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CDC 06 2022 QA

Section-1

Sec 1

Q.1 [11831809]

A bookseller sells three types of notebooks - A, B and C. The product of the prices (in Rs.) of three types is equal to 6400. The prices of A and B are in the ratio 2 : 5 respectively. If the bookseller decides to increase the prices of A and B by Rs. 12 each, keeping the price of C unchanged, the product is then changed to 25,600. Find the sum of the original prices (in Rs.) of a piece of A, B and C each.

1 ○ 56

2 ○ 68

3 ○ 88

4 ○ 64

Solution:
Correct Answer : 2

Answer key/Solution

Let the price of A and B be 2x and 5x respectively and C be y.
$2x \times 5x \times y = 6400 \Rightarrow x^2y = 640$ ... (i)
According to the question,
$(2x + 12) \times (5x + 12) \times y = 25600$ ... (ii)
Dividing (ii) by (i), $(2x + 12) \times (5x + 12) \times y/x^2y = 40$
$\Rightarrow 10x^2 + 24x + 60x + 144 = 40x^2$
$\Rightarrow 30x^2 - 84x - 144 = 0$
$\Rightarrow (x - 4)(5x + 6) = 0$
So $x = 4$
Therefore, the original prices of A, B and C are Rs.8, Rs.20 and Rs.40.
Hence, the required sum = 8 + 20 + 40 = Rs.68.

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Q.2 [11831809]

Four persons Pat, Quinn, Ryan and Tim can complete a work in 9, 12, 15 and 20 days respectively. One of them starts the work and it is continued on a rotation basis, with all the four taking turns and only one person working per day. Any one of the four can start work on the first day. Which of the following is the complete set of people, who can work on the first day such that the work begins and ends with the same person?

1 Pat, Quinn

2 Quinn, Ryan

3 Pat, Quinn, Ryan

4 Pat, Quinn, Tim

Solution:
Correct Answer : 3

Answer key/Solution

Let the total work be LCM(9, 12, 15, 20) = 180 units
Then, work done by Pat, Quinn, Ryan and Tim in one day is 20, 15, 12 and 9 units respectively.
Work done in 4 days = 56 units
Work done in 12 days = 168 units
Remaining work = 12 units
The remaining work can be completed by Pat, Quinn or Ryan on the last working day as each one can complete more than or equal to 12 units of the work in a day, but the same cannot be said about Tim.
Hence, the correct option is Pat, Quinn and Ryan.

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Q.3 [11831809]

A regular hexagon ABCDEF has a side length of 6 cm. BF and BE are diagonals of the hexagon which intersect the diagonal AD at points P and Q respectively. What is the ratio of the area of triangle BPQ to that of the quadrilateral ABDF?

1 ◯ 1 : 6

2 ◯ 1 : 8

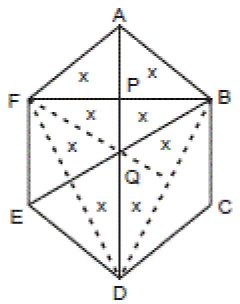
3 ◯ 1 : 10

4 ◯ 1 : 12

Solution:

Correct Answer : 2

Answer key/Solution



ΔBDF is an equilateral triangle.
So area of ΔPBQ = 1/6 × area of ΔBDF
And area of ΔBPQ = area of ΔABP
Let x be the area of the triangle BPQ.
Then, area of the quadrilateral ABDF = 8x
Hence, the required ratio = x ; 8x = 1 : 8.

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Q.4 [11831809]

f(x) is a quadratic function with the coefficient of highest power of x as 1 and has two real roots. f(0) = 9, and f(−9) = f(35). If the minimum value of f(x) is k, then find the value of k^2.

Solution:

Correct Answer : 25600

Answer key/Solution

Let $f(x) = ax^2 + bx + c$
Since the coefficient of highest power of x as 1 and f(0) = 9.
Therefore, a = 1 and c = 9.
$f(-9) = f(35) \Rightarrow (-9)^2 - 9b + 9 = (35)^2 + 35b + 9$
$\Rightarrow 81 - 9b = 1225 + 35b$
$\Rightarrow b = -26$
So $f(x) = x^2 - 26x + 9 = (x - 13)^2 - 160$
The minimum value of f(x) is − 160.
Hence, k = −160 and $k^2 = 25600$.

