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CDC 02 2022 QA

Scorecard (procreview.jsp?sid=aaaN5tjtX0b7WgArBjowyMon Jan 09 00:00:24 IST 2023&qsetId=un8UNb5PG s=&qsetName=CDC 02 2022 QA)

Accuracy (AccSelectGraph.jsp?sid=aaaN5tjtX0b7WgArBjowyMon Jan 09 00:00:24 IST 2023&qsetId=un8UNb5PG s=&qsetName=CDC 02 2022 QA)

Qs Analysis (QsAnalysis.jsp?sid=aaaN5tjtX0b7WgArBjowyMon Jan 09 00:00:24 IST 2023&qsetId=un8UNb5PG s=&qsetName=CDC 02 2022 QA)

Video Attempt / Solution (VideoAnalysis.jsp?sid=aaaN5tjtX0b7WgArBjowyMon Jan 09 00:00:24 IST 2023&qsetId=un8UNb5PG s=&qsetName=CDC 02 2022 QA)

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Section-1

Sec 1

Q.1 [11831809]

There are three runners Aadit, Badal and Chahel at the same point. Aadit starts running at a speed of 6 m/s from a point. After 10 seconds, Badal starts running behind Aadit at a speed of 8 m/s. After 5 more seconds, Chahel also starts running behind Badal at a speed of 10 m/s. What is the distance (in m) between Chahel and Badal when Chahel catches Aadit if all of them are running along a straight line?

1 ◯ 45

2 ◯ 5

3 ◯ 10

4 ◯ 15

Solution:
Correct Answer : 2
Distance covered by Aadit in (10 + 5 =) 15 seconds = 6 × 15 = 90 m
Time taken by Chahel to catch Aadit = 90/(10 – 6) = 22.5 seconds
So distance covered by Chahel to catch Aadit = 10 × 22.5 = 225 m
And distance covered by Badal when Chahel catches Aadit = 8 × 5 + 8 × 22.5 = 220 m
Hence, required distance between Chahel and Badal = 225 – 220 = 5 m.

Answer key/Solution

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Q.2 [11831809]

Three circles C1, C2 and C3 are tangent to the same straight line and to each other. If the larger circles C1 and C2 have equal radii of 8 cm, then what is the diameter (in cm) of the smaller circle C3?

1 ○ 2

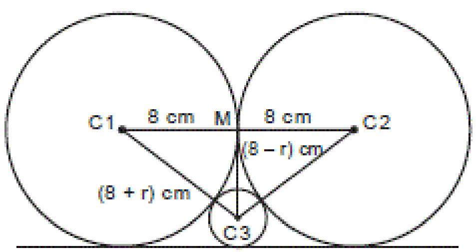
2 ○ 8

3 ○ 6

4 ○ 4

Solution:
Correct Answer : 4

Answer key/Solution



Let the radius of the smaller circle C3 be r.
Then, in right angled ΔC1MC3,
$(8 + r)^2 = 8^2 + (8 - r)^2$
$\Rightarrow 64 + r^2 + 16r = 64 + 64 + r^2 - 16r$
$\Rightarrow 32r = 64 \Rightarrow r = 2$ cm
Hence, the diameter of the smaller circle C3 = 4 cm.

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Q.3 [11831809]

Four friends bought certain number of candies in the ratio 2 : 3 : 5 : 6. If one of the friends bought exactly 30 candies, then which of the following CAN be sum of the total number of candies bought by any three of the friends?

1 ◯ 85

2 ◯ 120

3 ◯ 78

4 ◯ 160

Solution:
Correct Answer : 3

Answer key/Solution

For a certain value of x, the numbers of candies bought by the four friends are $2x$, $3x$, $5x$, and $6x$. The sum of the combination of candies with any three friends is equal to: 10x, 11x, 14x and 13x. It is given that one of these four friends had candies equal to 30.

Option 1: 10, 11, 14 and 13 doesn't divide 85. Therefore, it is not possible.

Option 2: 10x = 120 ⇒ x = 12.

Therefore, candies with all the four friends must be: 24, 36, 60 and 72, none of which is 30.

