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Prime CAT 03 2022 QA

Scorecard (procreview.jsp?sid=aaaN5tjtX0b7WgArBjowyMon Jan 09 00:07:49 IST 2023&qsetId=yxz6D/zwlC4=&qsetName=Prime CAT 03 2022 QA)

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Qs Analysis (QsAnalysis.jsp?sid=aaaN5tjtX0b7WgArBjowyMon Jan 09 00:07:49 IST 2023&qsetId=yxz6D/zwlC4=&qsetName=Prime CAT 03 2022 QA)

Video Attempt / Solution (VideoAnalysis.jsp?sid=aaaN5tjtX0b7WgArBjowyMon Jan 09 00:07:49 IST 2023&qsetId=yxz6D/zwlC4=&qsetName=Prime CAT 03 2022 QA)

Solutions (Solution.jsp?sid=aaaN5tjtX0b7WgArBjowyMon Jan 09 00:07:49 IST 2023&qsetId=yxz6D/zwlC4=&qsetName=Prime CAT 03 2022 QA)

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Section-1

Sec 1

Q.1 [11831809]

If $4-\log_4\sqrt{2+a}+3\log_4\sqrt{2-a}=\log_4\frac{1}{\sqrt{4-a^2}}$, then the value of '16a' is

Solution:

Correct Answer : 31

Answer key/Solution

$$4-\log_4\sqrt{2+a}+3\log_4\sqrt{2-a}=\log_4\frac{1}{\sqrt{4-a^2}}$$

$$\Rightarrow 4-\log_4\sqrt{2+a}+3\log_4\sqrt{2-a}=\log_4\left(\frac{1}{\sqrt{2+a}}\times\frac{1}{\sqrt{2-a}}\right)$$

$$\Rightarrow 4-\log_4\sqrt{2+a}+3\log_4\sqrt{2-a}=-\log_4\sqrt{2+a}-\log_4\sqrt{2-a}$$

$$\Rightarrow 4\log_4\sqrt{2-a}=-4$$

$$\Rightarrow \log_4\sqrt{2-a}=\log_4 4^{-1}$$

So, $\sqrt{2-a}=\frac{1}{4}$

$$\Rightarrow 2-a=\frac{1}{16}$$

$$\Rightarrow 16a=31.$$

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Q.2 [11831809]

Two-fifths students are engineering aspirants and the rest are medical aspirants. If 5/16 of the engineering aspirants and 1/4th of the medical aspirants joined the coaching for the exam preparation and the total number of students without coaching is 1305, then 7/10 of the total students exceeds the number of students who are medical aspirants by:

Solution:

Correct Answer : 180

Answer key/Solution

Let the total number of students be x.
Number of engineering aspirants = 2x/5
Number of medical aspirants = 3x/5
Number of students with coaching

$$=\frac{5}{16}\times\frac{2}{5}x+\frac{1}{4}\times\frac{3}{5}x=\frac{x}{8}+\frac{3}{20}x$$

Number of students without coaching

$$=\frac{11}{16}\times\frac{2}{5}x+\frac{3}{4}\times\frac{3}{5}x=\frac{11}{40}x+\frac{9}{20}x$$

$$=\frac{11x+18x}{40}=1305$$

$$\Rightarrow x = 1800$$

Hence, the required number $=\frac{7}{10}\times1800-\frac{3}{5}\times1800=1260-1080=180.$

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Q.3 [11831809]

There are four identical glasses which have water in them. The volume of water in four glasses is 40%, 58%, 65% and 89%. The glasses are emptied in an empty container and then the same container is used to fill 50% volume of each glass with water. If the remaining water in the container is 208 ml, what is the final total quantity of water (in ml) in all the four glasses?

1 ◯ 1008

2 ◯ 720

3 ◯ 800

4 ◯ 960

Solution:

Correct Answer : 3

Answer key/Solution

Let the volume of each glass = 100k, volume of four glasses = 4 × 100k = 400k
The volume of water in four glasses = (40% + 58% + 65% + 89%) × 100k = 252k
All glasses are emptied and refilled to a volume of 50%, total volume of four glasses = 50% × 400K = 200k
Remaining volume of water = (252k – 200k) = 52k ⇒ 52k = 208 ml
⇒ k = 4 ml
Hence, total volume of water in glasses = 200 × 4 = 800 ml.

