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Section-1

Sec 1

Q.1 [11831809]

A milkman, buys pure milk and adds some water before selling. He sells the mixture at a price 10% less than the price of pure milk and makes a profit of 10%. Find the quantity (in litres) of water that he adds to every 9 litres of pure milk.

1 ☐ 1

2 ☐ 2

3 ☐ 3

4 ☐ 4

Solution:

Correct Answer : 2

Let he buys 9L of pure milk at Rs. 100 per L.

Total cost = Rs. 900.

Total revenue = Rs. 990 (since he made a 10% profit).

Hence, at Rs. 90/L he must have sold 11 L of diluted Milk.

This means he added 2 L of water to pure milk.

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 Answer key/Solution

Q.2 [11831809]

The average of five natural numbers is 100. The largest number among these exceeds the smallest number by 60. The rest of the three numbers lie between these two numbers and are all equal. How many sets of the five numbers is possible?

1 ☐ 99

2 ☐ 98

3 ☐ 11

4 ☐ 12

Solution:

Correct Answer : 3

Let the numbers be $X, Y, Y, Y, X + 60$.

So $2X + 3Y = 440$; $X < Y$; $Y < X + 60$

Smallest value of X is 1; then $Y = 146$ (but this does not satisfy the conditions) since Y is 145 more than X .

X increases in steps of 3, Y decreases in steps of 2.

So for the difference in X and Y to be less than 60, the first value is $X = 1 + 18 \times 3 = 55$; $Y = 146 - 18 \times 2 = 110$.

For the least difference $X = 85$; $Y = 90$

Hence, the number of values of X from 55 to 85 is 11.

Alternate solution:

The five numbers are $X, Y, Y, Y, X + 60$ and their sum is 500.

So we can write $2X + 3Y = 440$; $X < Y$; $Y < X + 60$

For X to have integral values, Y can take only even values.

We can start from 100 and put even values of Y , on both sides of 100.

The set of values that Y can take will be (90, 92, 94, 96, 98, 100, 102, 104, 106, 108, 110).

The corresponding values of X will be (85, 82, 79, 76, 73, 70, 67, 64, 61, 58, 55).

Hence, we get 11 pairs of (X, Y) that satisfy the condition.

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 Answer key/Solution

Q.3 [11831809]

A school having 450 students provides facilities for playing four games – Cricket, Football, Tennis and Badminton. There are a few students in the school who do not play any of the four games. It is known that for every student in the school who plays at least N games, there are two students who play at least $(N - 1)$ games, for $N = 2, 3$ and 4 . If the number of students who play all the four games is equal to the number of students who play none, then how many students in the school play exactly two of the four games?

Solution:

Correct Answer : 100

 Answer key/Solution

Let there be ' a ' students who play exactly four games.

Then, there will be ' $2a$ ' students who play at least three games i.e., either three or four games.

Hence, we can say that ' a ' students play exactly three games.

Since there are ' $2a$ ' students who play exactly two games it means ' $4a$ ' students who play exactly one game. Also, since ' a ' students play all four games, the number of students playing none of the four games should also be ' a '.

Therefore, $a + 4a + 2a + a + a = 450 \Rightarrow a = 50$.

Hence, the number of students who play exactly two games is $2a$ i.e., $2 \times 50 = 100$.

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Q.4 [11831809]

A 240 ml flask contains 30% acid solution. What quantity (in ml) of the solution should be replaced with 12% acid solution so that the resultant solution contains 18% acid?

Solution:

Correct Answer : 160

 Answer key/Solution

If the 12% solution is mixed with 30% solution in the ratio $2 : 1$, then the resultant solution has a 18% concentration.

If the final volume is 240 ml, then the volume of the 12% solution is 160 ml.

Hence, the amount to be replaced is 160 ml.

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Q.5 [11831809]

One day each member of Ram's family consumed some milk and some water. Though the quantities of milk and water varied for the family members, the total consumption of the two liquids was exactly 7 litres for each family member. If Ram had one-fourth of the total milk consumed and onesixth of the total water consumed, then what was the ratio of the quantity of milk to that of water consumed by Ram on that day?

1 ☐ 3 : 2

2 ☐ 1 : 1

3 ☐ 2 : 3

4 ☐ Cannot be determined

Solution:

Correct Answer : 2

 Answer key/Solution

Let there be 'n' persons in Ram's family and the total amount (in litres) of milk consumed by the family be 'x'.
As per the given information,

$$\frac{x}{4} + \frac{(7n - x)}{6} = 7$$

$$\Rightarrow x + 14n = 84$$

'n' is an integer and $0 < x < 7n$.

$$\Rightarrow 0 < 84 - 14n < 7n$$

$$\Rightarrow 4 < n < 6$$

$$\Rightarrow n = 5 \text{ and } x = 14$$

Hence, the required ratio = $3.5 : 3.5 = 1 : 1$.

