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Prime CAT 09 2022 QA

Section-1

Sec 1

Q.1 [11831809]

If r is a constant such that $|x^2 - 8x + r| = 1$ has only one distinct real root, then the possible integral value of r is

1 ○ 15

2 ○ 16

3 ○ 17

4 ○ 18

Solution:

Correct Answer : 3

The given equation is $|x^2 - 8x + r| = 1$.

$\Rightarrow |(x - 4)^2 - 16 + r| = 1$

So $(x - 4)^2 - 16 + r = 1$ and $(x - 4)^2 - 16 + r = -1$

$\Rightarrow (x - 4)^2 = 17 - r$ and $(x - 4)^2 = 15 - r$

Case 1: when r = 15

$(x - 4)^2 = 2$ and $(x - 4)^2 = 0$, will give 3 distinct real roots.

Case 2: when r = 17

$(x - 4)^2 = 0$ and $(x - 4)^2 = -2$, will give 1 distinct real root.

Hence, the possible integral value of r is 17.

Alternate Solution:

Among the given options, if you substitute:

r = 15, will give 3 distinct real roots.

r = 16, will give 2 distinct real roots.

r = 17, will give 1 distinct real root.

r = 18, will not give any real root.

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Q.2 [11831809]

Class A has 6 less students than class B. The sum of total marks obtained by class A students were 288 and that of class B were 396 in the same test. If the average marks obtained by class A students were 2 more than the average marks obtained by class B students, then the sum total number of students of class A and class B are

1 ○ 28

2 ○ 30

3 ○ 45

4 ○ 48

Solution:

Correct Answer : 2

Let n be the number of students in class B.

Then, the number of students in class A will be = n – 6

According to the question,

288/(n – 6) = 396/n + 2

$\Rightarrow 2n^2 + 96n - 396 \times 6 = 0$

$\Rightarrow n^2 + 48n - 66 \times 18 = 0$

$\Rightarrow (n - 18)(n + 66) = 0$

So n = 18 or n = – 66

Hence, the sum total number of students of class A and class B = 12 + 18 = 30.

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Q.3 [11831809]

If $\log(1 + x) + \log(1 + x^2) + \log(1 + x^4) = 1 + \log(x - x^9) - \log(1 - x)$, then 100x equals

Solution:

Correct Answer : 10

$\log(1 + x) + \log(1 + x^2) + \log(1 + x^4) = 1 + \log(x - x^9) - \log(1 - x)$
$\Rightarrow \log(1 + x) + \log(1 - x) + \log(1 + x^2) + \log(1 + x^4) = 1 + \log x(1 - x^8)$
$\Rightarrow \log(1 - x^2) + \log(1 + x^2) + \log(1 + x^4) = 1 + \log x + \log(1 - x^8)$
$\Rightarrow \log(1 - x^4) + \log(1 + x^4) = 1 + \log x + \log(1 - x^8)$
$\Rightarrow \log(1 - x^8) = 1 + \log x + \log(1 - x^8)$
$\Rightarrow \log x = -1$
$\Rightarrow x = 1/10$
Hence, 100x = 10.

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Q.4 [11831809]

Two persons A and B buy two articles for Rs.500 and Rs.1,000 respectively. A marks his article up by P%, while B marks his article up by 2P% and allows a discount of P%. If both make the equal non-zero profit, then the sum of their profits (in Rs.) is

Solution:

Correct Answer : 250

According to the question,
$500(1 + P) - 500 = 1000(1 + 2P)(1 - P) - 1000$
$\Rightarrow P = 2(1 - P + 2P - 2P^2 - 1)$
$\Rightarrow P(4P - 1) = 0$
So P = 1/4 or 25% (Since P cannot be zero.)
Hence, their total profit
$= 500 \times 0.25 + 1000 \times 0.5 \times 0.75$
$= 125 + 125 = Rs.250$.

