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Section-1

Sec 1

Q.1 [11831809]

Two types of rice P and Q are mixed and then sold at Rs. 60 per kg. The profit is 20% if P and Q are mixed in the ratio 4 : 3, and profit is 10% if this ratio is 3 : 4. The cost prices per kg of P and Q are in the ratio

1 ○ 9 : 16

2 ○ 8 : 15

3 ○ 7 : 16

4 ○ 2 : 5

Solution:

Correct Answer : 2

Let cost prices per kg of rice P and Q be Rs. x and Rs. y respectively.
Then, $1.2 \times (4x + 3y)/7 = 60$ ... (i)
and $1.1 \times (3x + 4y)/7 = 60$ ... (ii)
From (i) and (ii), we get
$1.2 \times (4x + 3y)/7 = 1.1 \times (3x + 4y)/7$
$\Rightarrow 48x + 36y = 33x + 44y$
$\Rightarrow 15x = 8y$
$\Rightarrow x/y = 8/15$
Hence, the ratio of the cost prices per kg of P and Q is $8 : 15$.

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Q.2 [11831809]

If $x^4 - y^4 = 65$, where x and y are natural numbers, then the value of the expression $x^4 + y^4$ is

Solution:

Correct Answer : 97

$(x^2 - y^2)(x^2 + y^2) = 65$
$\Rightarrow (x^2 - y^2)(x^2 + y^2) = 1 \times 65 = 5 \times 13$
$\Rightarrow x^2 - y^2 = 5$ and $x^2 + y^2 = 13$ (because x and y are natural numbers.)
So, $2x^2 = 18$
$\Rightarrow x^2 = 9$
So $y^2 = 4$
Hence, $x^4 + y^4 = (3)^4 + (2)^4 = 97$.

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Q.3 [11831809]

Let $S = \{1, 2, 3, 4, ..., 27\}$. Three different numbers of this set are selected and their sum is calculated. How many such selections of 3 elements will give a sum of 72?

1 ◯ 21

2 ◯ 7

3 ◯ 15

4 ◯ 5

Let a + b + c = 72. Let c be the largest of them.

Since a, b, c are 3 different elements, c can take 3 values 25, 26, 27.

If c = 27, then a + b = 45

Then, (a, b) can take values (26, 19), (25, 20), (24, 21), (23, 22).

If c = 26, then a + b = 46.

Then, (a, b) can take values (27, 19), (25, 21), (24, 22).

If c = 25, then a + b = 47

Then, (a, b) can take values (27, 20), (26, 21), (24, 23)

Hence, a sum of 72 would be obtained for 7 combinations.

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Q.4 [11831809]

Ravi made an upstream journey of 15 km in a certain time. If his speed in still water was 2 km/h less and the speed of the stream was 2 km/h more, he would have taken five hours more for that journey. Find his upstream speed (in km/h).

1 ○ 5

2 ○ 2

3 ○ 4

4 ○ 6

Let his speed in still water and the speed of the stream (both in kmph) be u and v, respectively.

Given, $15/[u - 2 - (v + 2)] = 15/(u - v) + 5$

Let $W = u - v \Rightarrow 15/(W - 4) - 15/W = 5$

$\Rightarrow 60/[W(W - 4)] = 5$

$\Rightarrow W^2 - 4W - 12 = 0$

$\Rightarrow (W - 6)(W + 2) = 0 \Rightarrow W = 6$ or -2.

Since upstream speed is not negative, we get W = 6 km/h.
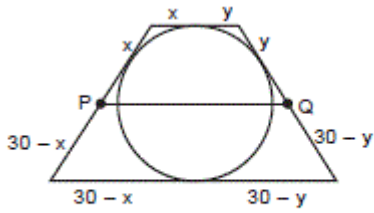
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Q.5 [11831809]

A circle is drawn inside an isosceles trapezium, whose non-parallel sides are 30 cm long. The circle touches all the four sides of the trapezium. What is the length (in cm) of the line joining the midpoints of the non-parallel sides of the trapezium?

Solution:

Correct Answer : 30

Sum of the parallel sides = 60 cm
Hence, the length of PQ = 60/2 = 30 cm.