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Q.6 [11831809]

Find the minimum possible value of 'y' if $9/25 < x/y < 17/43$, where x and y are natural numbers.

1 ☐ 3


2 ☐ 4

3 ☐ 7

4 ☐ 8

Solution:

Correct Answer : 4

 Answer key/Solution

$$\frac{9}{25} < \frac{x}{y} < \frac{17}{43}$$

$$\text{Or, } \frac{43x}{17} < y < \frac{25x}{9}$$

As 'x' increases, the interval in which 'y' lies also increases.

For x = 1 and 2, the intervals in which y lies are

$\left(2\frac{9}{17}, 2\frac{7}{9}\right)$ and $\left(5\frac{1}{17}, 5\frac{5}{9}\right)$ respectively. None of these pairs contains an integer between them.

For x = 3, the interval in which y lies is $\left(7\frac{10}{17}, 8\frac{3}{9}\right)$ i.e., (7.588, 8.33).

So 8 lies in the interval.

Hence, the minimum possible value of y is 8.

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Q.7 [11831809]

If a girl has coins of denominations Re. 1, Rs. 2 and Rs. 5, in how many ways can she make a payment of exactly Rs. 11?

1 ☐ 9

2 ☐ 10

3 ☐ 11

4 ☐ 12

Solution:

Correct Answer : 3

 Answer key/Solution

Let the number of coins of denominations Re. 1, Rs. 2 and Rs. 5 used to make the payment be x , y and z respectively.

$$\therefore x + 2y + 5z = 11.$$

The possible values of z are 0, 1 or 2.

Case (i): $z = 0$

$$\therefore x + 2y = 11.$$

The ordered pairs (x, y) that satisfy the above equation are (1, 5); (3, 4); (5, 3); (7, 2); (9, 1) and (11, 0).

Therefore, the number of ways in this case = 6.

Case (ii): $z = 1$

$$\therefore x + 2y = 6$$

The ordered pairs (x, y) that satisfy the above equation are (0, 3); (2, 2); (4, 1) and (6, 0).

Therefore, the number of ways in this case = 4.

Case (iii): $z = 2$

$$\therefore x + 2y = 1$$

The only ordered pair (x, y) that satisfies the above equation is (1, 0).

Hence, the total number of ways = $6 + 4 + 1 = 11$.

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Q.8 [11831809]

For how many values of 'k' are $\log a$, $\log ka$ and $\log (4a)$ are in an arithmetic progression?

Solution:

Correct Answer : 1

 Answer key/Solution

$$\log a + \log 4a = 2 \log ka.$$

$$\Rightarrow k^2 a^2 = 4a^2$$

So $k = +2$ or -2

But $k = 2$ is the only value we can consider, since both $a, ka > 0$.

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Q.9 [11831809]

A boat travels 60 km upstream and 100 km downstream in 8 hours and then travels 75 km upstream and 175 km downstream in 12 hours. What is the speed (in km/h) of the boat in still water?

1 ☐ 36

2 ☐ 30

3 ☐ 24

4 ☐ 20

Solution:

Correct Answer : 4

[🔍 Answer key/Solution](#)

Let the speed of the boat in still water be 'v' km/hr and speed of the stream be 'u' km/hr. Therefore,

$$\frac{60}{v-u} + \frac{100}{v+u} = 8 \quad \dots(i)$$

$$\frac{75}{v-u} + \frac{175}{v+u} = 12 \quad \dots(ii)$$

On solving equations (i) and (ii), we get

$v = 20$ and $u = 5$.

Hence, the speed of the boat in still water = 20 km/h.

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Q.10 [11831809]

How many terms in the expansion of $\left(3^{\frac{1}{5}} + 13^{\frac{1}{8}}\right)^{1000}$ are integers?

1 ☐ 201

2 ☐ 126

3 ☐ 25

4 ☐ 26

Solution:

Correct Answer : 4

[🔍 Answer key/Solution](#)

Each term in the expansion in which the power of $3^{\frac{1}{5}}$ is a multiple of 5 and the power of $13^{\frac{1}{8}}$ is a multiple of 8, will be an integer. Let the powers of $3^{\frac{1}{5}}$ and $13^{\frac{1}{8}}$ be $5p$ and $8q$ respectively, where p and q are whole numbers.

$$\Rightarrow 5p + 8q = 1000$$

If $q = 0$, then $p = 200$. As the values of p that satisfy the equation occur at intervals of 8, the total number of values of p will be 26 (i.e., 200, 192, 184, ..., 8, 0).

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Q.11 [11831809]

The 23rd term and the 32nd term of a geometric progression are the number of factors of 54 and 72 respectively. What is the geometric mean of the first 54 terms of the progression?

