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Section-1

Sec 1

Q.1 [11831809]

What is the least sum of a set of 5 distinct prime numbers whose average is also a prime number?

Solution:

Correct Answer : 55

The sequence of the numbers is 3, 5, 7, 11, 29.

Answer key/Solution

Bookmark FeedBack

Q.2 [11831809]

The mean and median of Ashok's 7 scores is 74. If his lowest 2 scores are not considered, the mean increased by 1 whereas the median remained the same. What is the highest score he could have got, if all his scores were whole numbers and and no number except 74 appears more than once?

1 ◯ 78

2 ◯ 79

3 ◯ 80

4 ◯ 81

Answer key/Solution

Solution:
Correct Answer : 3
For the given conditions the scores could have been in the increasing order A, B, C, 74, 74, D, E. This is because the median scores with 7, 5 were in both cases 74.
So the 4th and 5th scores have to both be 74
We need to maximize E. So A, B, C, D must be as small as possible but satisfying all the conditions.
Let A, B be 74 – x and 74 – y respectively. Since when these numbers are removed, the average of the remaining numbers is going up by 1, we can say that x + y will be equal to 5.
So the possible values of A, B, C, D are 71, 72, 73, 74 respectively.
In this case E = 80. This is the largest value of E that is possible.

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Q.3 [11831809]
A big cube is completely sliced into 64 identical cubes. If 12 litres of paint was used to paint the original cube, how many more litres of paint will be required to paint the smaller cubes on all the faces?

1 ◯ 18

2 ◯ 24

3 ◯ 36

4 ◯ 48

Answer key/Solution

Solution:
Correct Answer : 3
There are six faces in big cube. Each face takes 2 L paint. When it is cut into 64 identical and smaller cubes (by making 3 cuts along each dimension), each cut gives two new faces. So, 9 cut gives 18 new faces. Hence, extra amount of paint required is 36 L.

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Q.4 [11831809]

Anuj can complete a piece of work in 8 days, Bhanu in 12 days and Chetan in 16 days. All of them started the work together but Chetan left when he realised that the remaining work will be completed without him in the next three days, and Bhanu left when he realised that the remaining work will be completed without him in the next two days. Find the total number of days taken to complete the work.

1 ◯ 4

2 ◯ 5

3 ◯ 6

4 ◯ 10

Solution:
Correct Answer : 2

Answer key/Solution

Let number of units of work = LCM (8, 12, 16) = 48.
So, Anuj can do 6 units per day, Bhanu can do 4 units per day, Chetan can do 3 units per day and they together can do 13 units per day.
Let the required number of days be n.
$6n + 4(n - 2) + 3(n - 3) = 48$
$\Rightarrow 13n - 8 - 9 = 48$
$\Rightarrow 13n = 65$
$\Rightarrow n = 5$ days.

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Q.5 [11831809]

The interest accrued in the first two years and that in the first three years on a sum invested at a certain rate of interest, compounded annually, were Rs. 1,100 and Rs. 1,820 respectively. What was the rate of interest?

1 ◯ 10%

2 ◯ 24%

3 ◯ 30%

4 ◯ 20%

Solution:

Answer key/Solution

Correct Answer : 4

Let the rate of interest be r%.

The interest received in the first year = $\frac{Pr}{100} = k$ (say)

Total interest received in the first two years

$= k + k\left(1+\frac{r}{100}\right) = k\left(2+\frac{r}{100}\right) = 1100$ ... (i)

Interest received in the third year

$= k\left(1+\frac{r}{100}\right)^2 = 1820 - 1100 = 720$ ... (ii)

Dividing (i) by (ii), we get

$$\frac{k\left(2+\frac{r}{100}\right)}{k\left(1+\frac{r}{100}\right)^2} = \frac{1100}{720} \Rightarrow \frac{\left(2+\frac{r}{100}\right)}{\left(1+\frac{r}{100}\right)^2} = \frac{55}{36} \Rightarrow r = 20\%.$$

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Q.6 [11831809]

At the end of the year 2022, Madan had Rs. 500 and Birju had Rs. 50,000. At the end of every year, Madan will have twice as much money as he did at the end of the previous year and Birju will have 60% of the money that he did at the end of the previous year. At the end of which year will Madan have more money than Birju for the first time?

1 ◯ 2025

2 ◯ 2026

3 ◯ 2027

4 ◯ 2028

Solution:

Answer key/Solution

Correct Answer : 2

Let this happen k years after 2022.

Then, $500 \times (2^k) > (3/5)^k \times 50000$

Or, $(10/3)^k > 100$

So k = 4.

Hence, this would be the case in the year 2026.