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Q.5 [11831809]

Abhilash, Avinash and Akhilesh can complete a work alone in 20 days, 12 days and 30 days, respectively. Abhilash only works alternate days starting from the first day. Akhilesh only works on alternate days starting from second day. Avinash works every day. Then, the number of days taken to complete the work is

Solution:

Correct Answer : 8

Let the total work be LCM(20, 12, 30 =) 60 units.

Then, number of units work done by Abhilash, Avinash and Akhilesh will be 3, 5 and 2 units respectively.

In first 4 days, Abhilash works on 1st & 3rd days; Akhilesh works on 2nd & 4th days; and Avinash works on all 4 days.

So number of units of work done in first 4 days = 3 × 2 + 5 × 4 + 2 × 2 = 30

Therefore, remaining 30 units of work will be done in 4 days.

Hence, the number of days taken to complete the work = 8 days.

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Q.6 [11831809]

The number of kilometers covered by comet A and comet B together in a day is what comet C alone covers in 11 days. The number of kilometers covered by comet A and comet C together is what comet B alone covers in 7 days. The ratio of the daily kilometers covered by the comet who covers the most kilometers to the comet who covers the least kilometers is

1 ○ 19 : 2

2 ○ 2 : 19

3 ○ 3 : 2

4 ○ 19 : 3

Solution:

Correct Answer : 1

Let number of kilometers covered in one day by comet A, comet B and comet C be A, B and C respectively.

$A + B = 11C$ ... (i)

$A + C = 7B$ ... (ii)

Subtracting (ii) from (i), we get

$B - C = 11C - 7B$

$\Rightarrow 8B = 12C \Rightarrow B = 1.5C$

So $A + 1.5C = 11C \Rightarrow A = 9.5C$

$\Rightarrow A : C = 19 : 2$. (In a day A covers the most and C covers the least.)

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Q.7 [11831809]

How many 3 digit numbers between 257 and 762 increase by 495 when the three digits are arranged in reverse order?

Solution:

Correct Answer : 24

Let c, b and a be the units place digit, tens place digit and hundred place digit respectively.

Then, 100c + 10b + a − 100a − 10b − c = 495

⇒ 99c − 99a = 495

⇒ 99(c − a) = 495

⇒ c − a = 5

Since 3 digit numbers are between 257 and 762.

When a = 2 and c = 7, then b = 6, 7, 8, 9

When a = 3 and c = 8, then b = 0 to 9

When a = 4 and c = 9, then b = 0 to 9

Hence, total numbers = 4 + 10 + 10 = 24.

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Q.8 [11831809]

Two containers − A and B − are filled with the milk solution of strengths 40% and 50% respectively. The volumes of the containers A and B are 600 cc and 750 cc respectively. A part of the solution from the container A is thrown away and replaced by equal volume of the solution from container B. If the concentration of the milk solution in container A is 44%, then the solution left in the container B is

1 ○ 240 ml

2 ○ 360 ml

3 ○ 490 ml

4 ○ 510 ml

Solution:

Correct Answer : 4

Using alligation rule:

40%   50%

$\diagdown \diagup$

44%

$\diagup \diagdown$

6 : 4

Ratio of 40% solution to 50% solution = 3 : 2

The solution replaced from container A = 600 × 2/5 = 240 ml

Hence, remaining solution in container B = 750 − 240 = 510 ml.

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Q.9 [11831809]

If |x − 10| < 20 and |y − 10| < 40, then the number of integral values |x + y| can take is

Solution:

Correct Answer : 80

$|x - 10| < 20$ or, $-10 < x < 30$
$|y - 10| < 40$ or, $-30 < y < 50$
Therefore, $-40 < x + y < 80$
Or, $0 \leq |x + y| < 80$
Hence, 80 integral values are possible.