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Q.6 [11831809]

If $\log (x^4 y) = 1$; $\log (xy^3) = 2$, what is the value of $\log(xy)$?

1 ○ 8/11

2 ○ 8/33

3 ○ 3/5

4 ○ 3/11

Solution:

Correct Answer : 1

$3\log (x^4 y) = 3 = \log (x^{12}y^3)$ ... (i)
$\log (xy^3) = 2$ ...(ii)
(i) − (ii) : $\log (x^{11}) = 1$. So $\log x = 1/11$
Also, $\log (x^4 y) + \log (xy^3) = \log x + 4 (\log xy) = 3$.
So $\log(xy) = 8/11$.

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Q.7 [11831809]

Shawn was asked to add the numbers from 1 to 'n'. When teacher asked for the sum, he answered 1020. The teacher noted that Shawn missed adding a few numbers between 1 and 'n', excluding 1 and n. If n = 45, what is ratio of the minimum and maximum number of numbers Shawn could have missed?

1 ○ 1 : 3

2 ○ 2 : 3

3 ◯ 1 : 4

4 ◯ 1 : 5

Solution:

Q Answer key/Solution

Correct Answer : 3

Shawn missed numbers between 1 and n.

Thus, '1' and 'n' were necessarily included.

Sum = 1 + 2 + 3 + … + 45 = 1035

Shawn's sum = 1020

Thus, 15 more is required. Since '1' wasn't missed, there could be maximum four numbers 2, 3, 4, 6.

The minimum number of numbers can be 1 i.e., 15.

Hence, the required ratio is 1 : 4.

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Q.8 [11831809]

Shiv can do a piece of work in 10 hours. He starts the work on Monday at 10:00 AM, and after each successive hour, starting from 11:00 AM, a man, of half the efficiency of the man who started working just before, joins the existing member(s). By what time the work will be completed on that day?

1 ◯ 1:00 PM

2 ◯ 2:00 PM

3 ◯ 4:00 PM

4 ◯ 3:00 PM

Solution:

Q Answer key/Solution

Correct Answer : 3

Let total work be 640 units. (For the sake of simplicity, total work should be assumed in such a way that the work done by a person should be divisible by 2.)

Work done in the first hour = 64 units.

Work done in the second hour = 64 + 64/2 = 64 + 32 = 96 units

Work done in the third hour = 64 + 32 + 32/2 = 64 + 32 + 16 = 112 units

Work done in the fourth hour = 64 + 32 + 16 + 8 = 120 units

Work done in the fifth hour = 64 + 32 + 16 + 8 + 4 = 124 units

Work done in the sixth hour = 64 + 32 + 16 + 8 + 4 + 2 = 126 units

The total up until now has exceeded 640, therefore, work will definitely be completed in atmost 6 hours.
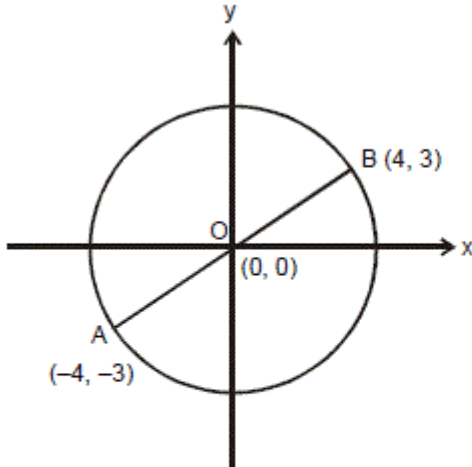
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Q.9 [11831809]

The coordinates of two diagonally opposite vertices of a rectangle are (4, 3) and (−4, −3). Find the number of such rectangle(s), if the other two vertices also have integral coordinates.

Solution:

Correct Answer : 5

Other two vertices will make two right angled triangles with AB as the common hypotenuse. So they must lie on the circle with AB as the diameter and O as the centre. Radius of that circle will be 5 units.
There will be 5 such pairs in which both the coordinates are integers.
[(5, 0), (−5, 0)], [(−4, 3), (4, − 3)],
[(−3, 4), (3, −4)], [(−3, −4), (3, 4)] and [(0, 5), (0, −5)]

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Q.10 [11831809]

Let S = {3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15}. The number of subsets of S comprising composite number(s) only and that of those comprising prime number(s) only are N_1 and N_2 respectively, then $|N_1 - N_2|$ is divisible by how many distinct prime numbers?

