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Prime CAT 07 2022 QA

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Qs Analysis (QsAnalysis.jsp?sid=aaaN5tjtX0b7WgArBjowyMon Jan 09 00:01:28 IST 2023&qsetId=lmn4k2yhqzk=&qsetName=Prime CAT 07 2022 QA)

Video Attempt / Solution (VideoAnalysis.jsp?sid=aaaN5tjtX0b7WgArBjowyMon Jan 09 00:01:28 IST 2023&qsetId=lmn4k2yhqzk=&qsetName=Prime CAT 07 2022 QA)

Solutions (Solution.jsp?sid=aaaN5tjtX0b7WgArBjowyMon Jan 09 00:01:28 IST 2023&qsetId=lmn4k2yhqzk=&qsetName=Prime CAT 07 2022 QA)

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Section-1

Sec 1

Q.1 [11831809]

ABC is a triangle. Points D, E and F are midpoints of AB, AC and BC respectively. Points P, Q and R are midpoints of DE, DF and EF respectively. The ratio of the area of parallelogram BDEF to that of triangle PQR is

1 ◯ 8 : 1

2 ◯ 4 : 1

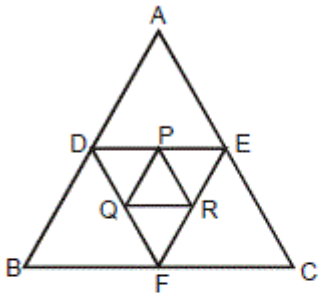
3 ◯ 6 : 1

4 ◯ 16 : 1

Solution:

Correct Answer : 1

Answer key/Solution



Let area of triangle ABC be x.

Then, area of parallelogram BDEF = $2 \times \frac{x}{4} = \frac{x}{2}$

Area of triangle PQR = $\frac{1}{4} \times \frac{x}{4} = \frac{x}{16}$

Hence, required ratio = $\frac{x}{2} : \frac{x}{16} = 8 : 1$.

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Q.2 [11831809]

If $\log_{\left(\frac{x+5}{3}\right)} 3 = \log_{\left(\frac{-1}{x+1}\right)} 3$, then x^2 equals:

1 ◯ 4

2 ◯ 9

3 ◯ 16

4 ◯ Either (1) or (3)

Solution:
Correct Answer : 3

Answer key/Solution

$\log_{\left(\frac{x+5}{3}\right)} 3 = \log_{\left(\frac{-1}{x+1}\right)} 3$

$\Rightarrow \frac{x+5}{3} = \frac{-1}{x+1},\ x+5>0,\ \frac{x+5}{3} \neq 1$

$\Rightarrow (x+5)(x+1) = -3,\ x > -5,\ x \neq -2$

$\Rightarrow x^2 + 6x + 8 = 0,\ x > -5, x \neq -2$

$\Rightarrow x = -2, -4,\ x > -5,\ x \neq -2$

Therefore, $x = -4$
Hence, $x^2 = 16$.

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Q.3 [11831809]

Meera and Neeta have a certain number of candies with them. Meera gave Neeta two-thirds of her candies and Neeta later returned two-thirds of the candies that she had to Meera. This is called a dealing and it is seen that after any whole number of such dealings the ratio of the number of candies with Meera and Neeta is always the same and nobody eats the candies in between. If Meera initially has 96 candies more than Neeta, then how many candies did Meera initially have?

Solution:
Correct Answer : 144

Answer key/Solution

Let the number of candies with Meera and Neeta be x and y respectively.
After the first dealing we can represent the number of candies with Meera as follows:

$x/3 + (y + 2x/3) \times \frac{2}{3} = (7x + 6y)/9$

Since the ratio of candies with them is same after any number of dealings and the total number of candies with both is also the same, it means that the number of candies with Meera after any number of dealings is equal to the initial number of candies with her.
So $(7x + 6y)/9 = x \Rightarrow x = 3y$
According to the question: $3y - y = 96 \Rightarrow y = 48$.
Hence, Meera had $(3 \times 48 =)$ 144 candies initially.

Alternate solution:
Let the number of candies with Meera be x then,
$96/x = 2/3$
$\Rightarrow x = 144$.

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Q.4 [11831809]

Eight points are marked on a straight line and seven points are marked on another line which is parallel to the first. The number of straight lines, including these two, can be formed with these points is

1 ◯ 54

2 ◯ 56

3 ◯ 58

4 ◯ 60

Solution:
Correct Answer : 3

Answer key/Solution

The required number of straight lines = $^{15}C_2 - {}^{8}C_2 - {}^{7}C_2 + 1 + 1 = 105 - 28 - 21 + 1 + 1 = 58$.