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Q.10 [11831809]

A shopkeeper is just able to pay rent of his shop if he sells a certain number of items at an average profit of Rs. 80 per item or if he sells 50 more items at an average profit of Rs. 60 per item. The rent of his shop, in Rs., is

1 ○ 10,000

2 ○ 12,000

3 ○ 15,000

4 ○ 9,000

Solution:

Correct Answer : 2

Let x items be sold at an average profit of Rs.80 per item.
Then, $80x = 60(x + 50)$
$\Rightarrow x = 150$
The shopkeeper can pay his rent if he sells 150 items at an average profit of Rs.80 per item.
Hence, his rent is $80 \times 150 = $ Rs.12,000.

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Q.11 [11831809]

Let a square S be inscribed in a circle C1 and another circle C2 inscribed in square S. Then, the area of circle C1 is how many times the area of circle C2?

Solution:

Correct Answer : 2

Let a be the radius of circle C1.

Then, side length of square S = √2a

So radius of circle C2 = √2a/2

Hence, ratio of areas of circles C1 and C2 = π × a² : π × (√2a/2)² = 2 : 1.

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Q.12 [11831809]

There are 4 gift hampers 1, 2, 3 and 4 such that all of them cost an equal amount. If gift 1 contains 4 cups, 2 spoons and 15 plates, gift 2 contains 3 cups, 6 spoons and 15 plates, and gift 3 contains 1 cup, 2 spoons and 16 plates, which of the following can be the contents of gift 4?

1 ○ 15 cups, 7 spoons and 10 plates

2 ○ 45 cups

3 ○ 10 cups, 14 spoons and 12 plates

4 ○ 8 spoon and 16 plates

Solution:

Correct Answer : 3

Let the cost of a cup, a spoon and a plate be C, S and P respectively.
Then, 4C + 2S + 15P = 3C + 6S + 15P
$\Rightarrow$ C = 4S   ... (i)
and 4C + 2S + 15P = C + 2S + 16P
$\Rightarrow$ P = 3C = 12S   ... (ii)
Therefore, 4C + 2S + 15P = 4 × 4S + 2S + 15 × 12S = 198S
Option (1), 15C + 7S + 10P = 60S + 7S + 120S = 187S
Option (2), 45C = 45 × 4S = 180S
Option (3), 10C + 14S + 12P = 10 × 4S + 14S + 12 × 12S = 198S
Option (4), 8S + 16P = 8S + 16 × 12S = 200S
Hence, option (3) is the correct answer.

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Q.13 [11831809]

Two trains cross each other in 5 seconds when moving in the opposite direction along parallel tracks and in 15 seconds when travelling in the same direction along parallel tracks. If the speed of the faster train is 40 km/h more than the speed of the slower train, then the speed of the slower train, in km/h, is

1 ○ 36

2 ○ 40

3 ○ 80

4 ○ 50

Solution:

Correct Answer : 2

Let the length of the slower train and faster train be x and y respectively.
Let the speed of the slower train be S km/h, then the speed of the faster train = (S + 40) km/h
According to the question,
(x + y)/40 = 15 × 18/5
⇒ x + y = 2160   ... (i)
and (x + y)/(2S + 40) = 5 × 18/5
⇒ x + y = 36S + 720   ... (ii)
From (i) and (ii),
36S + 720 = 2160 ⇒ S = 40 km/h
Hence, the speed of the slower train is 40 km/h.

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Q.14 [11831809]

A circle of diameter 4 cm is inscribed inside a triangle ABC of perimeter 24 cm where ∠ABC = 90°. The area of the triangle ABC (in cm^2) is

Solution:

Correct Answer : 24

Let the sides of the triangle be a, b and c, where a is the perpendicular side, b is the base and c is the length of the hypotenuse.
a + b + c = 24   ... (i)
(a + b − c)/2 = Radius = 2 ⇒ a + b − c = 4   ... (ii)
a^2 + b^2 = c^2 ... (iii)
Solving (i), (ii) and (iii), we get a = 6 or 8, b = 8 or 6 and c = 10.
Hence, the area of the triangle is = 1/2 × 6 × 8 = 24 cm^2.