Solution:

Correct Answer : 2

The given set S has 8 composite and 5 prime numbers.
The number of subsets of S comprising composite numbers only = $2^8 - 1$
The number of subsets of S comprising prime numbers only = $2^5 - 1$.
Hence, the required difference = $(2^8 - 1) - (2^5 - 1) = 2^8 - 2^5 = 224$, which is divisible by two distinct prime numbers 2 and 7.

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Q.11 [11831809]

Find the solution set for [x] + [2x] + [3x] + [4x] = 14, where x is a real number and [x] is the greatest integer less than or equal to x.

1 ◯ x < 5/3

2 ◯ 3/2 ≤ x < 5/3

3 ◯ 1 ≤ x < 4/3

4 ◯ 1/2 ≤ x < 2

Solution:

Correct Answer : 2

🔍 **Answer key/Solution**

By observing we can find that x > 1 and x < 2. Else the RHS ≠ 14.
So the combinations are [x] = 1, [2x] = 2 or 3, [3x] = 4 or 5, [4x] = 6 or 7
The combinations that give RHS = 14 are 1 + 2 + 4 + 7 or 1 + 3 + 4 + 6.
For any value of x, the case of "1 + 2 + 4 + 7" is not possible.
Therefore, it has to be the case of "1 + 3 + 4 + 6", which will occur when x ≥ 3/2 and x < 5/3.
Hence, the solution is 3/2 ≤ x < 5/3.

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Q.12 [11831809]

Heera, a fruit vendor, sold 12 coconuts, all of which are of the same cost price, such that profit percentage on no two coconuts is the same. The profits made on the given coconuts were in an arithmetic progression. If the profit percentage of the coconut with 5th highest and 8th highest selling price were 14% and 11% respectively, find the profit percentage on the whole.

1 ◯ 12%

2 ◯ 12.5%

3 ◯ 13%

4 ◯ 13.5%

Solution:

Correct Answer : 2

🔍 **Answer key/Solution**

If the profit amount is in an AP, then the profit percentage is also in an AP.
If P5 = 14% and P8 = 11%, then P6 = 13% and P7 = 12%.
Hence, average of the middle terms will give the profit % on the whole i.e., (12 + 13)/2 = 12.5%.

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Q.13 [11831809]

What is the largest integer that will always divide the number $(n + 1)(n + 3)(n + 5)(n + 7)(n + 9)$ for all positive even integers n?

1 ○ 15

2 ○ 35

3 ○ 105

4 ○ 165

Solution:

Correct Answer : 1

🔍 Answer key/Solution

For any even n, n + 1, n + 3, n + 5, n + 7, n + 9 will be 5 consecutive odd numbers which will always include a multiple of 5 and 3.

For n = 8, 9 × 11 × 13 × 15 × 17 is not divisible by 7k.

And, for n = 12, 13 × 15 × 17 × 19 × 21 is not divisible by 11k.

Therefore, the number 15 will always divide the number (n + 1)(n + 3)(n + 5)(n + 7)(n + 9).

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Q.14 [11831809]

For all natural numbers N, f(N) is defined as the sum of the digits of the number. How many 3 digit natural numbers N less than 500 are there such that f(N) is equal to 12?

Solution:

Correct Answer : 36

🔍 Answer key/Solution

f(N) = 12, then the digits could be ordered set of (9, 3, 0); (9, 2, 1); (8, 4, 0); (8, 3, 1); (8, 2, 2); (7, 5, 0); (7, 4, 1); (7, 3, 2); (6, 6, 0); (6, 5, 1); (6, 4, 2); (6, 3, 3); (5, 5, 2); (5, 4, 3); (4, 4, 4).

The number of cases less than 500 is 2 + 4 + 2 + 4 + 2 + 4 + 4 + 2 + 4 + 2 + 1 + 4 + 1 = 36.