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Q.5 [11831809]

Let abcde be a 5-digit number. If a + b + c + d = 16, b + c + d + e = 17 and d = e + 3. Then the highest possible 5-digit number satisfying the above conditions is

Solution:

Correct Answer : 52096

Answer key/Solution

a + b + c + d = 16 ... (i)
b + c + d + e = 17 ... (ii)
and d = e + 3 ... (iii)
From (i) and (ii), e – a = 1 ⇒ e = a + 1
So d = a + 4
a __ __ a + 4 a + 1
For the highest possible 5-digit number, the maximum d i.e., a + 4 can be 9.
So a = 5, d = a + 4 = 9, e = a + 1 = 6
Therefore, from (i), b + c = 16 – 5 – 9 = 2
For the highest possible 5-digit number, b = 2 and c = 0
Hence, the highest 5-digit number is 52096.

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Q.6 [11831809]

A circle of radius 13 cm is circumscribed about a quadrilateral ABCD. If AB = 10 cm and BC = 24 cm, then find the maximum possible area (in sq. cm) of the quadrilateral ABCD.

1 ◯ 288

2 ◯ 289

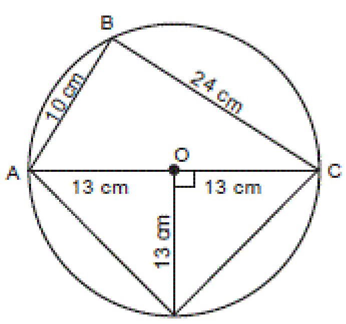
3 ◯ 324

4 ◯ 256

Solution:

Correct Answer : 2

Answer key/Solution



The maximum possible area of the quadrilateral ABCD
= Area of triangle ABC + Area of triangle ADC
=1/2 × 10 × 24 + 1/2 × 26 × 13 = 120 + 169 = 289 sq. cm.

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Q.7 [11831809]

Two runners Ram and Ravi simultaneously start running around a circular track. They run in the same direction. Ram runs at 9 m/s and Ravi runs at ‘s’ m/s. If they cross each other at exactly two points on the circular track and ‘s’ is a natural number, how many values can ‘s’ take?

1 ◯ 3

2 ◯ 4

3 ◯ 6

4 ◯ 5

Solution:

Correct Answer : 4

Answer key/Solution

Let the length of the track be x.
Then, time taken to meet first time = x/(9 –s) or x/(s – 9)
Time taken to meet for the first time at the starting point
= LCM(x/9, x/s) = x/HCF(9, s)
Number of meeting points = Time taken to meet at the starting point/Time taken for first meeting
Therefore, [x/HCF(9, s)]/[x/(9 –s)] = 2 or [x/HCF(9, s)]/[x/(s –9)] = 2

⇒ (9 – s)/HCF(9, s) = 2 or (s – 9)/HCF(9, s) = 2
Hence, s = 3, 7, 11, 15 and 27.

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Q.8 [11831809]

A dishonest shopkeeper mixes 250 grams of sand in 1 kilogram of rice. 350 grams of the mixture is spilled during transportation. He then uses a faulty balance that reads 1 kilogram for 800 gram while selling the mixture which is listed at the cost price of rice. If rice costs Rs. 70 per kg and sand costs Rs. 20 per kg, what is his overall profit/loss percentage during the entire transaction?

1 ◯ 12.5% Profit

2 ◯ 5% Profit

3 ◯ 5% Loss

4 ◯ No profit, no loss

Solution:
Correct Answer : 2
Cost of 1250 g of mixture of rice and sand = 70 + (20/4) = Rs.75
Given that 350 g was spilled, only 900 g of mixture remains.
The shopkeeper sells 800 g of mixture at Rs.70.
So the selling price of 900 g of mixture = 70/800 × 900 = Rs.78.75
Hence, profit percentage = (78.75 – 75)/75 × 100 = 5%.

Answer key/Solution

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Q.9 [11831809]

Let $\log_a(\log_b(\log_c p)) = 0$, where a, b and c assume distinct values among, 4, 8 and 16 only. If the product of all possible values of 'p' is equal to 2^n, then what is the value of 'n'?