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Q.15 [11831809]

Zubin invests equal amount of money at the same fixed rate of annual interest under simple interest as well as under compound interest. If the simple interest accrued at the end of the third year is Rs.1,200 and the compound interest accrued at the end of the third year is Rs.1,324, then the rate of interest per annum is

1 ◯ 8%

2 ◯ 10%

3 ◯ 12%

4 ◯ 20%

Solution:

Correct Answer : 2

Let the amount invested by Zubin be Rs. P and r% be the rate of interest.
Then, $1200 = 3Pr/100 \Rightarrow Pr = 40000$ ... (i)

And $P\left(1+\dfrac{r}{100}\right)^3 - P = 1324$ ... (ii)

From option (2), using r = 10% in (i) and (ii), we get
From (i), P = Rs.4,000

From (ii), $P\left(1+\dfrac{10}{100}\right)^3 - P = 1324$

$\Rightarrow P \times 1.331 - P = 1324 \Rightarrow P = Rs.4,000$
Hence, the required rate of interest is 10%.

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Q.16 [11831809]

Gabbar and Sambha can finish some work in 20 days, Sambha and Kalia can finish the same work in 35 days and Gabbar, Sambha and Kalia can together finish the same work in 14 days, then Sambha alone will take how many days to finish the same work?

Solution:

Correct Answer : 140

Let the total work be LCM (20, 35, 14) = 140 units.
Work done in a day by:
Gabbar and Sambha = 7 units; Sambha and Kalia = 4 units; Gabbar, Sambha and Kalia = 10 units
So in one day, work done by Kalia = 10 − 7 = 3 units and by Sambha = 1 unit
Hence, Samba alone can finish the work in 140/1 = 140 days.

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Q.17 [11831809]

If $x_1 = 1.385$ and $x_n = x_{n-1} \times (-1)^{n-1}$, n = 2, 3, 4, ... , then x_{2000} is equal to

1 ○ 1.385

2 ○ −1.385

3 ○ 0.385

4 ○ −2.385

Solution:

Correct Answer : 1

The given sequence is $x_n = x_{n-1} \times (-1)^{n-1}, x_1 = 1.385$.

$x_2 = x_1 \times (-1)^1 = -1.385$

$x_3 = x_2 \times (-1)^2 = -1.385$

$x_4 = x_3 \times (-1)^3 = 1.385$

$x_5 = x_4 \times (-1)^4 = 1.385$

$x_6 = x_5 \times (-1)^5 = -1.385$

$x_7 = x_6 \times (-1)^6 = -1.385$

$x_8 = x_7 \times (-1)^7 = 1.385$

...

Therefore, the pattern is $+, -, -, +; ...$
Hence, $x_{2000} = 1.385$.

Q.18 [11831809]

A man jogs at speeds of 1 kmph, 2 kmph, 2 kmph, 3 kmph, 6 kmph, 6 kmph and 12 kmph for seven consecutive days, respectively. The duration for which he jogs for the first three days is one third the durations for which he jogs for the next 3 days. The duration for which he jogs on the last day is twice the duration for which he jogs on the first day. His average speed (in kmph) for the entire week is the integer closest to _____.

1 ○ 6

2 ○ 4

3 ○ 5

4 ○ 16

Solution:

Correct Answer : 3

Let the time for the first three days be x hours, for the next three days be 3x hours and for the last day be 2x hours.
Distances covered on seven consecutive days will be, x, 2x, 2x, 9x, 18x, 18x and 24x km.
Total distance = 74x km
Total time = x + x + x + 3x + 3x + 3x + 2x = 14x hours
Hence, average speed = 74/14 ≈ 5.285 ≈ 5 km/hr.

Q.19 [11831809]

In how many ways can an experiment with more than two elements be performed using Sodium, Calcium, Helium, Neon, Argon, Krypton, Xenon and Radon such that Krypton is always chosen while any two of Sodium, Helium and Xenon are never together?