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Q.5 [11831809]

Let f(n) be a function defined as f(n + 2) = f(n + 1) + f(n) for all positive real values of 'n'. If f(1) = f(2) = 1, then find the highest common factor of f(8) and f(12).

1 ◯ 1

2 ◯ 2

3 ◯ 5

4 ◯ 3

Solution:
Correct Answer : 4
Given: f(1) = f(2) = 1
f(3) = 2, f(4) = 3, f(5) = 5, f(6) = 8, f(7) = 13, f(8) = 21, f(9) = 34, f(10) = 55, f(11) = 89 and f(12) = 144.
Hence, HCF (f(8), f(12)) = HCF(21, 144) = 3.

Answer key/Solution

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Q.6 [11831809]

To do a certain task Bihaan would take twice as long as Armaan and Rehmaan together; and Rehmaan would take 3 times as long as Armaan and Bihaan together. Three of them together can complete the task in 14 hours. How much time (in hours) is taken by Bihaan and Rehmaan to complete the task?

Solution:
Correct Answer : 24

Answer key/Solution

Let us represent the efficiency of Armaan, Bihaan and Rehmaan by A, B and R respectively.
According to the question,
B/(A + R) = 1/2 ... (i)
R/(A + B) = 1/3 ... (ii)
To equate the ratio in the above equations, let us multiply (i) by 2 and (ii) by 3.
We get, A : B : R = 5 : 4 : 3.
Total work done per hour = 5 + 4 + 3 = 12 units
In 14 hours, work completed = 12 × 14 = 168 units (total task)
Hence, time taken by Bihaan and Rehmaan to complete the task = 168/(4 + 3) = 24 hours.

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Q.7 [11831809]

A racing track is of length 60 m. Abhi and Bala enter a 360 m race starting simultaneously at one end of the track at speeds 4 m/s and 6 m/s respectively. How many times will they meet while running in opposite directions before Bala finishes the race?

Solution:
Correct Answer : 4

Answer key/Solution

Let the starting and end points of the racing track be A and B respectively.
Time taken by Abhi from point A to B = 60/4 = 15 seconds
And time taken by Bala from point A to B = 60/6 = 10 seconds
So between 10 seconds and 15 seconds they will meet once.
The table can be shows the times when Abhi and Bala would be at end points.

Abhi		Bala	
Time (in sec)	Position	Time (in sec)	Position
15	B	10	B
30	A	20	A
45	B	30	B
60	A	40	A
75	B	50	B
90	A	60	A

The table can be shows the time slots from 0 to 60 seconds.

Time (in sec)	Abhi	Bala	Meeting points
0 to 10	A to B	A to B	
10 to 15	A to B	B to A	Yes
15 to 20	B to A	B to A	
20 to 30	B to A	A to B	Yes
30 to 40	A to B	B to A	Yes
40 to 45	A to B	B to A	
45 to 50	B to A	A to B	Yes
50 to 60	B to A	B to A	

Hence, they will meet 4 times while running in opposite directions before Bala finishes the race.

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Q.8 [11831809]

In a local train from station A to station B, the passengers traveling in Tiers I, II and III are in the ratio 3 : 7 : 8 and the rates for each class are in the ratio 5 : 4 : 2. If the total monthly income from this train is Rs. 54,280, then find the annual income (in Rs.) of this train from Tier II.

Solution:
Correct Answer : 309120

Answer key/Solution

The passengers travelling in tiers I, II and III are 3x, 7x and 8x respectively.
The rate of each class is 5y, 4y and 2y respectively.
Total monthly income from this train is Rs. 54,280.
$15xy + 28xy + 16xy = 54280 \Rightarrow xy = 920$
Hence, annual income from tier II = $12 \times 28xy = 12 \times 28 \times 920$ = Rs. 3,09,120.

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Q.9 [11831809]

Rajesh, a fruit seller, had 2 boxes each containing 60 Alphonso mangoes. From the first box he sold 48 mangoes at a profit of 30% and 12 mangoes at a profit of 25%. He sold all the mangoes in the second box at a profit of 24% and his profit was reduced by Rs.450 when compared to the first box. What is the cost price (in Rs.) of a dozen mangoes?

1 ◯ 1,500

2 ◯ 1,800

3 ◯ 1,750

4 ◯ 2,400

Solution:

Correct Answer : 2

Answer key/Solution

Profit on the first box of mangoes = (48 × 30 + 12 × 25)/60 = 29%
Given that (29 – 24) = 5% = Rs.450
Total CP of one box of mangoes = 450 × 100/5 = Rs.9,000
Hence, CP of a dozen mangoes = 150 × 12 = Rs.1,800.