Solution:
Correct Answer : 156

$\log_a(\log_b(\log_c p)) = 0$
$\Rightarrow \log_b(\log_c p) = 1$
$\Rightarrow \log_c p = b$
$\Rightarrow p = c^b$
Therefore, different possible values of p can be 4^8, 4^{16}, 8^4, 8^{16}, 16^4, 16^8
Product of all possible values of $p = 4^8 \times 4^{16} \times 8^4 \times 8^{16} \times 16^4 \times 16^8 = 2^{156}$.
Hence, $2^n = 2^{156} \Rightarrow n = 156$.

Answer key/Solution

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Q.10 [11831809]

For natural numbers p, q and r, $81 \times 7^4 \times p = 3^5 \times 49 \times q^r$. If 40 > p > q > r, then what is the maximum possible value of p + q + r?

1 ◯ 48

2 ◯ 50

3 ◯ 31

4 ◯ 32

Solution:
Correct Answer : 2

Answer key/Solution

The given equation can be rewritten as:
$81 \times 7^4 \times p = 3^5 \times 49 \times q^r$
$\Rightarrow 7^2p = 3q^r$
So, p is a multiple of 3 and q is a multiple of 7.
Possible values of p = 9, 12, 15, 18, 21, 24, 27, 30, 33, 36, 39
The corresponding values of $7^2p = 7^2 \times 3^2$, $7^2 \times 3 \times 2^2$, $7^2 \times 3 \times 5$, $7^2 \times 2 \times 3^2$, $7^3 \times 3$, $7^2 \times 3 \times 2^3$, $7^2 \times 3^3$, $7^2 \times 3 \times 2 \times 5$, $7^2 \times 3 \times 11$, $7^2 \times 3^2 \times 2^2$, $7^2 \times 3 \times 13$
Of all these expressions, only $7^3 \times 3$, and $7^2 \times 3^3$ can be written in the form $3q^r$, such that $40 > p > q > r$.
Hence, the maximum possible value of p + q + r = 27 + 21 + 2 = 50.

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Q.11 [11831809]
In a group of four friends – A, B, C and D, the ratio of the weight of A to the weight of B is 3 : 2. Ratio of the weight of B to the weight of C is 5 : 6. If the weight of D, which is half the weight of A, is 37.5 kg, find the weight (in kg) of C.

1 ○ 60

2 ○ 50

3 ○ 56

4 ○ 64

Solution:
Correct Answer : 1

Answer key/Solution

Let the weights (in kg) of A, B and C be a, b and c respectively.
As per the question,
a : b = 3 : 2, b : c = 5 : 6
So, a : b : c = 15 : 10 : 12
Weight of A = 2 × 37.5 = 75 kg
Hence, weight of C = 12/15 × 75 = 60 kg.

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Q.12 [11831809]
Let |m − 3| + |n − 4| = 6, where m, n are one digit whole numbers. The maximum value of m × n is

Solution:
Correct Answer : 42
$|m - 3| + |n - 4| = 6$
The integral solutions of the given equation are: (0, 1), (0, 7), (1, 8), (2, 9), (4, 9), (5, 8), (6, 1), (6, 7), (7, 6), (8, 5) and (9, 4).
Hence, the maximum value of $m \times n = 6 \times 7$ or $7 \times 6 = 42$.

Answer key/Solution

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Q.13 [11831809]

ABCD is a rectangle in which AB = 8 and BC = 6 cm. If a perpendicular is drawn from B to the diagonal AC which intersects DC at E, then the ratio of DE : EC is

1 ◯ 5 : 7

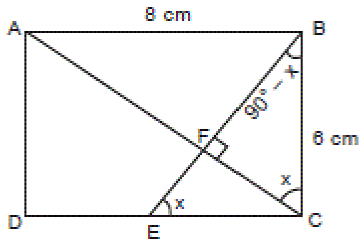
2 ◯ 3 : 5

3 ◯ 7 : 9

4 ◯ 9 : 11

Solution:
Correct Answer : 3

Answer key/Solution



Let $\angle CEF = x$.
$\angle CFE = 90°$, so $\angle CBE = 90° - x$.
Therefore, $\angle BCA = x$
So triangle CEB is similar to triangle BCA.
Therefore, CE/BC = BC/AB
$\Rightarrow CE = 6 \times 6/8 = 4.5$ cm
Therefore, $DE = 8 - 4.5 = 3.5$ cm
Hence, DE : EC = 3.5 : 4.5 = 7 : 9.