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Q.4 [11831809]

A pair of shoes costs 12 times the cost of a pair of socks. The shopkeeper earns a profit of 10% from the sale of the pair of shoes whereas the total profit from selling both the shoes and the socks was 15%. If there is a profit of Rs.45 on selling the pair of socks, then find the selling price (in Rs.) of the pair of shoes.

1 ◯ 840

2 ◯ 600

3 ◯ 792

4 ◯ 720

Solution:

Correct Answer : 3

Answer key/Solution

Let the CP of the pair of socks be Rs. x.
So, CP of the pair of shoes be Rs. 12x
So, total SP = 13x ×115/100 = Rs. 14.95x
SP of the shoes = 12x ×110/100 = Rs. 13.2x
SP of the socks = 14.95x – 13.2x = Rs. 1.75x
So, profit on the sale of socks = 1.75x – x = Rs. 0.75x
According to the question, 0.75x = 45
⇒ x = 60
So, the cost price of the pair of shoes = 12x = 12 × 60 = Rs.720.
Hence, the selling price of the pair of shoes = 720 x 1.1 = Rs.792.

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Q.5 [11831809]

If a pack of 3 pens, 5 pencils and 4 erasers costs as much as a pack of 2 pens, 5 pencils and 7 erasers or a pack of 10 pencils and 6 erasers, then the cost of any one of the packs is equal to the cost of _____ erasers.

1 ◯ 18

2 ◯ 21

3 ◯ 20

4 ◯ 19

Solution:

Correct Answer : 3

Answer key/Solution

Let the cost of a pen, a pencil and an eraser be x, y and z respectively.
Then, 3x + 5y + 4z = 2x + 5y + 7z
⇒ x = 3z
And 3x + 5y + 4z = 10y + 6z
⇒ 3 × 3z + 5y + 4z = 10y + 6z
⇒ 7z = 5y
⇒ y = 7/5 z
Hence, the cost of a pack = 3× 3z + 5 × 7/5 z + 4z = 20z.

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Q.6 [11831809]

Titu, Bitu, and Ritu are having a circular pizza with five slices. Each slice has a different topping. They divide the slices such that each of them gets at least one slice but none of them gets two adjacent slices. In how many ways could they divide the slices of the pizza?

1 ◯ 30

2 ◯ 24

3 ◯ 25

4 ◯ 31

Solution:
Correct Answer : 1

Answer key/Solution

Since no one gets adjacent slices, two of them must have taken two slices each and third must have taken exactly one slice. There are ${}^5C_2$ ways of selecting two parts by the first person out of which 5 cases are subtracted as they are the ways of selecting adjacent slices.
Ways of selecting non-adjacent slices = ${}^5C_2 - 5 = 5$ ways.
From the remaining three slices, two slices will be adjacent, therefore, the second person can select any one of them out of those two, in two ways.
And then third person will be left with exactly one way. Also, this entire process can take place in 3 different ways. (Distinct order of persons picking the slices.)
Hence, total ways = $5 \times 2 \times 3 = 30$ ways.

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Q.7 [11831809]
At a school picnic Rose milk is prepared by mixing 24 liters of rose syrup with 72 liters of milk. X liters of the mixture is taken out and 16 liters of rose syrup and 24 liters of milk are added to the remaining mixture. The final mixture contains 35% rose syrup, find the quantity of the mixture (in liter) that was taken out.