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Q.10 [11831809]

Two trains A and B are moving in opposite directions with speeds in the ratio 5 : 7. Train A crosses a pole in 20 seconds and Train B crosses the same pole in 8 seconds. What is the time (in seconds) in which they can completely cross each other?

Solution:

Correct Answer : 13

Answer key/Solution

Let the speed of trains A and B be 5x and 7x respectively.
Then, length of train A = 20 × 5x = 100x and length of train B = 8 × 7x = 56x

Hence, the time taken to cross each other = $\frac{156}{12}$ = 13 seconds.

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Q.11 [11831809]

ABCDEF is a regular hexagon inscribed inside a circle. If the shortest diagonal of the hexagon is of length √3 cm, then find the area (in sq. cm) of the circle outside the hexagon.

1 ◯ $\pi-\frac{2}{\sqrt{3}}$

2 ◯ $\pi-\frac{3\sqrt{3}}{2}$

3 ◯ $\pi-\frac{\sqrt{3}}{2}$

4 ◯ $2\pi-\frac{2}{\sqrt{3}}$

Solution:

Correct Answer : 2

Answer key/Solution

Let the side of the regular hexagon be a.

Then, length of shortest diagonal = $\sqrt{3}a$

$\Rightarrow \sqrt{3} = \sqrt{3}a$

$\Rightarrow a = 1$ cm

So, radius of the circle = 1 cm

Hence, required area = Area of circle – Area of regular hexagon

$= \pi \times 1^2 - 6 \times \frac{\sqrt{3}}{4} \times 1^2 = \left(\pi - \frac{3\sqrt{3}}{2}\right)$ sq. cm.

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Q.12 [11831809]

In preparing a meal for 12 people, a chef uses 2 kg of potatoes, 3 cauliflowers weighing 1/2 kg each, 1320 grams of bread and 1 kg of cheese. One-fourth of the weight of the material is lost in preparation and cooking. If 2 people leave the meal and the rest consume all the meal, then how much more average weight of the meal in grams (to the nearest integer) each of the remaining persons consumes?

1 ◯ 73

2 ◯ 82

3 ◯ 63

4 ◯ 71

Solution:

Correct Answer : 1

Answer key/Solution

For 12 people, weight of food used (in g) is = 2000 + 1500 + 1320 + 1000 = 5820 g
One-fourth of the weight of the material is lost in preparation and cooking.
So weight of remaining food = 5820 × 3/4 = 4365 g
Since 2 people leave, remaining 10 people consume = 4365 g
Hence, required answer = 4365/10 – 4365/12 = 436.5 – 363.75 = 72.75 or 73 g.

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Q.13 [11831809]

The arithmetic mean of 1/a and 1/b is A and the geometric mean of a and b is G. If G : 1/A = 5 : 4, then the ratio of b : a can be

1 ◯ 1 : 2

2 ◯ 1 : 3

3 ◯ 4 : 3

4 ◯ 4 : 1

Solution:

Correct Answer : 4

Answer key/Solution

$A = \frac{\frac{1}{a}+\frac{1}{b}}{2} = \frac{b+a}{2ab}$ and $G = \sqrt{ab}$

So, $\frac{G}{\frac{1}{A}} = \frac{5}{4} = \frac{AG}{1} = \frac{5}{4} \Rightarrow \frac{\frac{b+a}{2ab} \times \sqrt{ab}}{1} = \frac{5}{4}$

$\Rightarrow 2(b + a) = 5(ab)^{1/2}$

$\Rightarrow 4(b^2 + a^2 + 2ab) = 25ab$

$\Rightarrow 4a^2 – 17ab + 4b^2 = 0$

$\Rightarrow (4a – b)(a – 4b) = 0$

So, 4a – b = 0 or a – 4b = 0
Hence, b : a = 4 : 1 or 1 : 4.

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Q.14 [11831809]

Three workers A, B and C are appointed to do a job. They started the job together but C leaves after 4 days when 44% of the job is done. The remaining job is completed by A and B in 8 days. Find the number of days required by C to complete the entire job alone?

Solution:

Correct Answer : 25

Answer key/Solution

Let x, y and z units be the work done by A, B and C respectively in one day.
Let total work done be 100 units.
Then, 4(x + y + z) = 44 units
⇒ x + y + z = 11 units
And 8(x + y) = 56 units
⇒ x + y = 7 units
Therefore, z = 4 units
Hence, C alone will take 100/4 = 25 days to complete the entire job.