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Q.14 [11831809]

A worker works for 7 days on a project that has two tasks - X and Y. Starting from the second day, his daily wage for task X increases by 8% of the first day's wage for X, while his daily wage for task Y increases by 5% of the first day's wage for Y. The total wages of the worker for the first 3 days is Rs.4,140 and that for the last 3 days is Rs.5,100. What was the worker's average wage per day (in Rs.) during the week?

Solution:

Correct Answer : 1540

Answer key/Solution

Let the wages for the two tasks for the first day be x and y respectively. The wages for the two tasks for the 7 days are tabulated below.

Day	1	2	3	4	5	6	7
Task 1	x	1.08x	1.16x	1.24x	1.32x	1.40x	1.48x
Task 2	y	1.05y	1.10y	1.15y	1.20y	1.25y	1.30y

Wages for the first 3 days for task X are 3.24x and for task Y are 3.15y.
Wages for the last 3 days for task X are 4.2x and for task Y are 3.75y.
We get two equations in two unknowns.
$3.24x + 3.15y = 4140$ ...(i)
$4.2x + 3.75y = 5100$ ...(ii)
Solving for x and y, we get x = Rs.500 and y = Rs.800
Total wages for 7 days = $8.68x + 8.05y = 4340 + 6440$ = Rs.10,780
Hence, average wages per day = 10780/7 = Rs.1,540.

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Q.15 [11831809]

Let a_n be a sequence such that $a_n = \frac{a_{n-1}}{a_{n-2}}$ for each positive integer $n \geq 3$ where $a_1 = 2$ and $a_2 = 3$, then the value of $|a_{2007} - a_{2008}|$ is equivalent to

1 ◯ $3a_6$

2 ◯ $3(a_4 - a_5)$

3 ◯ $2a_4$

4 ◯ $2(a_2 - a_1)$

Solution:
Correct Answer : 3

Answer key/Solution

The first few terms of the sequence are:
$a_1 = 2$, $a_2 = 3$, $a_3 = 3/2$, $a_4 = 1/2$, $a_5 = 1/3$, $a_6 = 2/3$, $a_7 = 2$, $a_8 = 3$, ... and so on.
The terms in the sequence are repeating after every 6 terms.

Since 2007 and 2008 is equivalent to 3 mod 6 and 4 mod 6 respectively, therefore, $|a_{2007} - a_{2008}| = \frac{3}{2} - \frac{1}{2} = 1$.

$2a_4 = 2 \times 1/2 = 1$.

Hence, the answer is option (3).

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Q.16 [11831809]

Points A, B and C are along a straight line such that B lies between A and C. Ram starts from A towards C and after reaching C, he returns along the same line. Shyam starts from B towards A and after reaching A, returns along the same line. Ram and Shyam start simultaneously and the second time they meet is at point B. If the distance from A to B is 60 m and the ratio of speeds of Ram and Shyam is 4:3, find the distance between B and C.

1 ○ 60 m

2 ○ 150 m

3 ○ 50 m

4 ○ Cannot be determined

Solution:
Correct Answer : 3

Answer key/Solution

Let x be the distance between point B and point C.
Then, $(60 + 2x)/4 = 120/3 \Rightarrow x = 50$ m.

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Q.17 [11831809]

The sum of distinct real roots of the equation $\left(x+\frac{1}{x}\right)^2 - 4\left(x+\frac{1}{x}\right) + 3 = 0$ is

Solution:
Correct Answer : 3

Answer key/Solution

The given equation is $\left(x+\frac{1}{x}\right)^2-4\left(x+\frac{1}{x}\right)+3=0.$

Let $y=x+\frac{1}{x}$.

Then, $y^2 - 4y + 3 = 0$ ($y \geq 2$ & $y \leq -2$)
$\Rightarrow (y-1)(y-3) = 0$
$y = 1$ (Not possible) or $y = 3$

$x+\frac{1}{x}=3 \Rightarrow x^2 - 3x + 1 = 0$

So, $x = \frac{-(-3)\pm\sqrt{9-4}}{2}=\frac{3+\sqrt{5}}{2}$ or $\frac{3-\sqrt{5}}{2}$
Hence, sum of distinct real roots = 3.

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Q.18 [11831809]
Pipes A and B are inlet pipes while pipe C is an outlet pipe. Pipe A supplies water at 45 liters/hour. Pipe B can fill a tank in 3 hours while pipe C can empty it in 12 hours. All the pipes are simultaneously opened and the tank gets filled in 1 hour. What is the rate of flow of pipe B?

