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Qs Analysis (QsAnalysis.jsp?sid=aaaN5tjtX0b7WgArBjowySun Jan 08 23:43:44 IST 2023&qsetId=kssEdwiztMQ=&qsetName=)

Video Attempt / Solution (VideoAnalysis.jsp?sid=aaaN5tjtX0b7WgArBjowySun Jan 08 23:43:44 IST 2023&qsetId=kssEdwiztMQ=&qsetName=)

Solutions (Solution.jsp?sid=aaaN5tjtX0b7WgArBjowySun Jan 08 23:43:44 IST 2023&qsetId=kssEdwiztMQ=&qsetName=)

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Section-1

Sec 1

Q.1 [11831809]

From the first ‘n’ consecutive even natural numbers written on a blackboard, one of the numbers is removed. If the average of the remaining numbers remains is 32, then which of the following cannot be the value of ‘n’?

1 ○ 31

2 ○ 32

3 ○ 30

4 ○ 34

Solution:
Correct Answer : 4
The first even number is 2, the last one is 2n. So the average of all the numbers is n + 1.
Note that all the averages for the various value of n are even.
Any number that is removed can make a maximum difference of 1 to the average.
When a number is removed, the average of the remaining numbers has become 32.
There are 3 possibilities:-
(1) The original average itself was 32(n = 31). The number that was removed is 32.
(2) The original average is 33(n = 32) and the number that was removed is 64.
(3) The original average is 31(n = 30) and the number that was removed is 2.
Hence, the value of 'n' cannot be 34.

Answer key/Solution

Bookmark FeedBack

Q.2 [11831809]

Rohan had to pick his wife from home since they had planned to go for a movie. He planned to reach home from office and leave immediately to the movie hall. The movie hall and their home were in opposite directions from Rohan's office. Since he got delayed by 20 minutes, he asked his wife to pick an auto and come towards his office. His home was a 50 minute drive from his office. He asked her to start from her home at the moment he left his office towards his home. He picked her on the way and they managed to reach the venue just in time for the movie. If Rohan drives at an average speed of 80 km/h, find the speed (in km/h) of the auto-rickshaw.

Solution:
Correct Answer : 20
Since the auto option saved 20 minutes, it must have saved 10 minutes of onwards journey to home and the return journey from home to the movie hall.
Hence, his wife must have travelled a distance that Rohan would have covered in 10 minutes.
So Rohan must have travelled for 40 minutes from his office.
Hence, his wife would also have travelled for 40 minutes.
The auto covers in 40 minutes, that the Rohan covers in 10 minutes. So Auto's speed = 1/4 × 80 = 20 km/h.

Answer key/Solution

Bookmark FeedBack

Q.3 [11831809]

Raju has three clocks A, B and C. Once an alarm goes off on A, it rings continuously for 10 seconds, then pauses, then starts ringing again for 10 seconds after 2 minutes, and so on. The respective values for Clock B are 20 seconds and 4 minutes, and for Clock C are 30 seconds and 6 minutes. An alarm is set in each of the three Clocks for 06:00 AM. What time after 06:00 AM will the three alarms go off simultaneously for the first time again?

1 ○ 06:06 AM

2 ◯ 06:13 AM

3 ◯ 06:30 AM

4 ◯ 06: 33 AM

Solution:
Correct Answer : 2
LCM of (120 + 10), (240 + 20) and (360 + 30) is 780.
Hence, the three alarms will go off simultaneously 780 seconds or 13 minutes after 06:00 AM i.e., at 06:13 AM.

Answer key/Solution

Bookmark FeedBack

Q.4 [11831809]

A person has just sufficient money to buy either 30 guavas, 50 plums or 70 peaches. He spends 20% of the money on travelling, and buys 14 peaches, ‘x’ guavas and ‘y’ plums using rest of the money. If x, y > 0, what is the minimum value of the sum of x and y?