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Q.15 [11831809]

At Gokul Dairy farm the manager mixes milk and water in the ratio 4 : 7 in a can. However after mixing, he feels that the customers might not approve of such high levels of dilution so he removes 12 liters of the mixture and adds equivalent quantity of pure milk. Finally the ratio of milk and water when tested is 7 : 4. How many liters of mixture was there initially in the can?

1 ◯ 28

2 ◯ 30

3 ◯ 45

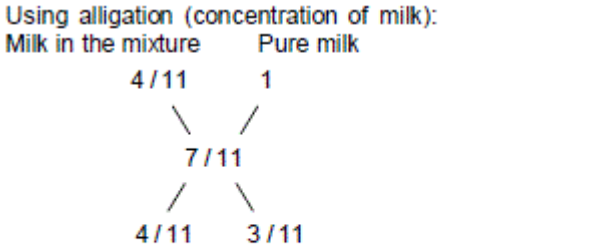
4 ◯ 35

Solution:

Correct Answer : 1

Answer key/Solution

Using alligation (concentration of milk):



Ratio = 4 : 3
3 in the ratio corresponds to 12 liters.
4 in the ratio will correspond to 16 liters
Hence, total capacity of the tank = 12 + 16 = 28 liters.

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Q.16 [11831809]

Let $ax^2 + bx + c = 0$ be a quadratic equation, where a, b and c are rational numbers and $a \neq 0$. If one of the roots of the equation is $(1 + \sqrt{2})$, then bc/a^2 is

1 ◯ 1/2

2 ◯ 1

3 ◯ 2

4 ◯ 4

Solution:

Correct Answer : 3

Answer key/Solution

The given equation is $ax^2 + bx + c = 0$.
Since one root of the equation is $(1 + \sqrt{2})$
Other root of the equation will be $(1 - \sqrt{2})$.

So, sum of roots = $-\frac{b}{a} = (1+\sqrt{2}) + (1-\sqrt{2}) = 2$

$\Rightarrow b = -2a$

and product of roots = $\frac{c}{a} = (1+\sqrt{2})(1-\sqrt{2}) = 1 - 2 = -1$

$\Rightarrow c = -a$

Hence, $\frac{bc}{a^2} = \frac{(-2a)(-a)}{a^2} = 2.$

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Q.17 [11831809]

Let 10 < N < 1000 be a natural number. P denotes the product of the digits of N. S denotes the sum of the digits of N. If 3P + 2S = 2N, then how many values can N take?

1 ◯ 9

2 ◯ 10

3 ◯ 11

4 ◯ More than 11

Solution:

Correct Answer : 3

Answer key/Solution

Case 1: Let N = 10a + b (11 to 99), then

3ab + 2(a + b) = 2(10a + b)

⇒ 3ab + 2a + 2b = 20a + 2b

⇒ a(6 – b) = 0

⇒ b = 6, and a = 1 to 9

Case 2: Let N = 100a + 10b + c (100 to 999), then

3abc + 2(a + b + c) = 2(100a + 10b + c)

⇒ 3abc + 2a + 2b + 2c = 200a + 20b + 2c

⇒ 3abc = 198a + 18b

⇒ abc = 66a + 6b. Divide by a since a is definitely not equal to zero.

$\Rightarrow bc = 66 + 6\left(\frac{b}{a}\right)$, possible pairs of (b,c) = (8,9), (9,8) and (9,9).

For (8,9), (9,8), bc = 72 and $\frac{6b}{a} = 6 \Rightarrow \frac{b}{a} = 1 \Rightarrow b = a$.

For (9, 9), bc = 81 and $\frac{6b}{a} = 15 \Rightarrow \frac{b}{a} = \frac{5}{2} \Rightarrow a = 3.6$ (Not possible)

Hence, total number of values of N = 9 + 2 = 11.

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Q.18 [11831809]

Harsh bought a flat that cost him Rs.25 lakh, which depreciated at 20% in the first year, 15% in the second year and 10% in the third year. He also bought a plot of land that cost him Rs.30 lakh that appreciated at the rate of 12% in the first year, 14% in the second year and 16% in the third year. What was the change in total value of the flat and plot of land at the end of three years?

1 ◯ Decrease of Rs. 44,543

2 ◯ Increase of Rs. 4,73,264

3 ◯ Increase of Rs. 5,73,212

4 ◯ Decrease of Rs. 3,72,654

Solution:

Correct Answer : 2

Answer key/Solution

Original value of flat and plot = 25 + 30 = Rs.55 lakh

New value of flat = 25 × 0.80 × 0.85 × 0.90 = Rs.15.3 lakh

New value of plot = 30 × 1.12 × 1.14 × 1.16 = Rs. 44.43264 lakh

∴ Total new value = 15.3 + 44.43264 = Rs.59.73264 lakh

Hence, change in value = 59.7324 – 55 = Increase of Rs. 4.73264 lakh.