1 ◯ 76

2 ◯ 82

3 ◯ 60

4 ◯ 65

Solution:
Correct Answer : 1

Answer key/Solution

Total mixture = 24 + 72 = 96 liters
% of syrup = 24/96 × 100 = 25%
% of milk = 75%
In the final mixture syrup is 35%, so milk = 65%
Ratio = 35 : 65 = 7 : 13
$(24 - X \times 0.25 + 16) : (72 - X \times 0.75 + 24) = 7 : 13$
$\Rightarrow 13(24 - X \times 0.25 + 16) = 7(72 - X \times 0.75 + 24)$
$\Rightarrow 13(40 - 0.25X) = 7(96 - 0.75X)$
$\Rightarrow 520 - 3.25X = 672 - 5.25X$
$\Rightarrow 2X = 152$
$\Rightarrow X = 76$ liters.

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Q.8 [11831809]

The sum of the roots of a quadratic equation $ax^2 + bx + c = 0$, where a, b, c are real numbers and $a \neq 0$, is 11 less than the product of the roots. If one root is 1 less than the other root, then the value of b/c is

1 ◯ –5/6 or 9/20

2 ◯ 5/6 or – 9/10

3 ◯ – 6/7 or 3/5

4 ◯ 5/6 or – 9/20

Solution:

Correct Answer : 4

Answer key/Solution

Let one root of the quadratic equation $ax^2 + bx + c = 0$ be α.
Then, other root = $\alpha - 1$.
Sum of roots = $\alpha + \alpha - 1 = -b/a$ and product of roots = $\alpha(\alpha - 1) = c/a$
According to the question,
$\alpha + \alpha - 1 = \alpha(\alpha - 1) - 11$
$\Rightarrow 2\alpha - 1 = \alpha^2 - \alpha - 11$
$\Rightarrow \alpha^2 - 3\alpha - 10 = 0$
$\Rightarrow (\alpha + 2)(\alpha - 5) = 0$
$\Rightarrow \alpha = -2$ or $\alpha = 5$
So, roots of the given quadratic equation are $-2, -3$ or $5, 4$.
Therefore, $-b/a = -5$ and $c/a = 6$ or $-b/a = 9$ and $c/a = 20$
Hence, b/c = 5/6 or – 9/20.

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Q.9 [11831809]

Let N = abc be a perfect square number. If digit 'a' is increased by 1, 'b' is increased by '2' and 'c' is increased by '3', then new number formed is also a perfect square. Find the sum of digits of N.

Solution:

Correct Answer : 10

Answer key/Solution

Let N be p^2, and the new number formed be q^2.
Now, $q^2 - p^2 = 123$.
Now, 123 can be factorised as either 123×1 or 41×3.
So we can say either
$(p + q)(q - p) = 123 \times 1$ which gives p and q as 61 and 62 OR
$(p + q)(q - p) = 41 \times 3$ which gives p and q as 19 and 22.
Hence, N i.e., p^2 is either 61^2 or 19^2. But 61^2 will not be a 3-digit number.
Hence, N must be $19^2 = 361$ and the sum of digits is 3 + 6 + 1 = 10.

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Q.10 [11831809]

The students of class 10 of a school are divided into three sections - A, B and C. Out of the total students 25%, 35% and 40% students are in A, B and C respectively. If 5%, 3% and 7% students of A, B and C respectively fail in their half-yearly exam, then what is the percentage of students who passed in all?

1 ◯ 88.8%

2 ◯ 91.8%

3 ◯ 94.9%

4 ◯ 98.9%

Solution:
Correct Answer : 3

Answer key/Solution

Let total number of students in class 10 be x.
Then, number of student in section A = 25% of x = 0.25x
Number of student in section B = 35% of x = 0.35x
Number of student in section C = 40% of x = 0.40x
Number of failed students in section A = 5% of 0.25x = 0.0125x
Number of failed students in section B = 3% of 0.35x = 0.0105x
Number of failed students in section C = 7% of 0.40x = 0.028x
So total number of failed students = 0.0125 + 0.0105x + 0.028x = 0.051x
Therefore, number of passed students = Total students – failed students = x – 0.051x = 0.949x
Hence, the percentage of failed students = 94.9%.

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Q.11 [11831809]

How many integral values of y satisfy the equation $2x + 3|y| = 100$, where x is a natural number?