1 ◯ 22

2 ◯ 20

3 ◯ 26

4 ◯ 24

Solution:
Correct Answer : 2
Let the total money (in Rs.) with the person be k × LCM (30, 50, 70) i.e., 1050k.
Therefore, the price of a guava, a plum and a peach will be 35k, 21k and 15k respectively.
$14 \times 15k + x \times 35k + y \times 21k = 0.8 \times 1050k$
$\Rightarrow 5x + 3y = 90$
For ‘x + y’ to be minimum, x has to be maximum. Since 90 is a multiple of 5, in order to maximise the value of 5x, the value of 3y has to be the lowest multiple of 5.
$3y = 15 \Rightarrow y = 5$
$\therefore x = 15$
Hence, the minimum value of the sum is 20.

Answer key/Solution

Bookmark FeedBack

Q.5 [11831809]

In triangle ABC, side AC and the perpendicular bisector of BC meet in point D, and BD bisects ∠ABC. If AD = 9 and DC = 7, what is the area of triangle ABD?

1 ○ 14

2 ○ 28

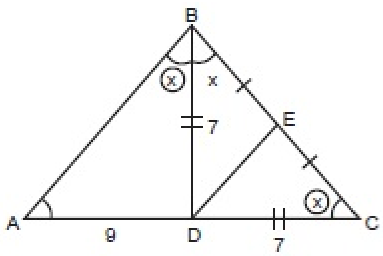
3 ○ 14√5

4 ○ 28√5

Solution:

Correct Answer : 3

Answer key/Solution



ΔBDE and ΔDEC are congruent.

So BD = DC = 7

ΔBAC is similar to ΔDAB.

$$\frac{AB}{AC} = \frac{9}{AB} \Rightarrow AB^2 = 144$$

$\Rightarrow AB = 12$

Area of ABD = $\sqrt{s(s-a)(s-b)(s-c)}$

$$s = \frac{9+12+7}{2} = 14$$

Hence, area of the triangle ABD $= \sqrt{14 \times 5 \times 2 \times 7} = 14\sqrt{5}$ sq.units.

Bookmark FeedBack

Q.6 [11831809]

Ajay left Hyderabad for Bengaluru at 6 AM. At 9:30 AM, Bhaskar left Hyderabad for Bengaluru at a speed that was 12 km/h more than the speed of Ajay. At 4:30 PM on the same day, the two were 91 km apart. If their cars had travelled with no halts, find the speed (in km/h) of car in which Ajay is travelling.

1 ○ 40

2 ○ 50

3 ○ 60

4 ◯ Cannot be determined

Solution:
Correct Answer : 2

Answer key/Solution

Let the speed of Ajay be s km/h. Therefore, the speed of Bhaskar must have been (s + 12) km/h.
According to the given condition, there are two possible cases: Either Ajay was 91 km ahead of Bhaskar or Ajay was 91 km behind Bhaskar.

Case (i): Ajay was 91 km ahead of Bhaskar.

$$s \times \frac{21}{2} - (s + 12) \times 7 = 91$$

$$\Rightarrow s = 50$$

Case (ii): Ajay was 91 km behind Bhaskar.

$$(s + 12) \times 7 - s \times \frac{21}{2} = 91$$

$$\Rightarrow s = -2$$

Since s cannot be negative, it has to be 50 km/h.

Bookmark FeedBack

Q.7 [11831809]

A society of 385 people organized a tournament comprising three different games. The number of people who participated in at least two games was 42% more than those who participated in exactly one game. What is the minimum number of people who did not participate in any game?

1 ◯ 0

2 ◯ 17

3 ◯ 22

4 ◯ 72

Solution:
Correct Answer : 3

Answer key/Solution

Let X people play in no game, Y people play in exactly 1 game.
So X + Y + 1.42Y = 385 ⇒ X + 121Y/ 50 = 385.
Y can take values 50, 100, 150.
Hence, the smallest value of X for Y = 150 is 385 – 363 = 22.

Bookmark FeedBack

Q.8 [11831809]

A table of 'n' rows and 'n' columns is created such that the value of the cell in the ith row and the jth column is given by (i + 1) + j. Some numbers are selected from the table. If it is found that exactly one number has been selected from each row and each column, then the sum of the selected numbers will be equal to

1 ◯ $n^2 + 1$

2 ◯ n(n + 1)/2

3 ◯ n(n + 2)

4 ◯ n(n + 1)

Solution:

Correct Answer : 3

Answer key/Solution

One number is selected from each row. Let us say in row one, the number is picked from column j_n, in row two the number is picked from column j_{n-1} and so on.