1 ○ 44

2 ○ 56

3 ○ 93

4 ○ 105

Solution:

Correct Answer : 2

🔍 **Answer key/Solution**

Out of the 8 elements Krypton is always there. From the remaining 7 we cannot select more than one out of Sodium,
Helium and Xenon, so we have either one or none selection out of these 3.
Case 1: None of Sodium, Helium and Xenon is selected.
Elements which can be selected are Calcium, Neon, Argon and Radon.
Elements can be selected in the following number of ways = $^4C_2 + {}^4C_3 + {}^4C_4 = 11$.
Case 2: Any one of Sodium, Helium and Xenon are selected.
Other elements which can be selected are Calcium, Neon, Argon and Radon.
Elements can be selected in the following number of ways = $({}^4C_1 + {}^4C_2 + {}^4C_3 + {}^4C_4) \times {}^3C_1 = 45$.
Hence, total number of ways = 11 + 45 = 56.

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Q.20 [11831809]

If $f(x) = x^2 + 8x + 12$ and $g(x) = x^2 + 2x - 24$, then $\dfrac{f(x)}{g(x)}$ is non negative if and only if

1 ○ $-\infty < x \leq -2$ or $4 \leq x < \infty$

2 ○ $-\infty < x < -6$ or $-6 < x \leq -2$ or $4 \leq x < \infty$

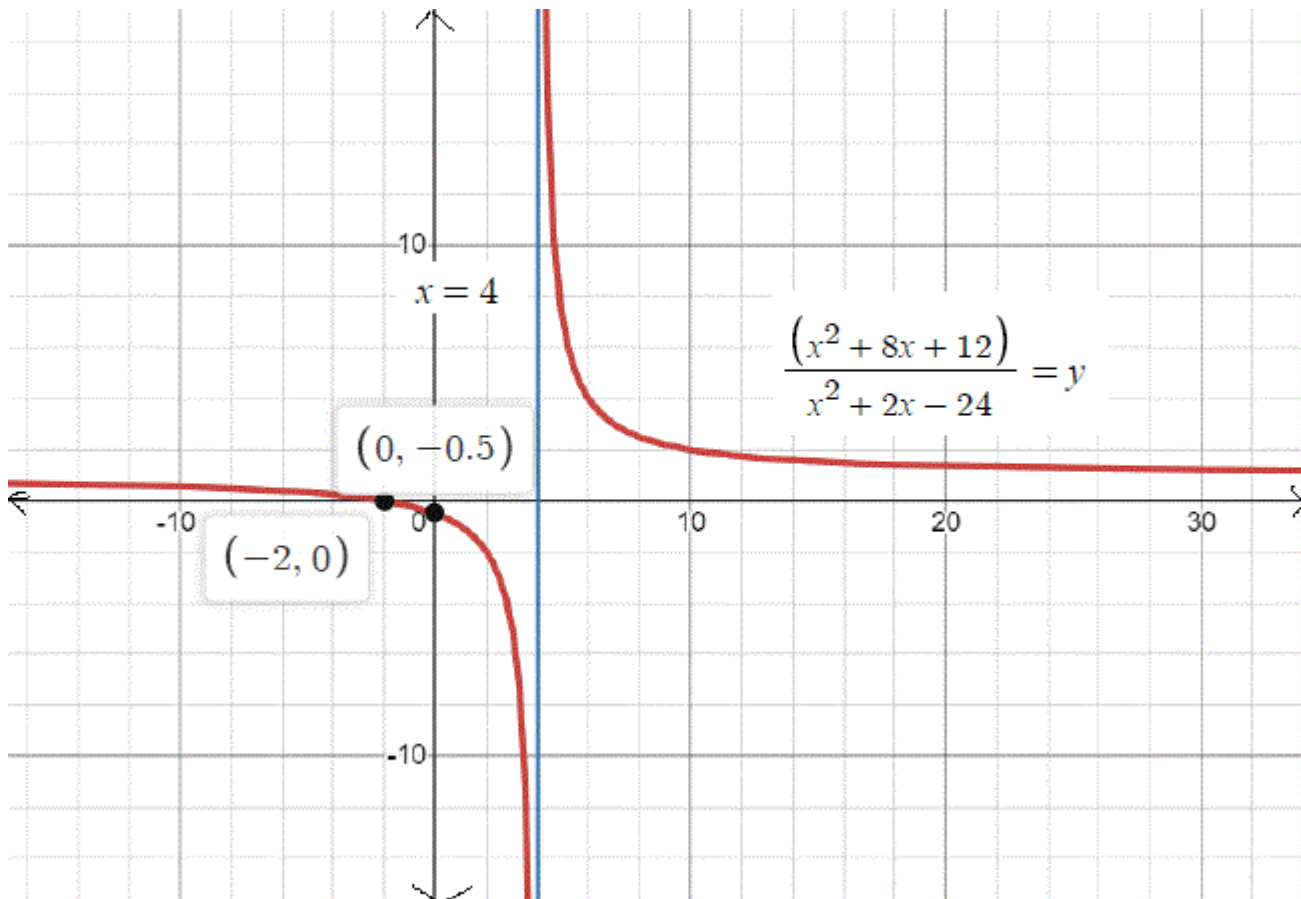3 ○ $-\infty < x \leq -2$ or $4 < x < \infty$

