times 10 = 1 \Rightarrow a = 10^{-1/5}.$$

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Q.20 [11831809]

If a regular hexagon is formed by cutting the corners of an equilateral triangle, then the ratio of the area of the 3 cut corners to the area of the equilateral triangle is
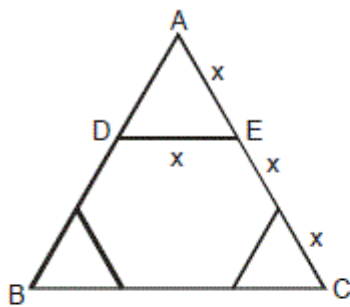
1 ⃝ 1 : 3

2 ⃝ 1 : 2

3 ⃝ 1 : 6

4 ⃝ 1 : 9

Solution:

Correct Answer : 1

$\triangle ADE$ will an equilateral triangle.

Side AE = x

Side of the equilateral triangle ABC = 3x

Area of 3 cut corners $= 3 \times \dfrac{\sqrt{3}}{4} \times x^2 = \dfrac{3\sqrt{3}x^2}{4}$ sq. units

Area of the equilateral triangle ABC $= \dfrac{\sqrt{3}}{4} \times (3x)^2 = \dfrac{9\sqrt{3}x^2}{4}$ sq. units

Hence, required ratio = 1 : 3.

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Q.21 [11831809]

A certain tank has two pipes A and B that can either fill it or empty it at the same respective rates depending on the requirements. If pipe A alone is used to fill the tank for the time that both pipes together take to fill the tank, then 3/4th of the tank would be full. On a certain day, the tank is empty and pipe A is used to fill it while B is used to empty it. What percent of the tank will be empty in half the time it takes to fill the tank by both pipes together when they are used for filling?

1 ◯ 25%

2 ◯ 80%

3 ◯ 45%

4 ◯ 75%

Solution:

🔍 Answer key/Solution

Correct Answer : 4

Let the time taken to fill the tank when both pipes are filling it be t minutes.
Then the time taken for both pipes together to empty the tank will also be t minutes.
It is given that in t minutes pipe A alone fills 3/4th of the tank.
Hence, in t minutes pipe B alone fills 1/4th of the tank.
Now it also follows that pipe A alone can empty 3/4th of the tank in 't' minutes and pipe B alone would empty 1/4th of the tank in 't' minutes (when they are used to empty the tank individually). If pipe A is used to fill and pipe B is used to empty for t/2 minutes, then the portion of the tank filled will be = (1/2) (3/4 − 1/4) = 2/8 = 25% full.
Hence, the tank will be 75% empty.

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Q.22 [11831809]

If w + x + y + z = 1, where w, x, y, z are non-negative, then the maximum value of $wxyz/(1 - w) (1 - x)(1 - y)(1 - z)$ is

1 ◯ 81/256

2 ◯ 1/81

3 ◯ 1/27

4 ◯ 64/27

Solution:

Correct Answer : 2

If w, x, y, z are interchanged, then the condition and the expression remain the same. So variables are equal i.e., w = x = y = z = 1/4.

So wxyz = 1/4 × 1/4 × 1/4 × 1/4 = 1/256 and (1 − w)(1 − x)(1 − y)(1 − z) = 3/4 × 3/4 × 3/4 × 3/4 = 81/256

Hence, the required maximum value = (1/256)/(81/256) = 1/81.

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