Solution:
Correct Answer : 33

Answer key/Solution

The given equation is $2x + 3|y| = 100$.
$\Rightarrow x = 50 - 3|y|/2$
$y = 0, \pm 2, \pm 4, \ldots, \pm 32$ satisfy the above equation.
Hence, the number of integral values of y is 33.

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Q.12 [11831809]

Amit and Ben stay next to each other and study in the same college. Speed of Ben is 20% less than the speed of Amit. They start at the same time from their residences, the faster of the two reaches the college first, turns around and starts walking back. If Amit and Ben meet 200 m away from the home. What is the distance (in m) between their residences and their college?

Solution:
Correct Answer : 225

Answer key/Solution

Let the distance where they met be 'd' metres from the college.
Distance travelled by slow walker = 200 m
Distance travelled by fast walker = 200 + d + d = 200 + 2d
As the ratio of their speed is 5:4, and time is same, hence the ratio of distance travelled by them is also 5:4.
(200 + 2d)/200 = 5/4
$\Rightarrow$ d = 25
Hence, distance between their residences to college = 200 + 25 = 225 m.

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Q.13 [11831809]

Asha and Bina run on a 540 m long circular track at a speed of 12 m/s and 18 m/s respectively. They start from the same point at the same time and run in opposite directions. Find the number of times they would have met when Bina covers 2916 meters.

Solution:
Correct Answer : 9

Answer key/Solution

When Asha and Bina together complete one round, the distance covered is 540 m.
When they meet Asha covers = 12/(12 + 18) × 540 = 216 m, Bina covers 540 – 216 = 324 m
When Bina covers 2916 meters, they would have met 2916/324 = 9 times.

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Q.14 [11831809]

ABC is an equilateral triangle. O is the point of intersection of altitudes AD, BE and CF. If AO = 8 cm, then what is the area, in sq. cm, of the triangle ABC?

1 ◯ $24\sqrt{3}$

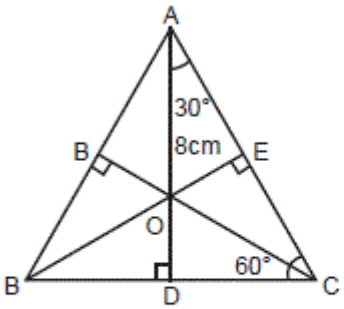
2 ◯ $36\sqrt{3}$

3 ◯ $48\sqrt{3}$

4 ◯ $72\sqrt{3}$

Solution:
Correct Answer : 3

Answer key/Solution



Altitude AD = 8 × 3/2 = 12 cm
In triangle ADC, DC = AD × tan 30° = 12 × 1/√3 = 12/√3 cm
So each side of the triangle ABC = 24/√3 cm
Hence, area of triangle ABC = √3/4 × 24/√3 × 24/√3 = 48√3 sq. cm.

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Q.15 [11831809]

If $f(x^2 - 2) = 5x^4 - 3bx^2 + 5c$ and $f(x - 3) = 2x^3 + 3cx - 2b$, then b + c is

1 ◯ −11

2 ◯ −17/2

3 ◯ −83/7

4 ◯ Cannot be determined

Solution:
Correct Answer : 4

Answer key/Solution

$f(x^2 - 2) = 5x^4 - 3bx^2 + 5c$
Let $x^2 = 2$, then $f(0) = 20 - 6b + 5c$ ... (i)
$f(x - 3) = 2x^3 + 3cx - 2b$
Let x = 3, then $f(0) = 54 + 9c - 2b$ ... (ii)
From (i) and (ii),
$20 - 6b + 5c = 54 + 9c - 2b$
$\Rightarrow 4b + 4c = -34$
$\Rightarrow b + c = -17/2.$
For $x^2 = 1$,
$f(-1) = 5 - 3b + 5c$ ... (iii)
And for x = 2,
$f(-1) = 16 + 6c - 2b$ ... (iv)
From (iii) and (iv),
$\Rightarrow 5 - 3b + 5c = 16 + 6c - 2b$
$\Rightarrow b + c = -11$
Therefore, the value of b + c cannot be determined.

