Prime CAT 06 2022 QA



Section-1

## Sec 1

**Q.1 [11831809]**

Sequence A is defined as $A_n = A_{n-1} + 6$, $A_2 = 15$ and sequence B is defined as $B_n = B_{n-1} - 7$, $B_4 = 106$. If $A_k > B_k$, then find the smallest value that k can take.

1 ◯ 13

2 ◯ 10

3 ◯ 7

4 ◯ 11

**Solution:**
**Correct Answer : 4**

Answer key/Solution

$A_n = A_{n-1} + 6$ and $A_2 = 15$
So, $A_3 = 21$, $A_4 = 27$, ...., $A_{10} = 63$, $A_{11} = 69$, $A_{12} = 75$,...
$B_n = B_{n-1} - 7$ and $B_4 = 106$
So, $B_5 = 99$, $B_6 = 92$,...,$B_{10} = 64$, $B_{11} = 57$,...
Hence, for smallest value of k = 11, $A_k > B_k$.

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**Q.2 [11831809]**

Ramesh starts from city A towards city B in his car at a certain speed. Due to a broken road 50 km away from city A, the speed of his car decreased to 3/5 of the original speed. Because of this, Ramesh reached city B late by 1 hour 40 minutes. Had the broken road been 100 km away from city A and since then he would have maintained 3/5 of the original speed, he would have reached city B late by 1 hour. What was the original speed (in km/h) of his car?

1 ◯ 25

2 ◯ 50

3 ◯ 80

4 ◯ 100

**Solution:**
**Correct Answer : 2**

Answer key/Solution

Let the distance between city A and city B be (50 + x) km and the original speed of his car be s km/h.

Then, $\frac{(x+50)}{s} + \frac{5}{3} = \frac{50}{s} + \frac{5x}{3s}$ ... (i)

$\frac{(x+50)}{s} + 1 = \frac{100}{s} + \frac{5(x-50)}{3s}$ ... (ii)

Subtracting (ii) from (i), we get

$\frac{2}{3} = -\frac{50}{s} + \frac{250}{3s} \Rightarrow s = 50$ km/h.

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**Q.3 [11831809]**

A scientist knows that the maximum amount of a solute that can be dissolved in 100 g of water is 20 g. If more solute is added it remains undissolved and settles down. It is known that water evaporates at the rate of 280 g/hour from 1 kg of the mixture which contains 5% solute. If the scientist starts boiling the mixture, after how much time (in hours) will the solute start depositing at the base?

**Solution:**

Answer key/Solution

**Correct Answer : 2.5**

**Depositing at the base will start when the ratio of solute to water becomes 20 : 100 or 1 : 5.**

**Now in 1000 g of solution, quantity of solute = 5% of 1000g = 50 g and the remaining 950g is water.**

**Depositing at the base will start when ratio becomes 1 : 5 or when 50 g of solute is dissolved in 250g of water.**

**Quantity of water that needs to be evaporated = 950 – 250 = 700gv Hence, time taken to evaporate 700 g water = 700/280 = 2.5 hours.**

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**Q.4 [11831809]**

Annual income of Adam is Rs.2,00,000 and he saves Rs.40,000 annually. Savings up to 15% of the income are exempted from the tax and rest of the savings are charged at the rate of 5% tax. On the remaining income, tax is calculated at 10% up to Rs.1,00,000 and 20% for the rest of the income. What is the annual tax (in Rs.) paid by Adam?

**Solution:**

Answer key/Solution

**Correct Answer : 22500**

**As 15% of income = Rs. 30,000**

**Therefore, taxable savings = Rs. 10,000 and Tax incurred = 10,000 × 0.05 = Rs.500**

**Now of the remaining income 10% charged first on Rs. 1,00,000. Therefore, tax is Rs. 10,000 and 20% charged on remaining Rs. 60,000. So, tax is Rs. 12,000.**

**Hence, total tax = 500 + 10,000 + 12,000 = Rs.22,500.**

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**Q.5 [11831809]**

If points A, B, C and D are on the circumference of a circle of radius 4 cm such that ABC is an equilateral triangle and AD is a diameter of the circle, then BD + AC (in cm) is