4 ○ $-\infty < x < -6$ or $-6 < x \leq -2$ or $4 < x < \infty$

Solution:

Correct Answer : 4

The graph of f(x)/g(x) is:

On the graph: $x = 4$, $(0, -0.5)$, $(-2, 0)$

$$\frac{\left(x^2 + 8x + 12\right)}{x^2 + 2x - 24} = y$$

f(x)/g(x) = [(x + 6)(x + 2)/(x + 6)(x − 4)] = (x + 2)/(x − 4) ≥ 0
The values that x can take are:
−∞ < x < −6 or −6 < x ≤ −2 or 4 < x < ∞

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Q.21 [11831809]

A right angled triangle ABC is right angled at B and ∠BCA = 5∠BAC. D is a point on AB such that D is twice the distance from C than its shortest distance from the side AC. What is the measure of the ∠ADC (in degrees)?

1 ⃝ 105

2 ⃝ 120

3 ⃝ 135
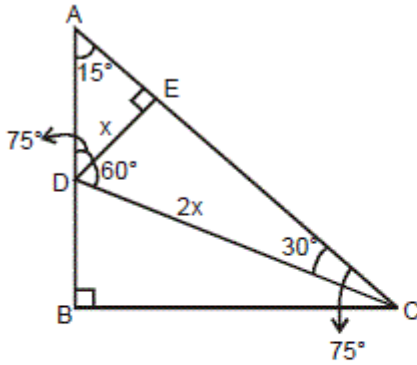
4 ⃝ 75

Solution:

Correct Answer : 3

Let the perpendicular from D meet AC at E. We know that DE is x units and DC is 2x units.
So ∠DCA will be 30°. (sin 30° = x/2x = 1/2).
Hence, ∠CDE is 60°.
In triangle ABC ∠A is 15° and ∠C is 75°. (from the given information)
In triangle ADE ∠A is 15°, ∠E is 90°.
So ∠D is 75°.
Hence, ∠ADC = ∠CDE + ∠ADE = 60° + 75° = 135°.

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Q.22 [11831809]

The perfect squares are divided into groups as (1), (4, 9, 16, 25), (36, 49, 64, 81, 100, 121, 144, 169, 196) … and so on. Then the sixth perfect square in the eleventh group is

1 ○ 152881

2 ○ 36100

3 ○ 152100

4 ○ 153664

Solution:

Correct Answer : 1

The number of elements in each group follows the series of squares of natural numbers.
The sum of elements in the first ten sets is n(n + 1)(2n + 1)/6 = 10(10 + 1)(2 × 10 + 1)/6 = 385.
So the 6th element in the 11th set is 391^2.
Hence, the required value = 391 × 391 = 152881.

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