1 ◯ 20 liters/hour

2 ◯ 30 liters/hour

3 ◯ 24 liters/hour

4 ◯ 25 liters/hour

Solution:
Correct Answer : 1

Answer key/Solution

Portion of tank filled by pipe A in 1 hour = 1 – 1/3 + 1/12 = 3/4
∴ Time taken by A to fill the tank = 4/3 hours
Volume of the tank = 4/3 × 45 = 60 liters
Pipe B fills 60 liters in 3 hours.
Hence, rate of flow of pipe B = 60/3 = 20 liters/hour

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Q.19 [11831809]

How many integral values of x satisfy the inequality $\frac{\sqrt{2x+6}}{1-x}>1$?

Solution:
Correct Answer : 1

Answer key/Solution

$$\frac{\sqrt{2x+6}}{1-x} > 1$$

Or, $\sqrt{2x+6} > 1 - x$
Or, $2x + 6 > 1 + x^2 - 2x$
Or, $x^2 - 4x - 5 < 0$
Or, $(x - 5)(x + 1) < 0$
So $-1 < x < 5$
Since $1 - x > 0$, which implies $x < 1$.
Hence, only value that satisfies the inequality is '0'.

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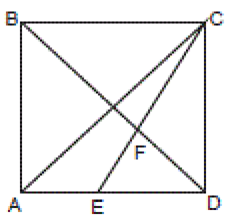
Q.20 [11831809]
ABCD is a square and E is a point on AD such that ∠CED = 4 × ∠ACE. If CE intersects diagonal BD at F, then find ∠EFB (in degrees).

Solution:
Correct Answer : 105

Answer key/Solution



Let ∠ACE = x
Then, ∠CED = 4x ⇒ ∠CAE = 3x = 45° (CA is the diagonal of the square ABCD.)
⇒ x = 15° and ∠DEC = 60°
And ∠FDE = 45°
Hence, ∠DFE = 180° – 60° – 45° = 75°
⇒ ∠EFB = 180° – 75° = 105°.

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Q.21 [11831809]
There are 40 students in a class. All the students play at least one of the three games among football, cricket and badminton. Anyone who plays football also plays cricket. No one plays football and badminton and 30% of the students play cricket and badminton. The number of students who play exactly one of the three games is more than the number of students who play more than one of the three. If the number of students who play only Badminton is minimum, then what is the maximum number of students who play both Cricket and Football?

1 ◯ 5

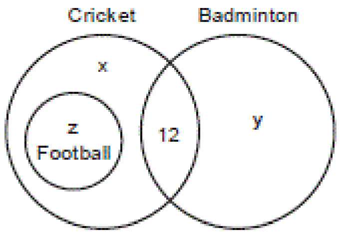
2 ◯ 6

3 ○ 8

4 ○ 7

Solution:
Correct Answer : 4

Answer key/Solution



$x + y + z + 12 = 40$
$\Rightarrow x + y + z = 28$
According to the question,
$x + y > z + 12$
For minimum y,
Let $y = 0$, $x + z = 28$ and $x > z + 12$
Hence, the maximum value of z is 7.

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Q.22 [11831809]

A shopkeeper hiked the price of an article by x% and then gave x% discount and the price of the article decreased by Rs.3,000. Once again the price of the article was increased by x/2% and then decreased by x/2% and it was finally sold at Rs.71,280. What can be the initial price of the article?

1 ○ Rs.78,500

2 ○ Rs.75,000

3 ○ Rs.72,000

4 ○ Rs.86,000

Solution:
Correct Answer : 2

Answer key/Solution

Let the price of the article be Rs.P.
Given that the price is increased and decreased successively by x%,
So the effective decrease is $[x^2/100]\%$ on the list price. This decrease is given to be Rs.3,000.
After that, (P – 3000) is increased by (x/2)% and decreased by (x/2)%.
The effective decrease must be less than Rs.750.
∴ The total decrease is in the range Rs.3,000 to Rs.3,750
∴ $71,280 + 3,000 < P < 71,280 + 3,750$.
Or, $74,280 < P < 75,030$
Among the given choices only Rs.75,000 lies in that range.
We can verify that this is correct.
$75000 \times x^2/100 = 3000$
$\Rightarrow x = 2$
After the first increase/decrease the price is Rs.72,000.
After the second increase/decrease, there would be a net decrease of 1% or Rs.720.
Hence, the final price would be Rs.71,280.

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