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Q.7 [11831809]

Let $f(x) = x^2 + ax + b$ be a quadratic, where a and b are integers with $5 \le a, b \le 11$. For how many distinct ordered pairs (a, b) will f(x) not have real solutions ?

Answer key/Solution

Solution:
Correct Answer : 7
If the graph does not cut the X-axis, then the roots must be imaginary.
$a^2 - 4b < 0$:
If a = 5, there are 5 cases: b = 7 to b = 11
If a = 6, there are 2 cases: b = 10, 11
Hence, 7 ordered pairs (a, b) are there.

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Q.8 [11831809]

In how many ways can 10 be written as the sum of two or more natural numbers? Consider (1 + 9) to be different from (9 + 1).

1 ◯ 1024

2 ◯ 512

3 ◯ 511

4 ◯ 1023

Answer key/Solution

Solution:
Correct Answer : 3

The number of solutions of $x_1 + x_2 + x_3 + \ldots + x_r = n$, where $x_1, x_2, x_3, \ldots, x_r$ are natural numbers, is ${}^{n-1}C_{r-1}$.
According to the question, the value of n is 10 and the values that 'r' can have are 2, 3, 4, 5, ..., 10.
Hence, the required number of ways = ${}^9C_1 + {}^9C_2 + {}^9C_3 + \ldots + {}^9C_9 = 2^9 - {}^9C_0 = 2^9 - 1 = 512 - 1 = 511$.

Bookmark FeedBack

Q.9 [11831809]

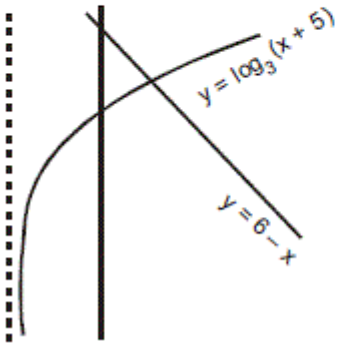
Find the number of solutions of the equation $\log_3 (x + 5) = 6 - x$.

Solution:
Correct Answer : 1

Answer key/Solution

$\log_3 (x + 5) = 6 - x$
$\Rightarrow x + 5 = 3^{6-x}$
x will always be an even number.
(Power of 3 is always an even number. In left hand side if x is even, then (x + 5) will be odd)
Possible values of x = 0, 2, 4, 6, ...
Only x = 4 satisfies the condition.

Alternative method:



Only one intersection point.

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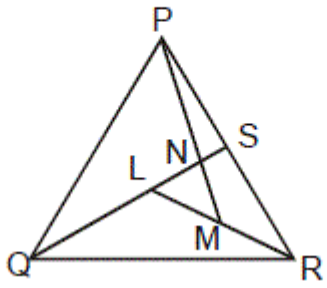
Q.10 [11831809]

In the figure given below, PS : SR = 1 : 2, QL : LS = 1 : 2 and LM = MR. Find the ratio of the area of triangle PQR to that of LMN.



1 ◯ 9 : 1

2 ◯ 6 : 1

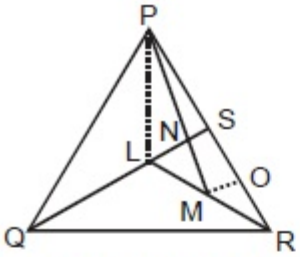
3 ◯ 24 : 5

4 ◯ 3 : 1

Answer key/Solution

Solution:

Correct Answer : 2



It can be observed that ΔRMO and ΔRLS are similar.

$\therefore \frac{RM}{RL}=\frac{RO}{RS}=\frac{MO}{LS}=\frac{1}{2}$ (As RM : ML = 1 : 1 or RM = ML)

RO : OS = 1 : 1 and PS : SR = 1 : 2.

∴ RO = OS = SP

It can also be observed that ΔPNS and ΔPMO are also similar.

$\therefore \frac{PS}{PO}=\frac{NS}{MO}=\frac{1}{2}$ (∵ OS = SP)

$\Rightarrow NS=\frac{MO}{2}$ and $MO=\frac{LS}{2}$ or $NS=\frac{LS}{4}$

$\Rightarrow LN:NS=3:1$

Let the area of ΔPQR = x sq. units.

QS divides PR in the ratio 1 : 2 at S.