1 ☐ $4\sqrt{3}$

2 ☐ $6\sqrt{2}$

3 ☐ $8\sqrt{3}$

4 ☐ $4\sqrt{6}$

Solution:

Correct Answer : 4

T_{23} = The number of factors of 54 = 8

T_{32} = The number of factors of 72 = 12

Geometric Mean (GM) of the first 54 terms of the GP.

$$= \sqrt{T_{23} \times T_{54-22}} = \sqrt{T_{23} \times T_{32}} = \sqrt{8 \times 12} = 4\sqrt{6}.$$

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 Answer key/Solution

Q.12 [11831809]

How many ordered pairs (a, b) are there for which the system of equations $3x + ay = b$ and $ax + 12y = 48$ will have infinite solutions?

Solution:

Correct Answer : 2

The system of equations $3x + ay = b$ and $ax + 12y = 48$ will have infinite solutions if and only if $3/a = a/12 = b/48$

Hence, the number of ordered pairs is 2 i.e., (6, 24) and (-6, -24).

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 Answer key/Solution

Q.13 [11831809]

Raju bought 6 oranges, 8 apples and 10 bananas for Rs. 124 and his sister Pinki bought 8 oranges, 10 apples and 8 bananas for Rs. 144, then what amount (in Rs.) did Billu pay for 1 orange, 2 apples and 7 bananas?

1 ☐ 42

2 ☐ 44

3 ☐ 54

4 ☐ Cannot be determined

Solution:

Correct Answer : 1

 Answer key/Solution

Let the price of each orange, apple and banana be O, A and B respectively.

$\therefore 6O + 8A + 10B = 124$...(i) and

$8O + 10A + 8B = 144$...(ii)

So $3 \times (i) - 2 \times (ii)$ gives $10 + 2A + 7B = \text{Rs. } 42$.

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Q.14 [11831809]

Hasan writes down 10 consecutive integers and then Kishan erases one of the them. If the sum of the remaining 9 numbers is 2022, what number did Kishan erase?

Solution:

Correct Answer : 223

 Answer key/Solution

Let the numbers Hasan wrote be $n, n + 1, n + 2 + \dots + n + 9$.

Sum of the 10 numbers he wrote down is equal to $10n + 45$.

Therefore, Kishan erases one of the numbers must be from $9n + 36$ to $9n + 45$ inclusive.

Since 2022 leaves a remainder of 6 when divided by 9, the sum of the remaining numbers must be $9n + 42$, meaning Kishan erased the number equal to $n + 3$.

Therefore, since $9n + 42 = 2022$, n must be equal to 220, meaning Kishan erased the number 223.

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Q.15 [11831809]

How many distinct regular polygons can be constructed by using all of 36 sticks, each of length 6 cm, ensuring that there is no two sticks overlap?

1 ☐ 6

2 ☐ 7

3 ☐ 8

4 ☐ 9

Solution:

Correct Answer : 2

 Answer key/Solution

Since all the sides are equal in a regular polygon. All sides must be of equal length.

So the equal number of stick(s) must be used to construct each side.

Since all 36 sticks are to be used together, factors of 36 (i.e., 1, 2, 3, 4, 6, 9, 12, 18 and 36) should be the number of stick(s) used for each side. We can't use 18 and 36 sticks for a side since the number of sides would then be reduced to 2 and 1 respectively, which is not acceptable.

Hence, the number of distinct polygons = $9 - 2 = 7$.

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Q.16 [11831809]

P, Q and R can together earn Rs. 7,350 in 10 days. Q and R together can earn Rs.3,630 in 6 days. P and R together can earn Rs.2,250 in 5 days. Find the daily wage (in Rs.) of R.

Solution:

Correct Answer : 320

 Answer key/Solution

Total daily wage of P, Q and R = $7350/10 = \text{Rs.}735$

Total daily wage of Q and R = $3630/6 = \text{Rs.}605$

Total daily wage of P and R = $2250/5 = \text{Rs.}450$

Total daily wage of P, Q and 2R = Rs.1,055

Hence, R's daily wage = $1055 - 735 = \text{Rs.}320$.

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Q.17 [11831809]

A natural number consists of only 0's and 1's. If the number is divisible by 375, then what is the least possible number of 0's and 1's together in the number?

1 ☐ 3

2 ☐ 6

3 ☐ 7

4 ☐ 9

Solution:

Correct Answer : 2

 Answer key/Solution

$375 = 3 \times 125$. If a number is divisible by 125, then the last three digits of the number should be divisible by 125. Since the number consists only 0's and 1's, the last three digits of the number will be 000. As the number is divisible by 3, the sum of digits of the number should be divisible by 3. Therefore, there should be at least three 1's in the number. Hence, the smallest such number = 111000.