So all the numbers in the set will be $1 + j_n + 1, 2 + j_{n-1} + 1, 3 + j_{n-2} + 1, \ldots, i + j_{n-i+1} + 1, \ldots, n + j_1 + 1$.

Sum of all the elements of any such set = $(1 + j_n + 1) + (2 + j_{n-1} + 1) + (3 + j_{n-2} + 1) + \ldots + (i + j_{n-i+1} + 1) + \ldots + (n + j_1 + 1)$

$$= (1+2+\ldots+n) + (j_1 + j_2 + \ldots + j_n) + \underbrace{(1+1+\ldots+1)}_{n\text{ times}}$$

$$= \sum_{i=1}^{n} i + \sum_{i=1}^{n} j_i + \sum_{i=1}^{n} 1$$

Since exactly one number is selected from each column, $j_1, j_2, j_3, \ldots, j_n$ will be 1, 2, 3, ...,n (in any order).

Hence, required sum = $\frac{n(n+1)}{2} + \frac{n(n+1)}{2} + n = n^2 + 2n = n(n + 2)$.

Alternate solution:

Consider a 1 × 1 table. The only value in the table is (1 + 1) + 1 = 3.

Putting n = 1 in all the options, only n(n + 2) gives the value as 3.

Bookmark FeedBack

Q.9 [11831809]

The product of the first five terms of an increasing arithmetic progression is 40/81. If the 1st, 2nd and 4th terms of the arithmetic progression are in geometric progression, what is the sum of the 1st term and the 5th term of the arithmetic progression?

Solution:

Correct Answer : 2

Answer key/Solution

Let the five terms in the A.P. be a – 2d, a – d, a, a + d and a + 2d.

Then, $(a - 2d) \times (a - d) \times a \times (a + d) \times (a + 2d) = \frac{40}{81}$ ...(i)

and $\frac{a-d}{a-2d} = \frac{a+d}{a-d}$

$\Rightarrow d(3d - a) = 0$

$\Rightarrow d = \frac{a}{3}$ (Since $d \neq 0$)

Substituting the value of d in (i), we get a = 1.

Hence, the sum = (a – 2d) + (a + 2d) = 2a = 2 × 1 = 2.

Bookmark FeedBack

Q.10 [11831809]

P, Q, R and S are four points on the circumference of a circle such that SR is a diameter of the circle. The point of intersection L of PR and QS lies inside the circle. If ∠PRQ = x°, ∠PQS = (x – 10)° and ∠QSR = (x + 10)°, then the measure of ∠SLR is

1 ◯ 90°

2 ◯ 120°

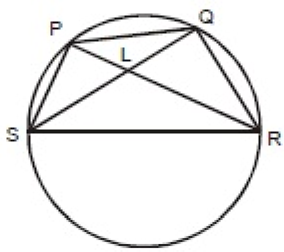
3 ◯ 100°

4 ◯ Cannot be determined

Solution:

Correct Answer : 2

Answer key/Solution



Since SR is the diameter of the circle, ∠SQR = ∠SPR = 90°.

∠QSR = ∠QPR = (x + 10)° and ∠PQS = ∠PRS = (x – 10)° (angles in the same segment)

Now, ∠SPQ + ∠SRQ = 180° (opposite angle of cyclic quadrilateral)

⇒ ∠SPR + ∠QPR + ∠SRP + ∠PRQ = 180°.

⇒ 90 + x + 10 + x – 10 + x = 180 or x = 30°.

Hence, ∠SLR = 180 – (x + 10) – (x – 10) = 120°.

Bookmark FeedBack

Q.11 [11831809]

How many non-negative integral pairs (m, n) satisfy the condition $0 < m \times n \leq m + n$ such that $m, n < 50$?

Solution:

Correct Answer : 98

Since $0 < m \times n$, therefore, m and n both cannot be equal to zero.