Area of $\Delta QSR = \frac{2}{3}x$

$\therefore$ Area of $\Delta QLR=\frac{1}{3}\left(\frac{2}{3}x\right)=\frac{2}{9}x$

$\therefore$ Area of $\Delta RLS = \frac{2}{3}x-\frac{2}{9}x=\frac{4}{9}x$

Also, the area of $\Delta QLP=\frac{1}{3}\left(\frac{1}{3}x\right)=\frac{1}{9}x$

$\therefore$ Area of $\Delta PLS=\frac{1}{3}x-\frac{1}{9}x=\frac{2}{9}x$

$\therefore$ Area of $\Delta PLN=\frac{3}{4}\left(\frac{2}{9}x\right)=\frac{1}{6}x$ (∵ LN : NS = 3 : 1)

$\therefore$ Area of ΔPLR = Area of ΔPLS + Area of ΔRLS

$=\frac{4}{9}x+\frac{2}{9}x=\frac{2}{3}x$

$\therefore$ Area of $\Delta PLM=\frac{1}{2}\left(\frac{2}{3}x\right)=\frac{1}{3}x$ (∵ LM = MR)

Area of ΔLNM = Area of ΔPLM – Area of ΔPLN

$=\frac{1}{3}x-\frac{1}{6}x=\frac{1}{6}x$ sq. units

Hence, the required ratio = 6 : 1.

Alternate solution:

If the area of triangle PQR is 'x' sq. units.

Since PS : SR = 1 : 2, therefore, area of triangle QSR = 2x/3 sq. units

Since QL : LS = 1 : 2, therefore, area of triangle LSR = 2x/3 × 2/3 sq. units
Since LM = MR and LN = 3NS (Approximately, from the diagram)
So area of triangle LMN will be between 2x/3 × 2/3 × 1/4 and 2x/3 × 2/3 × 1/3
i.e., between x/9 and x/6.75
Hence, only option (2) i.e., 6 : 1 satisfies the condition.

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Q.11 [11831809]

The number of factors of the number of balls in four boxes – P, Q, R and S – is 16, 28, 40 and 49 respectively. If Ravi wants to pick a box, out of the four boxes, which box should he pick to be sure of picking up of a box in which the number of balls is the cube of a natural number?

1 ◯ P

2 ◯ Q

3 ◯ R

4 ◯ S

Answer key/Solution

Solution:
Correct Answer : 4
The number of factors of a number (N) = $p^a \times q^b \times r^c$ ..., where a, b, c, ... a natural numbers and p, q, r, ... are prime numbers, is (a + 1) × (b + 1) × (c + 1).
If N is a perfect cube, a, b, c, ... have to be multiples of 3.

If the number of factors is 16 ...(a, b, c, ...), these can be (1, 7) or (3, 3) or (1, 1, 3) and their ordered sets. In all cases we do not see that the number is a perfect cube.
Similarly, for 28 the set should be (1, 13); (3, 6); (1, 1, 6), ...and their ordered sets.
For 40 it is (1, 19); (3, 9); (4, 7), ..., and their ordered sets.
For 49 it is (6, 6) only. This is the only number that can be a perfect cube only.

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Q.12 [11831809]

A square shaped floor of dimensions 35 × 35 is fully covered with square shaped tiles of dimensions 1 × 1, 2 × 2 and 3 × 3. The number of tiles used of dimensions 1 × 1 to cover the floor cannot be less than

1 ◯ 1

2 ◯ 2

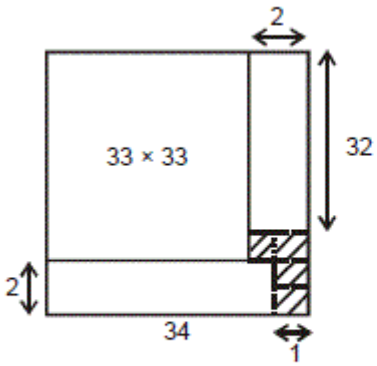
3 ◯ 4

4 ◯ 8

Solution:
Correct Answer : 3

Answer key/Solution

3 × 3 tiles may be used to cover 33 × 33 units part of the floor.



The left out part, as shown in the above figure, may be covered by using the 2 × 2 tiles.
The shaded part shows the part that cannot be filled even by using 2 × 2 tiles and have to be filled by 1 × 1 tiles.
Hence, the minimum number of tiles of dimension 1 × 1 is required is 4.

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Q.13 [11831809]
Vishal went from A to B at a certain speed and came back to A from B at a speed that was twice the speed at which he went from A to B. The entire journey took 5 hours. Had Vishal returned at a speed that was 25% more than the speed at which he actually returned, how long would it have taken him for the entire journey?