1 ○ $4(1 + \sqrt{3})$

2 ○ $8(1 - \sqrt{3})$

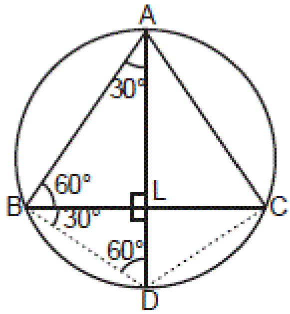
3 ○ $8(1 + \sqrt{3})$

4 ◯ 4(1 − √3)

**Solution:**

**Correct Answer : 1**

Answer key/Solution




Diameter, AD = 4 + 4 = 8 cm
Since ABC is an equilateral triangle.
So AB = BC = AC
Then, in triangle ABD,

$\frac{AB}{AD} = \sin 60°$

$\Rightarrow \frac{AB}{8} = \frac{\sqrt{3}}{2} \Rightarrow AB = 4\sqrt{3}$ cm

Also, $\frac{BD}{AD} = \cos 60°$

$\Rightarrow \frac{BD}{8} = \frac{1}{2} \Rightarrow BD = 4$ cm

Hence, BD + AC = $4 + 4\sqrt{3} = 4\left(1+\sqrt{3}\right)$ cm.

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**Q.6 [11831809]**

Tara, Mira and Sara completed some work together in 30 days and received a total payment of Rs. 45,000. Tara took one-fifth of the total money, Mira took one-third and Sara took the remaining. In how many days could Tara and Sara complete the work if Mira was not working?

1 ◯ 52 days

2 ◯ 45 days

3 ◯ 56 days

4 ◯ 40 days

**Solution:**
**Correct Answer : 2**

Answer key/Solution

**Tara, Mira and Sara received a total payment of Rs. 45,000, in the ratio of 1/5 : 1/3 : (1 − 1/5 − 1/3 = 7/15) = 3 : 5 : 7.**
**Note, that the efficiencies are in the same ratio as the share received in total amount.**
**So, let Tara, Mira and Sara does 3 units, 5 units, and 7 units of work in a day respectively.**
**Together they do 15 units of work in a day.**
**If they complete the work together in 30 days, total work will be 15 × 30 = 450 units.**
**Tara and Sara will complete 10 units of work in a day.**
**Hence, 450 units of work will be completed in = 450/10 = 45 days.**

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**Q.7 [11831809]**

Let N be a 5-digit number such that the sum of the digits of N is 7 and three of these 5 digits are 0, 1, and 2. How many such numbers are possible?

**Solution:**
**Correct Answer : 100**

Answer key/Solution

**Since 0, 1 and 2 are already three of the digits and sum of the digits must be 7, therefore, possible combination of other two digits are (0, 4), (1, 3), (2, 2).**
**Case I: – (0, 4)**
**3 × 4 × 3 × 2 × 1/2 = 36**
**Case II: – (1, 3)**
**4 × 4!/2! = 48**
**Case III: – (2, 2)**
**4 × 4!/3! = 16**
**Hence, total such numbers = 36 + 48 + 16 = 100.**

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**Q.8 [11831809]**

If $\log_2\left(3+\log_3\left(4+\log_4\left(\frac{1}{2}+\log_{625}(x-2)\right)\right)\right)-2=0$, then the value of 5x is

**Solution:**
**Correct Answer : 11**

Answer key/Solution

$$\log_2\left(3+\log_3\left(4+\log_4\left(\frac{1}{2}+\log_{625}(x-2)\right)\right)\right)-2=0$$

$$\Rightarrow 3+\log_3\left(4+\log_4\left(\frac{1}{2}+\log_{625}(x-2)\right)\right)=4$$

$$\Rightarrow 4+\log_4\left(\frac{1}{2}+\log_{625}(x-2)\right)=3$$

$$\Rightarrow \frac{1}{2}+\log_{625}(x-2)=\frac{1}{4}$$

$$\Rightarrow x-2=(625)^{-\frac{1}{4}}$$

$$\Rightarrow x-2=\frac{1}{5} \Rightarrow 5x = 11.$$

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**Q.9 [11831809]**

The railway ticket for a child costs half the full ticket but the reservation charges are the same for half as well as full ticket. Mr. and Mrs. Sharma along with their 7 years old son purchased three tickets for a journey between two stations and paid a total of Rs.812. If the total cost of the ticket for the child alone is Rs.176, then what are the reservation charges per ticket (in Rs.)?