Therefore, it is not possible.

Option 3: 13x = 78 ⇒ x = 6.

Therefore, candies with all the four friends must be: 12, 18, 30, 36. It is possible.

Option 4: 10x = 160 ⇒ x = 16.

Therefore, candies with all the four friends must be: 32, 48, 80 and 96, none of which is 30.

Therefore, it is not possible.

Hence, option (3) is the correct answer.

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Q.4 [11831809]

The students in class X of a school are divided into three sections A, B and C. They wrote a Talent Search Test. The average scores of A, B and C in that test were 67, 83 and 95 respectively. If the average score of the students of sections A and B together is 73 and that of sections B and C together is 89, then find the average score of the students of sections A and C together.

1 ◯ 72.5

2 ◯ 67.5

3 ◯ 77.5

4 ◯ 83.5

Solution:

Correct Answer : 3

Answer key/Solution

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

Using alligation:

```
A(67)    B(83)
   \      /
     73
   /      \
 10        6
```

Hence, a : b = 10 : 6

```
B(83)    C(95)
   \      /
     89
   /      \
  6        6
```

Hence, b : c = 6 : 6

So we get a : b : c = 10 : 6 : 6 = 5 : 3 : 3

The required average score of the students of sections A and C together

= (5 × 67 + 3 × 95)/8 = (335 + 285)/8 = 77.5.

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Q.5 [11831809]

If a cube of edge 8 cm is cut into as many 1 cm cubes as possible, then the surface area of the lager cube will be what percent more or less than the sum of the surface areas of the smaller cubes?

1 ◯ 2.5%

2 ◯ 87.5%

3 ◯ 25%

4 ◯ 75%

Solution:

Correct Answer : 2

Answer key/Solution

Number of smaller cubes of edge 1 cm = 8 × 8 × 8 = 8^3

Surface area of the larger cube = 6 × 8^2 sq. cm

Sum of the surface areas of the smaller cubes = 8^3 × 6 × 1^2 sq. cm

Ratio of surface areas = 6 × 8^2 : 8^3 × 6 × 1^2 = 1 : 8

Hence, required percentage = (8 – 1)/8 × 100 = 87.5% less.

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Q.6 [11831809]

What is the value of x, if $\log_x (\log_{108} (\sqrt{3} + \sqrt{75})) = -1/2$?

Solution:
Correct Answer : 4

Answer key/Solution

$$\log_x\left(\log_{108}\left(\sqrt{3}+\sqrt{75}\right)\right)=-\frac{1}{2}$$

$$\Rightarrow \log_x\left(\log_{108}\left(\sqrt{3}+5\sqrt{3}\right)\right)=-\frac{1}{2}$$

$$\Rightarrow \log_x\left(\log_{(6\sqrt{3})^2}\left(6\sqrt{3}\right)\right)=-\frac{1}{2}$$

$$\Rightarrow \log_x\left(\frac{1}{2}\right)\left(\log_{(6\sqrt{3})}\left(6\sqrt{3}\right)\right)=-\frac{1}{2}$$

Hence, $-\log_x 2=-\frac{1}{2} \Rightarrow x = 4.$

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Q.7 [11831809]

A saree is marked at 100% above the cost price. What is the maximum number of successive discounts of 20% each, which can be offered, before selling the saree such that a loss is not incurred?

Solution:
Correct Answer : 3

Answer key/Solution

Let the cost price of the saree be Rs.100.
Marked price = Rs. 200
Therefore, 200 × $(0.8)^3$ = Rs. 102.40
Hence, the maximum number of successive discounts of 20% each is 3.