1 ◯ 4 hours 40 minutes

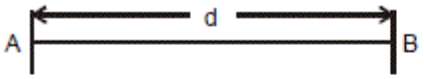
2 ◯ 4 hours 30 minutes

3 ◯ 5 hours 15 minutes

4 ◯ 3 hours 40 minutes

Solution:
Correct Answer : 1

Answer key/Solution



Let d be the distance between A and B and x km/h be the speed at which Vishal travels.
Time taken for the onward and return journey = d/x + d/2x = 5 ...(i)
⇒ d/x = 10/3
When the return speed is increased by 25%, the time taken is = d/x + 2d/5x = 7d/5x
⇒ 7d/5x = 7/5 × 10/3 = 14/3 hours = 4 hours 40 minutes.

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Q.14 [11831809]

A total of 'x' litres of pure milk was drawn from a vessel containing 256 litres of pure milk and was replaced with water. The resulting mixture was thoroughly mixed to obtain a homogenous solution and then again 'x' litres of solution was drawn, and replaced with water. The resulting mixture was thoroughly mixed. This procedure was performed four times and the vessel now contained 81 litres of pure milk. Find the value of 'x'.

Solution:
Correct Answer : 64

Answer key/Solution

Final quantity of the component = Initial quantity of the component $\left(1-\frac{\text{replaced quantity in each turn}}{\text{total quantity of the mixture}}\right)^n$

$\Rightarrow 81 = 256\left(1-\frac{x}{256}\right)^4$

$\Rightarrow \left(\frac{81}{256}\right)^{\frac{1}{4}} = 1-\frac{x}{256}$

$\Rightarrow 1-\frac{x}{256} = \frac{3}{4}$

$\Rightarrow x = 64.$

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Q.15 [11831809]

For non-negative real numbers x and y, 3x + 4y ≤ 16 and 5x + 2y ≤ 10. What is the maximum possible value of (4x + 10y)?

1 ◯ 40

2 ◯ 32

3 ◯ 48

4 ◯ 52

Solution:
Correct Answer : 1
If we want to maximise 4x + 10y, y should be maximum as coefficient of y is 10.
From given inequalities maximum value of y is 4 and then the value of x will be zero.
So maximum of 4x + 10y = 4(0) + 10(4) = 40.

Answer key/Solution

Bookmark FeedBack

Q.16 [11831809]

Find the value of the following expression:

$$\log_{0.001}\left[\frac{1}{2}\right]+\log_{0.001}\left[\frac{2}{3}\right]+\log_{0.001}\left[\frac{3}{4}\right]+....+\log_{0.001}\left[\frac{99}{100}\right].$$

1 ◯ – 3/2

2 ◯ 2/3

3 ◯ 3/2

4 ◯ – 2/3

Solution:
Correct Answer : 2

Answer key/Solution

$$\log_{(0.001)}\left[\frac{1}{2}\right]+\log_{(0.001)}\left[\frac{2}{3}\right]+\log_{(0.001)}\left[\frac{3}{4}\right]+...+\log_{(0.001)}\left[\frac{99}{100}\right]$$

$$=\log_{(0.001)}\left[\frac{1}{2}\right]\times\left[\frac{2}{3}\right]\times\left[\frac{3}{4}\right]\times...\times\left[\frac{99}{100}\right]$$

$$=\log_{(0.001)}\left[\frac{1}{100}\right]=\log_{(0.1)^3}\left[\frac{1}{10}\right]^2=\frac{2}{3}.$$

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Q.17 [11831809]

Ramu gave away return gifts on the occasion of his daughter's birthday. Every gift was a pack of 1 Toy, 2 Chocolates and 1 Book. The Toys were available in boxes of 30 Toys each, the Chocolates in boxes of 40 Chocolates each and the Books came in boxes of 15 books each. Ramu made no incomplete gift and there were no unused Toys, Chocolates or Books. What is the minimum number of boxes purchased for the party?

Answer key/Solution

Solution:
Correct Answer : 9
There must be N number of Toys, 2N of Chocolates and N of Books.
LCM of (30, 60, 30) is 60. So the number of Toys must be 60, the number of Chocolates must be 120 and the number of Books must be 60. This will make sure that no box is left unused. And there are no incomplete gifts.
So the minimum number of boxes is 2 + 3 + 4 = 9.