1 ◯ 24

2 ◯ 34

3 ◯ 36

4 ◯ 28

**Solution:**
**Correct Answer : 2**

Answer key/Solution

**Let the reservation charges be Rs.x and ticket fare be Rs.y.**
**3x + (2y + y/2) = 812 ...(i)**
**x + y/2 = 176 ...(ii)**
**Hence, solving (i) and (ii), we get x = Rs.34.**

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**Q.10 [11831809]**

Number of integer values for which the inequality $(3x - 1)(x - 3) > (2x^2 - 8x + 2)$ does not hold true is/are:

1 ◯ 0

2 ◯ 1

3 ◯ 2

4 ◯ More than 2

**Solution:**
**Correct Answer : 2**

Answer key/Solution

Simplify the inequality:

$(3x - 1)(x - 3) > (2x^2 - 8x + 2)$

or, $3x^2 - 10x + 3 > 2x^2 - 8x + 2$

or, $x^2 - 2x + 1 > 0$

or, $(x - 1)^2 > 0$

At x = 1, the expression will be equal to 0, therefore, for exactly one integral value the inequality doesn't hold.

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**Q.11 [11831809]**

A cube with each side equal to 1600 units is cut into smaller cuboids with identical integral dimensions in such a way that there is no wastage. In how many ways can this be achieved if the smaller cuboids cannot be cubes with equal dimensions?

**Solution:**
**Correct Answer : 9240**

Answer key/Solution

**The length, breadth and height of smaller cuboids must be factors of 1600 units.**
**And 1600 = $2^6 \times 5^2$ (21 factors). Therefore, number of cuboids that can be formed is $21^3$ = 9261.**
**Number of ways in which a cube can be obtained = 21 (since in cube the three dimensions are equal to the same factor.)**
**Hence, number of ways in which smaller cuboids can be achieved is 9261 – 21 = 9240.**

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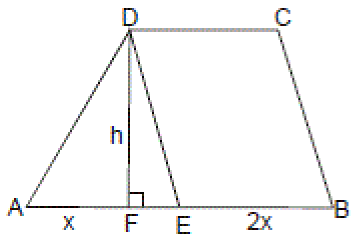
**Q.12 [11831809]**

ABCD is a quadrilateral and AB is parallel to CD. The point E is on AB such that AE : EB : CD = 1: 2 : 2. If the area of triangle ADE is 25 sq. cm, then the area (in sq. cm) of the quadrilateral ABCD is

**Solution:**
**Correct Answer : 125**

🔍 Answer key/Solution




Let AE and EB be x and 2x respectively.

Then, area of triangle ADE = $\frac{1}{2} \times x \times h = 25$

$\Rightarrow xh = 50$ sq. cm
Since EB is parallel to CD and EB = CD.
Therefore, BCDE is a parallelogram.
So, area of parallelogram BCDE = $2x \times h = 2 \times 50 = 100$ sq. cm.
Hence, the area of the quadrilateral ABCD = 25 + 100 = 125 sq. cm.

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**Q.13 [11831809]**
If f(x) + f(x − 1) = $x^2$ for all real values of x such that f(29) = 80, then find f(80).

**Solution:**
**Correct Answer : 3595**

🔍 Answer key/Solution

$$f(x)+f(x-1)=x^2$$

$$\begin{aligned}
f(80) &= 80^2 - f(79) \\
&= 80^2 - 79^2 + f(78) \\
&= \left(80^2 - 79^2\right) + 78^2 - f(77) \\
&= (80+79) + \left(78^2 - 77^2\right) + f(76) \\
&= (80+79) + (78+77) + (76+75) + \ldots + (32+31) + f(30) \\
&= (80+79) + (78+77) + (76+75) + \ldots + (32+31) + \left(30^2 - 80\right) \\
&= 79 + 78 + 77 + 76 + \ldots + 31 + 900 \\
&= \frac{49}{2}(31+79) + 900 = 3595.
\end{aligned}$$

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**Q.14 [11831809]**
Sahil, a merchant, marks up his goods 20% higher than the cost price. If he offers 15% discount on 3/5th of the total goods and 10% discount on 1/4th of the total goods. If Sahil gets an overall profit of 5%, then what percentage of discount should be given by Sahil to customers on the remaining goods?