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Q.18 [11831809]

The numerical values of the surface area and the volume of a cuboid are equal. If the edge lengths are $\log_2 x$, $\log_3 x$, $\log_5 x$, then the value of 'x' is

Solution:

Correct Answer : 900

 Answer key/Solution

The edge lengths are $\log_2 x$, $\log_3 x$, $\log_5 x$

Surface area = Volume

$$\Rightarrow 2(\log_2 x \cdot \log_3 x + \log_3 x \cdot \log_5 x + \log_5 x \cdot \log_2 x) = \log_2 x \cdot \log_3 x \cdot \log_5 x$$

$$\Rightarrow 2\left(\frac{1}{\log_5 x} + \frac{1}{\log_2 x} + \frac{1}{\log_3 x}\right) = 1$$

$$\Rightarrow 2(\log_x 5 + \log_x 2 + \log_x 3) = 1$$

$$\Rightarrow 2(\log_x 30) = 1 \Rightarrow x^{1/2} = 30$$

Hence, $x = 900$.

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Q.19 [11831809]

Points A(-2, 9) and B(6, 3) lie on the circumference of a circle whose radius is an integer. Which of the following cannot be the length of the radius?

1 ☐ 3

2 ☐ 5

3 ☐ 6

4 ☐ 9

Solution:

Correct Answer : 1

[🔍 Answer key/Solution](#)

$$AB = \sqrt{(-2-6)^2 + (9-3)^2} = \sqrt{8^2 + 6^2} = 10$$

As A and B lie on the circumference of the circle, diameter of the circle must be greater than or equal to AB. So the radius must be greater than or equal to 5.

Hence, the radius of the circle cannot be 3.

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Q.20 [11831809]

Binu takes 210 strides to cross a slowly moving metro train while moving in the same direction as the train. If he was moving in the opposite direction it takes him only 70 strides. If the train was stationary on the platform, how many strides would he take to stride from the front to the back of the train?

Solution:

Correct Answer : 105

Let the walking speed of Binu be 1 stride/sec.

While walking in the same direction total distance covered by Binu is 210 strides in 210 seconds.

This happens in Length of the train/(Relative Speed) = 210 . So Length of the train (L) = 210 × (S_{Binu} - S_T) .

Similarly, in the opposite direction, Length of the train (L) = 70 × (S_{Binu} + S_T).

From this, we get S_{Binu} = 2 S_T.

So length of the Train = 105 strides.

Hence, Binu will take 105 seconds to cross a stationary train.

[🔍 Answer key/Solution](#)

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Q.21 [11831809]

ABCD is a square. E and F are points on CD and AD respectively. Lines CF and BE intersect at G at 90°. If GF = 12 and GC = 8, the area of the square is

1 ☐ 196

2 ☐ 320

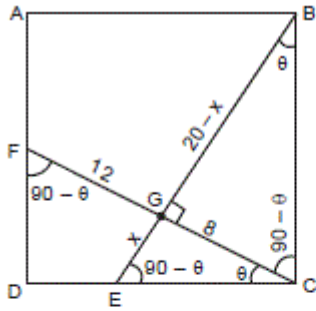
3 ☐ 400

4 ☐ 576

Solution:

Correct Answer : 2

[Answer key/Solution](#)



$\triangle FDC$ is congruent to $\triangle ECB$.

So $BE = FC = 20$

Let $GE = x$

So $BG = 20 - x$

$\triangle BGC$ is similar to $\triangle CGE$.

$$\text{So } \frac{BG}{GC} = \frac{CG}{GE} \Rightarrow \frac{20-x}{8} = \frac{8}{x}.$$

$$\text{So } (20-x)(x) = 64$$

$$\therefore 16 \times 4 = 64 \quad (x = 4)$$

$$(\text{or}) 4 \times 16 = 64 \quad (x = 16)$$

However $x < 20 - x$, so we take $x = 4$.

Hence, area of the square =

$$BC^2 = (20-x)^2 + 8^2 = 16^2 + 64 = 256 + 64 = 320.$$

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Q.22 [11831809]

A cat chases a mouse on ground which has grid lines like the coordinate plane. The mouse starts at (2, 3) and wants to get to the mouse hole at (7, 8). The cat starts at (-3, 5). The mouse and the cat can only travel along the grid lines at 1 unit/sec and 2 units/sec respectively. If the cat decides to catch the mouse at the mouse hole, how long would it have to wait there? (to the nearest half a second)

1 ☐ 3.5 seconds

2 ☐ 0.5 Second

3 ☐ 6.5 Seconds

4 ☐ The mouse reaches the hole 3 seconds before the cat.

Solution:

Correct Answer : 1

Mouse takes 10 seconds to reach the hole travelling along the grid lines.

The cat is at a distance of 13 units from the hole. It takes 6.5 seconds to reach the hole.

Hence, it waits for 3.5 seconds

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