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Q.8 [11831809]

If in rectangle ABCD, AD = 2√3 cm, point P is on AB, and DB and DP trisect ∠ADC, then the perimeter (in cm) of ΔBDP is

1 ○ 4(1 + 2√3)

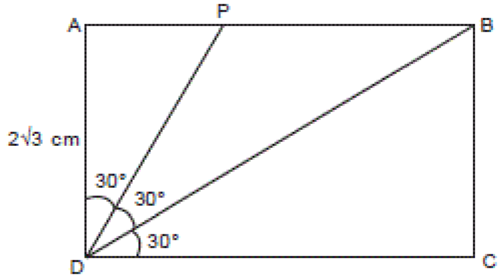
2 ○ 2(1 + 2√3)

3 ○ 4(2 + √3)

4 ○ 2(4 + √3)

Solution:
Correct Answer : 3

Answer key/Solution



In ΔADP, $\tan 30° = AP/AD \Rightarrow 1/\sqrt{3} = AP/2\sqrt{3} \Rightarrow AP = 2$ cm
So $DP = \sqrt{[(2\sqrt{3})^2 + 2^2]} = 4$ cm
Now, in ΔADB, $\tan 60° = AB/AD \Rightarrow \sqrt{3}/1 = AB/2\sqrt{3} \Rightarrow AB = 6$ cm
So $PB = 6 - 2 = 4$ cm and $DB = \sqrt{[(2\sqrt{3})^2 + 6^2]} = 4\sqrt{3}$ cm
Hence, perimeter of $\Delta BDP = DP + PB + DB = 4 + 4 + 4\sqrt{3} = 4(2 + \sqrt{3})$ cm.

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Q.9 [11831809]

For how many integral values of x, such that $|x| < 5$, the inequality $\left(\frac{1}{3}\right)^{\sqrt{x+4}} > \left(\frac{1}{3}\right)^{\sqrt{x^2+3x+4}}$ is satisfied?

1 8

2 7

3 6

4 5

Solution:
Correct Answer : 3

Answer key/Solution

$$\left(\frac{1}{3}\right)^{\sqrt{x+4}} > \left(\frac{1}{3}\right)^{\sqrt{x^2+3x+4}}$$

$\therefore \sqrt{x+4} < \sqrt{x^2+3x+4}$

Or, $x^2 + 3x + 4 > x + 4,\ x \geq -4$

Or, $x^2 + 2x > 0;\ x \geq -4$

So $x < -2$ or $x > 0;\ x \geq -4$

Also, $-5 < x < 5$, therefore, possible integral values of x are: –4, –3, 1, 2, 3, 4, which is 6 possible values.

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Q.10 [11831809]

A swimming pool can be filled by two pipes A and B in 4 hours and 6 hours respectively. Both pipes are opened together for a certain time but due to some clogging in the pipes, only 7/12th of the full quantity of water flows through pipe A and only 5/8th through pipe B. The clogs are detected and removed. The remaining part of the pool is filled in one hour after repair. How long was it before the clogs were removed?

1 ◯ 2 hours 40 minutes

2 ◯ 1 hour 40 minutes

3 ◯ 1 hour 20 minutes

4 ◯ 2 hours 20 minutes

Solution:

Correct Answer : 4

Answer key/Solution

Let both the pipes be working at partial capacity for x hours.
Given that 7/12th of the capacity flows, so portion filled in 1 hour by pipe A
= 1/4 × 7/12 = 7/48th of the pool.
In x hours, it fills (7x/48)th part of the pool.
Similarly, pipe B fills 1/6 × 5/8 = (5/48)th part in 1 hour.
In x hours, it fills (5x/48)th part of the pool.
Given that after the clogs are removed, both the pipes fill the pool in one hour.
Portion filled after repair = 1/4 + 1/6 = 5/12th part
Now, 7x/48 + 5x/48 + 5/12 = 1 ⇒ x = 7/3 hours = 2(1/3) hours
Hence, the pipes were clogged for 2 hours 20 minutes.

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Q.11 [11831809]

Let m and n be the roots of equation $ax^2 + bx + c = 0$, $a \neq 0$. If a, b, c are in AP and $\frac{1}{m} + \frac{1}{n} = 2$, then $|m - n|$ is equal to

1 ◯ $\frac{\sqrt{3}}{5}$

2 ◯ $\frac{2\sqrt{6}}{5}$

3 ◯ $\frac{2\sqrt{3}}{5}$

4 ◯ $\frac{\sqrt{6}}{5}$

Solution:

Correct Answer : 2

Answer key/Solution

The given equation is $ax^2 + bx + c = 0$.