1 ◯ 9.33%

2 ○ 8.67%

3 ○ 5.33%

4 ○ 6.67%

**Solution:**

**Correct Answer : 4**

Answer key/Solution

Let cost price of Sahil's goods be Rs.x.
Then, marked price of his goods = Rs. 1.2x.
His remaining goods = 1 – 3/5 – 1/4 = 3/20
Let discount percentage on the remaining goods be p%.
Then, according to the question,
$3/5 \times 1.2x \times 0.85 + 1/4 \times 1.2x \times 0.9 + 3/20 \times 1.2x \times (1 - p/100) = 1.05x$
$\Rightarrow 0.612 + 0.27 + 0.18 \times (1 - p/100) = 1.05$
$\Rightarrow (1 - p/100) = 0.9333$
$\Rightarrow p = 6.67\%$.

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**Q.15 [11831809]**

The number of real solutions of the equation $x^2 - 5|x - 1| - 1 = 0$ is

1 ○ 1

2 ○ 2

3 ○ 3

4 ○ 4

**Solution:**
**Correct Answer : 3**

Answer key/Solution

The given equation is $x^2 - 5|x - 1| - 1 = 0$ .
**Case 1:** $x - 1 \geq 0$ i.e., $x \geq 1$
So, $|x - 1| = x - 1$
The equation is $x^2 - 5(x - 1) - 1 = 0$.
$\Rightarrow x^2 - 5x + 4 = 0$
$\Rightarrow (x - 1)(x - 4) = 0$
$\Rightarrow x = 1$ or $x = 4$
Therefore, there are 2 solutions in this case.
**Case 2:** $x - 1 < 0$ i.e., $x < 1$
So, $|x - 1| = -(x - 1)$
The equation is $x^2 + 5(x - 1) - 1 = 0$.
$\Rightarrow x^2 - 5x - 6 = 0$
$\Rightarrow (x - 1)(x + 6) = 0$
$\Rightarrow x = 1$ or $x = -6$
Since $x = 1$ is not valid in this case. Therefore, there is 1 solution in this case.
Hence, 1, 4, −6 are three real solutions of the given equation.

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**Q.16 [11831809]**

Mithilesh calculates his average marks in seven subjects in which maximum marks awarded were 99. By mistake he writes the digits of the scores of two subjects in the reverse order of original marks thereby increasing the average by 9 marks. If the incorrect numbers are in the ratio 8 : 7, what is the total of the original scores in the two subjects?

1 ○ 115

2 ○ 131

3 ○ 123

4 ○ 117

**Solution:**
**Correct Answer : 4**

Answer key/Solution

Let the numbers be “ab” and “xy”.
After they are written in reverse numbers will be “ba” and “yx”.
There is an increase of 9 marks in the average, so the total marks is 63.
As rest of the numbers remain same, the increase is only in the two numbers
So “ba” + “yx “ – “ab” – “xy” = 63
$\Rightarrow$ 10b + a + 10y + x – (10a + b + 10x + y) = 63
$\Rightarrow$ 9 (b – a) + 9 (y – x) = 63
$\Rightarrow$ (b – a) + (y – x) = 7
Hence, the sum of difference of the digits of the two numbers is 7.
Ratio of incorrect number = 8 : 7
Multiplying both 8 and 7 by number like 5, 6, 7, 8, .... etc., we get 12 × 8 = 96 and 12 × 7 = 84,
96 and 84 is the only combination where the sum of the difference of digits is 7.
Hence, the original numbers are 69 and 48 and their sum = 69 + 48 = 117.

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**Q.17 [11831809]**

The ratio of the price of an orange to that of an apple is 5 : 3 whereas the ratio of the weight of an orange to that of an apple is 4 : 1. The weight of a packet of apples is twice the weight of a packet of oranges. If Jia buys 2 packets of apples and 4 packets of oranges such that the price of each kind of packet was an integer, then what total price (in Rs.) she could have paid?

1 ◯ 138

2 ◯ 204

3 ◯ 102

4 ◯ 85

**Solution:**
**Correct Answer : 2**

Answer key/Solution

Let the number of apples and orange in a packet of apples and orange be m and n respectively. Let the weight of an orange and an apple be 4x and x respectively.

$$\Rightarrow \frac{2}{1} = \frac{mx}{4nx}$$

$$\Rightarrow \frac{2 \times 3}{1 \times 5} = \frac{m \times 3}{4n \times 5}$$

$$\Rightarrow \frac{3m}{5n} = \frac{24}{5}$$

Price of 1 packet of apple and orange are 24k and 5k respectively.
Therefore, price of 2 packets of apples and 4 packets of oranges must be 48k + 20k = 68k.
Among the options, option (2) is correct, as it will yield the value of k as 3.