If m = 1, then n can range from 1 to 49.

As, $1 \times n \leq 1 + n$ where n = 1, 2, 3, ..., 49

Similarly, if n = 1, then m can range from 1 to 49.

So, such possible pairs will be 97 as pair (1, 1) will be common to both.

Other than these pairs, (2, 2) will also be possible.

Hence, total number of possible pairs are 98.

Answer key/Solution

Bookmark FeedBack

Q.12 [11831809]

A school divided its students into various groups to manage the annual day celebrations. There were 3 groups of 9 each to coordinate Arts, 12 groups of 7 each to coordinate the hospitality, 17 groups of 3 each to manage the music events. The orientation for all these groups was done simultaneously in N rooms each of which had a capacity of 14 students. What is the least value of N to manage the orientation, if all students belonging to any group are all seated in the same room?

Solution:

Correct Answer : 13

Room 1 to 3: Each of the rooms has 1 Arts group, 1 music group.

Room 4 to 9: Each room has 2 hospitality groups.

Room 10 to 12: 4 Music Groups in each room; Room 13: 2 music groups.

Hence, the least value of N is 13.

Answer key/Solution

Bookmark FeedBack

Q.13 [11831809]

The roots of the quadratic equation $x^2 - 24x + K = 0$ are both prime numbers. The difference between the maximum and the minimum values of K is

1 ◯ 23

2 ◯ 24

3 ◯ 43

4 ◯ 48

Solution:
Correct Answer : 4
Sum of the roots = 24. Since they are both prime numbers. The possible combination of the roots are (11, 13); (7, 17); (5, 19). The possible values of K is 143, 119, 95. So the difference between the maximum and the minimum values of K is 48.

Answer key/Solution

Bookmark FeedBack

Q.14 [11831809]

Suppose that a and b are digits, not both nine and not both zero, and the repeating decimal $0.\overline{ab}$ is expressed as a fraction in lowest terms. How many different numerators are possible if the denominator is less than 50?

Solution:
Correct Answer : 38

Answer key/Solution

Let N = $0.\overline{ab}$ Writing it as a rational number, we get N = ab/99 = X/Y.
If Y is less than 50, Y can be 33, 11, 9 or 3.
If Y = 33, the value of X that is a co-prime to it are all natural numbers from 1 to 33 excluding those divisible by 3 or 11 or by both. So there are 33 – (11 + 3 – 1) = 20.
If Y = 11, there are 10 numbers.
If Y = 9, the values are 1, 2, 4, 5, 7, 8 i.e., 6 values.
If Y = 3, the values are 1 and 2 i.e., 2 values.
Hence, the required answer is 38.

Bookmark FeedBack

Q.15 [11831809]

If $a_1 = 3$, $a_2 = 7$ and $a_n = 3a_{n-1} - 2a_{n-2}$ for $n \geq 3$, then the value of a_8 is

Solution:
Correct Answer : 511

Answer key/Solution

$a_1 = 3 = 2^2 - 1$
$a_2 = 7 = 2^3 - 1$
$a_3 = 3 \times 7 - 2 \times 3 = 15 = 2^4 - 1$
$a_4 = 3 \times 15 - 2 \times 7 = 31 = 2^5 - 1$
$\vdots$
$a_8 = 2^9 - 1 = 511.$

Bookmark FeedBack

Q.16 [11831809]

The sum of the edges of a cuboid is 12. What is the maximum numerical value of the sum of its volume and its surface area?

Solution:

Answer key/Solution

Correct Answer : 160

Let the dimensions of the cuboid be X, Y, Z.

Volume + Surface area = XYZ + 2(XZ + XY + YZ)

= (X + 2)(Y + 2)(Z + 2) – (4X + 4Y + 4Z + 8)

(X + 2) + (Y + 2) + (Z + 2) = 18

So maximum value of (X + 2)(Y + 2)(Z + 2) = 216

Hence, maximum value of (X + 2)(Y + 2)(Z + 2) – (4X + 4Y + 4Z + 8) = 216 – 56 = 160.