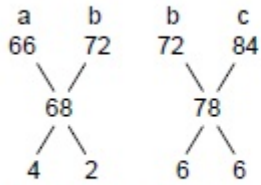Bookmark   FeedBack

Q.15 [11831809]

The average scores of students of sections A, B and C in the Mathematics test were 66, 72 and 84, respectively. If the average score of the students of sections A and B together is 68 and that of sections B and C together is 78, then find the average score of the students of sections A and C together.

Solution:

Correct Answer : 72

Answer key/Solution

Let the number of students in sections A, B and C be a, b and c, respectively.

```
 a    b    b    c
66   72   72   84
  \  /      \  /
   68        78
  / \        / \
 4   2      6   6
```

So a : b : c = 2 : 1 : 1.

Hence, the average score of the students of sections A and C together = (66 × 2k + 84 × k)/3k = 72.

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Q.16 [11831809]

ABCD is a parallelogram. AB = 20 cm and AD = 40 cm. Points P and Q on AB and AD respectively are such that AP : PB = 1 : 3 and AQ : QD = 3 : 2. In what ratio will PQ divide the diagonal AC?
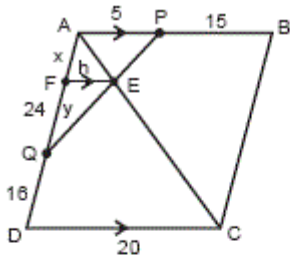
1 ○ 2 : 9

2 ○ 3 : 14

3 ○ 4 : 13

4 ○ 3 : 5

Solution:

Correct Answer : 2

△AFE is similar to △ADC.

$$\Rightarrow \frac{x}{40} = \frac{h}{20} \Rightarrow x = 2h$$

△EFQ is similar to △PAQ.

$$\Rightarrow \frac{y}{24} = \frac{h}{5} \Rightarrow y = \frac{24}{5}h$$

$$\Rightarrow x + y = 2h + \frac{24}{5}h.$$

$$\Rightarrow h = \frac{5}{34} \times 24$$

△AFE is similar to △ADC.

Therefore, $\frac{AE}{AC} = \frac{h}{DC} \Rightarrow \frac{AE}{AC} = \frac{24 \times 5}{34 \times 20} = \frac{3}{17}.$

$\Rightarrow$ AE : AC = 3 : 17.

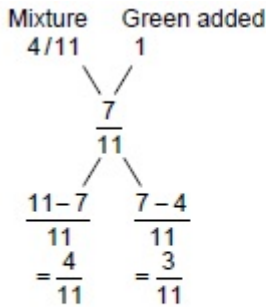Hence, AE : EC = 3 : 14.

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Q.17 [11831809]

Nerolak paints mixes Green and White in the ratio 4 : 7 in a tank. However after mixing, the company finds that the resultant shade has less of Green and removes 24 liters of the mixture and adds an equivalent quantity of Green. The shade thus obtained has Green and White in the inverse ratio. How many liters of mixture was there initially in the tank?

Solution:

Correct Answer : 56

Mixture   Green added
  4/11   1
         \   /
          $\frac{7}{11}$
         /   \
  $\frac{11-7}{11}$ $\frac{7-4}{11}$
  $=\frac{4}{11}$ $=\frac{3}{11}$

Ratio = 4 : 3
3 in the ratio corresponds to 24 liters.
4 in the ratio will correspond to = 24 × 4/3 = 32 liters
Hence, total capacity of the tank = 32 + 24 = 56 liters.

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Q.18 [11831809]

The polynomial $p(x) = x^3 + ax^2 + bx + c$ has the property that the sum of its roots is three times the product of its roots which is equal to the sum of the coefficients of the polynomial. If c = 4, then what is the value of b?

1 ○ −17

2 ○ −21

3 ○ 42

4 ○ 38

Solution:

Correct Answer : 2

Given: c = 4.

So, the product of the roots is −4.

Since the sum of the roots is 3 times the product of the roots, we get −a = 3(−4) (or) a = 12.

It is also given that the sum of the coefficients is −4.

So, f(1) = Sum of the coefficients = 1 + a + b + c = 1 + 12 + b + 4 = −4

Hence, b = −21.