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Q.16 [11831809]

Three friends A, B and C can solve a set of 600 questions each in 10 hrs, 15 hrs and 20 hrs respectively. The set of 600 questions is divided into two equal parts. A and B start solving the first 300 questions and C starts solving the last 300 questions. After 2 hrs A joins C and B is left alone with the first half. What is the time difference between the completion of the first and last half of the set?

1 ◯ 10 minutes

2 ◯ 30 minutes

3 ◯ 20 minutes

4 ◯ 15 minutes

Answer key/Solution

Solution:
Correct Answer : 1
Time to solve 600 questions by A = 10 hrs, B = 15 hrs and C = 20 hrs
Questions solved by A = 60 /hr, B = 40 /hr and C = 30 /hr
After 2 hours A and B have solved 200 questions from the first part, so the remaining questions in the first part are 100.
C has solved 40 questions in 2 hours, so the number of remaining questions in the last part is 240.
Time taken by A and C to complete 240 questions together = 240/(60 + 30) = 2 hours 40 minutes
Time taken by B to complete 100 questions = 100/40 = 2 hours 30 minutes
Hence, required difference = 10 minutes.

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Q.17 [11831809]

If $x_0 = 1$ and $x^3_{n+1} = 99x^3_n$, n = 0, 1, 2, 3,..., then what is the last digit of $x_{99} + x_{111}$?

Solution:
Correct Answer : 8

Answer key/Solution

Given: $x^3_{n+1} = 99x^3_n$

$\Rightarrow \frac{x^3_{n+1}}{x^3_n} = 99$

$\Rightarrow \frac{x_{n+1}}{x_n} = \sqrt[3]{99}, \frac{x_n}{x_{n-1}} = \sqrt[3]{99}, \ldots$

Therefore, $\frac{x_{n+1}}{x_n} \times \frac{x_n}{x_{n-1}} \times \frac{x_{n-1}}{x_{n-2}} \times \ldots \times \frac{x_2}{x_1} = \sqrt[3]{99} \times \sqrt[3]{99} \times \ldots \times \sqrt[3]{99}$

$\Rightarrow \frac{x_{n+1}}{x_1} = \left(\sqrt[3]{99}\right)^n$

$\Rightarrow x_{n+1} = \left(\sqrt[3]{99}\right)^{n+1}$

$\therefore x_{99} = \left(\sqrt[3]{99}\right)^{99} \Rightarrow x_{99} = 99^{33}$

$x_{111} = \left(\sqrt[3]{99}\right)^{111} \Rightarrow x_{111} = 99^{37}$

Cyclicity of 9 is 1 and 9 for odd and odd powers respectively. Here last digit will be 9 + 9 = 8.

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Q.18 [11831809]

A circle with center O has radius 25 cm. Chord AB of length 30 cm and chord CD of length 14 cm intersects at point E. If P and Q are the midpoints of chords AB and CD respectively and PQ = 12 cm, then the area (in sq. cm) of ΔPOQ is

1 ◯ 24√7

2 ◯ 16√14

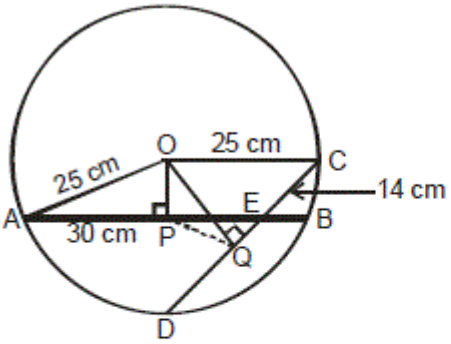
3 ◯ 64√7

4 ◯ 32√14

Solution:

Correct Answer : 4

Answer key/Solution



In ΔOPA, $OP = \sqrt{25^2 - 15^2} = 20$ cm

In ΔOQC, $OQ = \sqrt{25^2 - 7^2} = 24$ cm

$(OP + PQ + QO)/2 = (20 + 12 + 24)/2 = 28$ cm

Hence, area of $\Delta OPQ = \sqrt{28(28-20)(28-12)(28-24)} = 32\sqrt{14}$ sq. cm.