Bookmark FeedBack

Q.17 [11831809]

In year N, the 230th day of the year is a Tuesday. In year N + 1, the 130th day is also a Tuesday. On what day of the week did the 30th day of year N – 1 occur?

1 Monday

2 Thursday

3 Friday

4 Saturday

Solution:

Answer key/Solution

Correct Answer : 2

After the 230th day of year N till 130th day of year N + 1, there are either 135 + 130 (or) 136 + 130 days.

Since in the year N + 1, it is a Tuesday, we can say that it must be 266 days (which is exactly 38 weeks away).

So year N must be a leap year.

So year N – 1 is not a leap year.

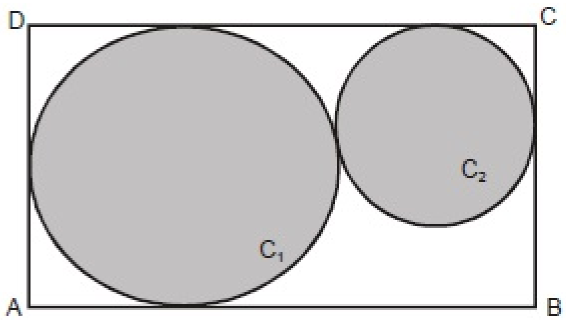
The number of days after the 30th day of year N – 1 till 230th day of year N + 1 is 335 + 230 days.

This is exactly 80 weeks and 5 days. Since in the year N it is a Tuesday, it must be a Thursday.

Bookmark FeedBack

Q.18 [11831809]

In the figure given below, circle C_1 touches three sides of rectangle ABCD and circle C_2 touches the circle C_1 and two sides of the rectangle. If AB = 9 cm and BC = 8 cm, find the area (in cm^2) of the unshaded region of the rectangle.



1 ◯ 18

2 ◯ 18.57

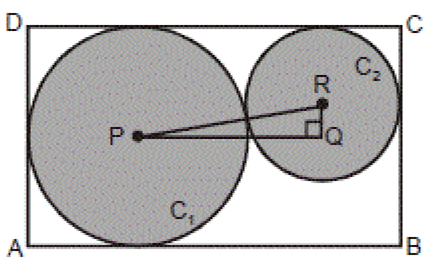
3 ◯ 20.92

4 ◯ 24

Solution:

Correct Answer : 2

Answer key/Solution



Let P and R be the centers of the circles C_1 and C_2 respectively and r cm be the radius of the circle C_2.

Radius of the circle $C_1 = \frac{AD}{2} = 4\,\text{cm}$

In ΔPQR,

PR = 4 + r, RQ = 4 – r and PQ = 9 – 4 – r = 5 – r.

$PR^2 = PQ^2 + QR^2$

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

$\Rightarrow r^2 - 26r + 25 = 0$

$\Rightarrow r = 1$ or $r = 25$

Since 'r' cannot be greater than 4, r = 1.

Hence, the area of the unshaded region $= 9 \times 8 - (\pi \times 4^2 + \pi \times 1^2)$

$= 72 - \frac{22}{7} \times 17 \approx 18.57\ cm^2$.

Bookmark FeedBack

Q.19 [11831809]

A bike running at 80 km/h initially is slowed down to 60 km/h as soon as the fuel indicator touches the half level mark. It keeps running at this speed till it runs out of fuel, thereby covering a total distance of 640 km in 10 hours. If the bike consumes 2.5 litres of fuel per hour, what is the capacity (in litres) of the fuel tank of the bike?

Solution:

Answer key/Solution

Correct Answer : 40

Let the time for which the bike travelled at 60 km/h and 80 km/h be x and (10 – x) hours respectively.

∴ 60x + 80(10 – x) = 640 ⇒ x = 8

Hence, the capacity of the fuel tank = 2 × (2.5 × 8) = 40 litres.

Bookmark FeedBack

Q.20 [11831809]

A shopkeeper has 2031 apples, 2391 bananas and 2811 peaches. He makes N baskets of these fruits such that every basket has a apples, b bananas and c peaches. In the end the shopkeeper is left with k(< a, b, c) fruits of each type. Find the maximum possible value of N.