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Q.19 [11831809]

A large plot is in the form of a rectangle of dimensions 42 m × 18 m. The 800 meters of iron wire for fencing is available. The field has to be divided into many identical smaller square plots, having integral sides (in meters), each of which is to be fenced with iron wire. Find the side (in meter) of each of the square plots such that the fencing iron wire that is left out is minimum.

1 ◯ 1

2 ◯ 2

3 ◯ 3

4 ◯ 6

Solution:

Correct Answer : 3

🔍 **Answer key/Solution**

Since the HCF of 42 and 18 is 6, the side of the identical square plots must be one of the factors of 6.
The factors of 6 are 1, 2, 3, and 6.
If side of the square plot is 1 m, the length of fencing iron wire required is (19 × 42 + 43 × 18) = 1572 m
But 1572 m > 800 m
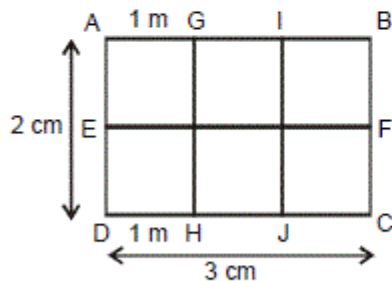If side of the square plot is 2 m, the length of fencing iron wire required is
(22 × 18 + 10 × 42) = 816 m > 800 m
If side of the square plot is 3 m, the length of fencing iron wire required is
(15 × 18 + 7 × 42) = 564 m < 800 m
Hence, for minimum fencing iron wire to be left the side of identical square plot = 3 m.
For example: If the rectangular plot is of dimensions 3 m × 2 m.

Number of squares of side 1 m = 3 × 2 = 6
Perimeter of these squares = 6 × 4 = 24 m
Hence, required iron wire for fencing = 24 – EF – GH – IJ = 24 – 3 × 1 – 2 × 1 – 2 × 1 = 17 m
Or 3 × 3 + 4 × 2 = 17 m.

[Bookmark] [FeedBack]

Q.20 [11831809]

How many of the five-digit numbers that are formed using the digits 1, 2, 3, 4 and 5 without repetition are divisible by the digit present in its units place?

1 ◯ 120

2 ◯ 96

3 ◯ 102

4 ◯ 104

Solution:

Correct Answer : 3

Number of 5 digit numbers that can be formed using 1, 2, 3, 4 and 5 without repetition = 5! = 120.

We are interested in finding out those numbers which are divisible by the number present in its units place.

Now, any number having a 1, 2 and 5 in the units place is divisible by 1, 2 or 5 respectively,

3 × 4! = 72 such numbers exist.

Any number with 3 in its units place is divisible by 3, because the sum of digits = 1 + 2 + 3 + 4 + 5 = 15, is divisible by 3.

So 24 more such numbers exist.

Now, if a number ending in 4 has to be divisible by 4, the last two digits should be 24. 6 such numbers exist.

Hence, a total of 72 + 24 + 6 = 102 such numbers exist.

🔍 Answer key/Solution

[Bookmark] [FeedBack]

Q.21 [11831809]

The selling price of one apple is equal to the cost price of 7 bananas. The fruit vendor gains 40% from sales of apples and 60% from sales of bananas. If he sells one banana and one apple, then find his overall profit%.

1 ◯ 36(2/3)%

2 ◯ 43(1/3)%

3 ◯ 40%

4 ◯ 45%

Solution:

Correct Answer : 2

🔍 Answer key/Solution

Let x be the CP of a banana and 7x be the SP of an apple.

According to the question,

The SP of a banana is 1.6x and the CP of an apple is 5x.

Total CP of 1 apple and 1 banana = 6x

Total SP of 1 apple and 1 banana = 8.6x

Hence, required overall profit = (2.6x/6x) × 100 = 43(1/3)%.

[Bookmark] [FeedBack]

Q.22 [11831809]

How many integral values of 'x', which is a real number, satisfy the equations $x^2 - 4x - 96 < 0$ and $x^2 > 4$?

Solution:

Correct Answer : 14

Here, (x + 8) (x − 12) < 0

So, −8 < x < 12 = 19 values.

But $x^2 > 4$

So, x = −2, −1, 0, 1, 2 do not satisfy this condition.

Hence, x has 14 values.

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