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Q.18 [11831809]

If P is a point on $x^2 + y^2 + 18 = 2(5x + 3y)$ and Q is a point on $x^2 + y^2 + 240 = 2(16x + 3y)$, the distance (in units) between P and Q cannot be more than

1 ◯ 18

2 ◯ 20

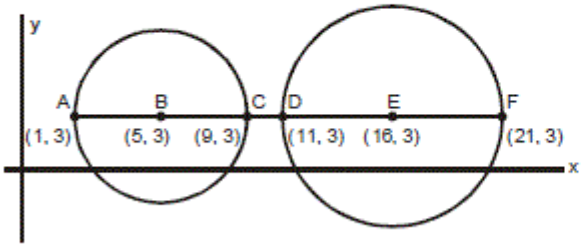
3 ◯ 21

4 ◯ 23

Solution:
Correct Answer : 2

Answer key/Solution

The given equations can be rewritten as:
$(x - 5)^2 + (y - 3)^2 = 4^2$ ... (i)
$(x - 16)^2 + (y - 3)^2 = 5^2$ ... (ii)
From the above equations, it can be noted that the given equations represent circles.
The following graph shows the positions of the two circles.



From the graph, it can be noted that the maximum distance between any two points on the circle, with one point on each, cannot be more than AF i.e., 20 units.

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Q.19 [11831809]

Ramlal, a fruit vendor, sells only apples and oranges. One day in the morning, he bought the two types of fruits in the ratio 3 : 5 respectively. Later on, he found that 8% of the apples and 12% of the oranges were rotten. At the end of the day, he was left with 24 fruits, which accounted for 4% of the total number of fruits that he had bought in the morning. On the given day, if Ramlal sold only those fresh fruits that he had bought in the morning and disposed of all the rotten fruits during the course of the day, the number of fruits sold by Ramlal was

Answer key/Solution

Solution:

Correct Answer : 513

Let the total number of fruit bought by Ramlal be 'x'.

$\therefore$ 4% of x = 24 $\Rightarrow$ x = 600

Number of apples bought by Ramlal $= \frac{3}{8} \times 600 = 225$

Number of pineapples bought by Ramlal $= \frac{5}{8} \times 600 = 375$

Hence, the required number of fruits = 600 – (8% of 225 + 12% of 375 + 24) = 513.

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Q.20 [11831809]

If $f(x) = |x - 4|$ and $g(x) = x^2$, find the number of values of x for which f(g(x)) = g(f(x)).

Answer key/Solution

Solution:

Correct Answer : 1

$f(g(x)) = |x^2 - 4|$; $g(f(x)) = |x - 4|^2$

Both sides have to be positive because $|x - 4|^2$ will always be positive.

Therefore, solution of $f(g(x)) = g(f(x))$ is same as solution of $x^2 - 4 = x^2 - 8x + 16$; x = 2.5 (this is consistent with our original assumption)

Hence, the number of values of x for which f(g(x)) = g(f(x)) is 1, that is., x = 2.5.

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Q.21 [11831809]

The percentage volumes of liquid 'A' in three solutions – I, II and III – form a geometric progression in that order. If we mix I, II and III solutions in the ratio 2 : 3 : 4, we obtain a solution containing 32% of A. If we mix them in the ratio 3 : 2 : 1, we obtain a solution containing 22% of A. What is the percentage of liquid A in II?

1 ◯ 18%

2 ◯ 36%

3 ◯ 24%

4 ◯ 48%

Solution:

Correct Answer : 3

Answer key/Solution

Let percentage of liquid A in I, II and III vessels be a, ar and ar^2 , respectively.

$\therefore \frac{2a+3ar+4ar^2}{900}=\frac{32}{100}$

and $\frac{3a+2ar+ar^2}{600}=\frac{22}{100}$

$2a + 3ar + 4ar^2 = 288$ ... (i)

$3a + 2ar + ar^2 = 132$ ... (ii)

Dividing (i) by (ii), we get

$132r^2 + 99r + 66 = 72r^2 + 144r + 216$

$\Rightarrow (4r + 5) \times (r - 2) = 0$

$\Rightarrow r = 2$ (As r is an integer)

$\therefore a = 12.$

Hence, the percentage of liquid A in II is 24%.

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Q.22 [11831809]

The marks scored by Pankaj in three subjects are in the ratio 4 : 5 : 6. Pankaj scored an overall aggregate of 62.5% in the exam. If the maximum marks in each subject are in the ratio 3 : 4 : 5, in how many subjects did Pankaj score more than 65% marks?

Solution:

Correct Answer : 1

Answer key/Solution

Let the maximum marks in each subject be 3k, 4k and 5k.

$\therefore$ Pankaj's total score = 62.5% of (12k) = 7.5k

Let Pankaj have scored 4x, 5x and 6x in the three subjects.

$\therefore 4x + 5x + 6x = 15x = 7.5k \Rightarrow x/k = 1/2$

If maximum marks in each subject is 60, 80 and 100, then his score in the respective subjects are 40, 50 and 60.

We know that 40/60 = 66.67% whereas the other two are less than 65%.

Hence, he has scored more than 65% in exactly one subject.

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