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Q.19 [11831809]

If -6 is a root of the equation $2x^2 + px - 18 = 0$, and the equation $p(x^2 + x) + (k + 1) = 0$ has equal roots, then the value of 'k' is:

1 ◯ 3/2

2 ◯ 5/4

3 ◯ 5/3

4 ◯ 4/3

Solution:

Correct Answer : 2

Answer key/Solution

Since -6 is a root of the equation $2x^2 + px - 18 = 0$.

Therefore, $2(-6)^2 + p(-6) - 18 = 0$

$\Rightarrow p = 9$

$9(x^2 + x) + (k + 1) = 0$

$\Rightarrow 9x^2 + 9x + k + 1 = 0$

Since roots are equal.

Therefore, $B^2 - 4AC = 0$

$\Rightarrow 81 - 4(9)(k + 1) = 0$

$\Rightarrow 81 - 36k - 36 = 0$

$\Rightarrow 45 = 36k$

$\Rightarrow 45/36 = k$

$\Rightarrow k = 5/4$.

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Q.20 [11831809]

ABCD is a square. P and Q are points on AB and BC respectively. The line through P parallel to BC and line through Q parallel to AB divide ABCD into two squares and two non-square rectangles. If the sum of the area of two squares is 3/4 of the area of square ABCD, then $\frac{AP}{PB}+\frac{PB}{AP}$ is

1 ◯ 3

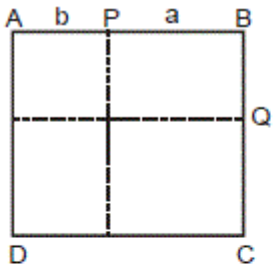
2 ◯ 6

3 ◯ 4

4 ◯ 12

Solution:
Correct Answer : 2

Answer key/Solution



Let the side length of square ABCD be 'p'.
Let PB (= a) and AP (= b) be the lengths of sides of larger and smaller inner squares respectively.

Then, $\frac{AP}{PB}+\frac{PB}{AP}=\frac{b}{a}+\frac{a}{b}=\frac{a^2+b^2}{ab}$

The sum of the area of the two inner squares = $a^2 + b^2 = 3p^2/4$
The sum of the area of the two inner non-square rectangles = $2ab = p^2/4$
$\Rightarrow ab = p^2/8$

Hence, $\frac{a^2+b^2}{ab}=\frac{3p^2/4}{p^2/8}=6.$

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Q.21 [11831809]

Mr.Shah invested one half of his savings in an Insurance Policy that paid simple interest for 2 years and received Rs.36,000 as interest. He invested the remaining in a Mutual fund that paid compound interest, calculated annually, for 2 years at the same rate of interest and received Rs.38,700 as interest. What was the value (in Rs. lakh) of his total savings before investing in these two policies?

1 ◯ 1.2

2 ◯ 3.6

3 ◯ 2.4

4 ◯ 4.8

Solution:
Correct Answer : 3

Answer key/Solution

Mr.Shah received an extra amount of Rs.2,700 (= 38700 – 36000) on his Mutual fund.
Interest for the first year is the same for S.I. and C.I.
Interest for first year = 36000/2 = Rs.18,000
∴ Rate of interest = (2700 × 100)/18000 = 15%
Let the amount invested at S.I. be Rs. x.
∴ 36000 = x × 15 × 2/100
⇒ x = Rs.1.2 lakh
Hence, total investment = 2x = Rs. 2.4 lakh.

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Q.22 [11831809]

Find the area (in sq. units) of the region bounded by the curve $\left|x-10^{20}\right|+\left|y-30^{196}\right|=20$.

Solution:
Correct Answer : 800

Answer key/Solution

Shifting center of the region to the origin (0, 0).

Thus, the area of the region bounded by the curve $\left|x-10^{20}\right|+\left|y-30^{196}\right|=20$ is equal to the region bounded by the curve $|x|+|y|=20$.

Hence, area = $4\times\frac{1}{2}\times 20\times 20=800$ sq. units.

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