1 ◯ 1

2 ◯ 10

3 ◯ 30

4 ◯ 60

Solution:

Answer key/Solution

Correct Answer : 3

As the shopkeeper is left with k of fruits of each type, 2031 – k apples, 2391 – k bananas and 2811 peaches – k should all be divisible by N.

We must also keep in mind that k < a, b, c

N is the largest factor that divides 2031 – k , 2391 – k and 2811 – k.

So N should also divides the (360, 420). The common factors are 60 and its factors.

If N = 60, the smallest value of k is = 51 (which actually works out to be greater than a, b, c).

a = 33; b = 39; c = 47. So we ignore this case.

If N = 30, smallest k = 21 (which is less than a, b, c). Then, a = 67; b = 79; c = 93.

So the largest value for N = 30.

Bookmark FeedBack

Q.21 [11831809]

The sum of the roots of the quadratic equation $ax^2 + bx + c = 0$ is equal to the sum of the squares of their reciprocals. If a, b and c are real numbers, and $a \neq 0$, then bc^2, ca^2 and ab^2 are in

1 AP

2 GP

3 HP

4 None of these

Solution:

Correct Answer : 1

Answer key/Solution

Let the roots of the equation be x_1 and x_2.

$$x_1 + x_2 = \frac{-b}{a} \text{ and } x_1 \times x_2 = \frac{c}{a}$$

$$\text{Given, } x_1 + x_2 = \left(\frac{1}{x_1}\right)^2 + \left(\frac{1}{x_2}\right)^2$$

$$\Rightarrow x_1 + x_2 = \frac{x_1^2 + x_2^2}{x_1^2 \times x_2^2}$$

$$\Rightarrow x_1 + x_2 = \frac{(x_1 + x_2)^2 - 2x_1 \times x_2}{(x_1 \times x_2)^2}$$

$$\Rightarrow \frac{-b}{a} = \frac{\left(\frac{-b}{a}\right)^2 - 2 \times \frac{c}{a}}{\left(\frac{c}{a}\right)^2}$$

$$\Rightarrow 2ca^2 = ab^2 + bc^2$$

$\Rightarrow bc^2$, ca^2 and ab^2 are in AP.

Bookmark FeedBack

Q.22 [11831809]

The common tangents of two circles of radii 10 cm and 5 cm intersect at 90°. What is the distance (in cm) between the centers of the circles?

I. 5√2
II. 10√2
III. 15√2

1 II only

2 I & III

3 ◯ I & II

4 ◯ II & III

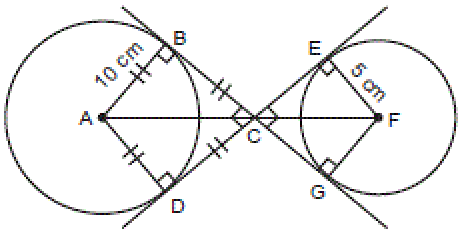
Solution:

Correct Answer : 2

Answer key/Solution

Two cases:

Case (i):



BC = CD = AB = AD

(All angles are 90°.)

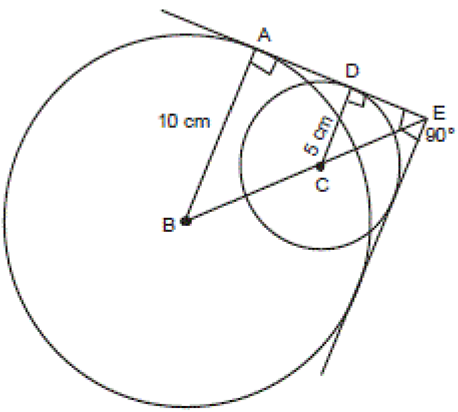
So ABCD must be a square.

So AC = $10\sqrt{2}$ cm

Similarly, FC = $5\sqrt{2}$ cm

Hence, AF = $15\sqrt{2}$ cm.

Case (ii):



AB = 10 cm ⇒ BE = $10\sqrt{2}$ cm

CD = 5 cm ⇒ CE = $5\sqrt{2}$ cm

Hence, BC = $5\sqrt{2}$ cm.

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