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**Q.18 [11831809]**

Let ABC be a right-angled triangle with in radius 3 cm and circumradius 8 cm. The area (in sq. cm) of the triangle ABC is

1 57

2 56.5

3 57.5

4 58

**Solution:**

**Correct Answer : 1**

Answer key/Solution

In radius, r = 3 cm and circumradius, R = 8 cm (Half of hypotenuse)

$$r = \frac{(a + b - h)}{2}$$

$$\Rightarrow 3 = \frac{(a + b - 16)}{2}$$

$\Rightarrow a + b = 22$ ... (i)

$a^2 + b^2 = 16^2$

$\Rightarrow a^2 + (22 - a)^2 = 16^2$

$\Rightarrow a^2 - 22a + 114 = 0$

Two roots of this equation are a and 22 – a.

Product of roots = 114

Hence, the area of triangle ABC = $\frac{1}{2}$ × Product of roots = 57 sq. cm.

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**Q.19 [11831809]**

Hima and Jaya run a 15 km race on a circular track of length 1500 m. They complete one round in 300 seconds and 600 seconds respectively. After how much time from the start will the faster person meet the slower person for the last time?

1 1 hour

2 1 hour 40 minutes

3 50 minutes

4 40 minutes

**Solution:**
**Correct Answer : 3**

Answer key/Solution

Hima and Jaya complete one round of length 1500 m in 300 seconds and 600 seconds respectively.
Since the race is for 15 km, therefore, both will have to complete 15/1.5 = 10 rounds each.
With every two rounds that Hima completes, Jaya will complete 1 round which implies Hima and Jaya will meet after every two rounds Hima completes.
Therefore, they two meet for the last time after Hima completes her 10th round.
Hence, Hima completes her 10th round in = 10 × (300/60) = 50 minutes.

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**Q.20 [11831809]**

If number of divisors of a natural number n is 15, then number of ordered pairs (n, m) which satisfy the equation $n - m^2 = 44$ where m is a positive integer, is equal to

**Solution:**
**Correct Answer : 1**

Answer key/Solution

Since n has odd number of divisors, therefore, $n = t^2$.

$n - m^2 = 44$

$\Rightarrow t^2 - m^2 = 44$

$\Rightarrow (t-m)(t+m) = 44$

$\Rightarrow (t-m)(t+m) = (1, 44), (2, 22), (4, 11)$

**Case 1:** (1, 44)
t = 45/2, m = 43/2 (not possible)
**Case 2:** (2, 22)
t = 12, m = 10.
**Case 3:** (4, 11)
t = 15/2, m = 7/2 (not possible)
Hence, only one ordered pair is possible.

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**Q.21 [11831809]**

The area of a regular hexagon ABCDEF is equal to the area of an equilateral triangle of side 18 cm. Find the length (in cm) of diagonal AC of the regular hexagon.

1 ◯ 6√2

2 ◯ 9√2

3 ◯ 6√3

4 ◯ 9√3

**Solution:**

**Correct Answer : 2**

Answer key/Solution

Let the side of the regular hexagon ABCDEF be a.

Then, $6 \times \frac{\sqrt{3}}{4} \times a^2 = \frac{\sqrt{3}}{4} \times 18^2$

$\Rightarrow a = 3\sqrt{6}$ cm

$AC^2 = a^2 + a^2 - 2 \times a \times a \times \cos 120°$

$\Rightarrow AC^2 = 3a^2$

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

Hence, diagonal AC = $3\sqrt{6} \times \sqrt{3} = 9\sqrt{2}$ cm.

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**Q.22 [11831809]**

Sumit deposited some money in scheme A, which pays 15% interest per annum compounded annually. If scheme B provides simple interest at the same rate instead of compound interest, he receives Rs. 4,800 as interest after 2 years. Find the total amount (in Rs.) that he received from scheme A after 3 years.

1 ◯ 25,160

2 ◯ 24,334

3 ◯ 21,160

4 ◯ 23,716

**Solution:**

**Correct Answer : 2**

Answer key/Solution

Let the principal be Rs.P

Given that : Prt/100 = 4800 ⇒ P = (4800 × 100)/(15 × 2) = Rs.16,000

Hence, total amount that he received from scheme A after 3 years

= 16000 × 1.15 × 1.15 × 1.15 = Rs.24,334.

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