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Q.19 [11831809]

The sides of a parallelogram are 7x – 2 and 5x + 6. It has a perimeter of 56 cm and an area of 96 sq. cm. The value of the obtuse angle (in degrees) between its sides is

1 ◯ 150

2 ◯ 120

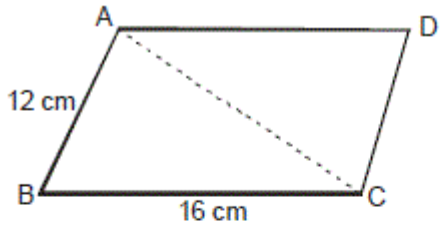
3 ◯ 100

4 ◯ 135

Solution:

Correct Answer : 1

Answer key/Solution



Perimeter of the parallelogram = 56 sq. cm

$\Rightarrow 2(7x - 2 + 5x + 6) = 56$

$\Rightarrow 24x + 8 = 56$

$\Rightarrow x = 2$

So, sides of the parallelogram are 12 cm and 16 cm.

Area of triangle ABC = $\frac{1}{2} \times 96$

$\Rightarrow \frac{1}{2} \times 12 \times 16 \sin\theta = \frac{1}{2} \times 96 \Rightarrow \sin\theta = \frac{1}{2}$

So, $\theta = 30°$ or $150°$

Hence, required obtuse angle is 150°.

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Q.20 [11831809]

Let $a_n = \frac{a_{n-2} \times a_{n-1}}{2a_{n-2} - a_{n-1}}$ for $n \geq 3$ and $a_1 = 1, a_2 = \frac{3}{7}$. If $\frac{a_{14}a_{16}a_{19}}{a_4a_7a_9} = \frac{p}{q}$ such that p and q are natural numbers coprime to each other, then what is the value of p + q?

Solution:
Correct Answer : 58

Answer key/Solution

$a_1 = 1, a_2 = \frac{3}{7}, a_3 = \frac{3}{11}, a_4 = \frac{3}{15}, a_5 = \frac{3}{19}, a_6 = \frac{3}{23}, \ldots$

Clearly, $a_n = \frac{3}{4n-1}$

$$\therefore \frac{a_{14}a_{15}a_{19}}{a_4a_7a_9} = \frac{\frac{3}{55} \times \frac{3}{63} \times \frac{3}{75}}{\frac{3}{15} \times \frac{3}{27} \times \frac{3}{35}}$$

$$= \frac{15 \times 27 \times 35}{55 \times 63 \times 75}$$

$$= \frac{3}{55}$$

Hence, p + q = 3 + 55 = 58.

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Q.21 [11831809]

Siddhi deposited Rs. 1,20,000 in a bank which paid 10% compound interest for 2 years. Then after 2 years, she started a business with the amount received along with Riddhi, who joined with a capital of Rs.1.32 lakh. Siddhi invested for 6 months and left whereas Riddhi invested for the whole year. What will be the ratio of their profits at the end of the year?

1 ◯ 11 : 20

2 ◯ 12 : 17

3 ◯ 121 : 130

4 ◯ 13 : 19

Solution:
Correct Answer : 1

Answer key/Solution

Capital of Siddhi = Rs.1.2 lakh ; Rate of Interest = 10% ; Time = 2 years
Amount invested = $1.2 (1 + 10/100)^2 = 1.2 \times 1.21$ = Rs. 1.452 lakh
Investment of Siddhi in the business = Rs.1,45,200
Investment of Riddhi in the business = Rs.1,32,000
Hence, ratio of their profits = $145200 \times 6 : 132000 \times 12 = 11 : 20$.

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Q.22 [11831809]

The number of integral values of x satisfying the inequality $|6x - 9| < 15 - 4x$ is:

Solution:

Correct Answer : 5

Answer key/Solution

$|6x - 9| < 15 - 4x$
Or, $-(15 - 4x) < 6x - 9 < (15 - 4x)$
Or, $4x - 15 < 6x - 9 < 15 - 4x$
$4x - 15 < 6x - 9$
Or, $-6 < 2x$
Or, $-3 < x$
$6x - 9 < 15 - 4x$
Or, $10x < 24$
Or, $x < 2.4$.
Hence, the number of integer values of x are –2, –1, 0, 1 and 2.

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