$m + n = -b/a$ and $mn = c/a$ ... (i)

$$\frac{1}{m} + \frac{1}{n} = 2 \Rightarrow \frac{m+n}{mn} = 2 \Rightarrow m + n = 2mn$$

$$\Rightarrow -\frac{b}{a} = \frac{2c}{a} \Rightarrow 2c = -b \quad \text{... (ii)}$$

Since a, b, c are in AP.

So $2b = a + c$

$\Rightarrow -4c = a + c$

$\Rightarrow a = -5c$ ... (iii)

From (i), (ii) and (iii), we get

$$mn = -\frac{1}{5} \text{ and } m + n = -\frac{2}{5}$$

$(m - n)^2 = (m + n)^2 - 4mn$

$$\Rightarrow (m-n)^2 = \left(-\frac{2}{5}\right)^2 - 4 \times \left(\frac{1}{5}\right)$$

$$\Rightarrow (m-n)^2 = \frac{24}{25} \Rightarrow |m-n| = \frac{2\sqrt{6}}{5}.$$

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Q.12 [11831809]

In a test, there are 100 questions divided into three sections I, II and III each containing at least one question. Each question in section I, II and III carries 1 mark, 2 marks, and 3 marks respectively. If questions in section I together carry at least 60% of the total marks and section II contains 23 questions, then how many question(s) is/are there in section III?

1 ◯ 1

2 ◯ 2

3 ◯ 3

4 ◯ More than 3

Solution:

Correct Answer : 1

Answer key/Solution

Section II has 23 questions, that is, 23 × 2 = 46 marks.
Option 1: If section III has 1 question, then section I has 100 – 23 – 1 = 76 questions.

So, percentage of marks in section I = $\frac{76}{76+46+3} = 60.8\% > 60\%$

Option 2: If section III has 2 questions, then section I has 100 – 23 – 2 = 75 questions.

So, percentage of marks in section I = $\frac{75}{75+46+6} \approx 59\% < 60\%$

Hence, section III must have 1 question.

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Q.13 [11831809]

A trader spends Rs.1,680 to purchase two varieties of rice. If the selling price of each variety of rice was Rs.20 per kg more than the cost price, then the profit would be Rs.1,120. If the cost price of the first variety is Rs.8 less than the second one and the quantities purchased are in the ratio 3 : 1, what is the cost price (in Rs.) of 4 kg of the second variety of rice?

1 ◯ 80

2 ◯ 112

3 ◯ 144

4 ◯ 160

Solution:

Correct Answer : 3

Answer key/Solution

Let the cost price of the first variety of rice be Rs.x per kg.
Then, the price of the second variety is Rs.(x + 8) per kg.
Let the quantities of rice of the two varieties purchased be 3y and y respectively.

3xy + (x + 8)y = 1680 … (i)
(x + 20) × 3y + (x + 28)y = 2800 … (ii)
From (i) and (ii),
y = 14 and x = 28
Hence, price of 4 kg of second variety of rice = 4 × 36 = Rs.144.

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Q.14 [11831809]

If $\sqrt{1+\frac{1}{1^2}+\frac{1}{2^2}}+\sqrt{1+\frac{1}{2^2}+\frac{1}{3^2}}+\sqrt{1+\frac{1}{3^2}+\frac{1}{4^2}}+\ldots+\sqrt{1+\frac{1}{19^2}+\frac{1}{20^2}}=k-\frac{1}{k}$ where k is a natural number, then the value of k is

Solution:

Correct Answer : 20

Answer key/Solution

$$T_n=\sqrt{1+\frac{1}{n^2}+\frac{1}{(n+1)^2}}=\sqrt{\frac{n^4+2n^3+n^2+n^2+2n+1+n^2}{n^2(n+1)^2}}=\sqrt{\frac{(n^2+n+1)^2}{n^2(n+1)^2}}=\frac{n^2+n+1}{n(n+1)}=1+1/n-1/(n+1)$$

Therefore, $\sum_{n=1}^{n=19}(1+1/n-1/(n+1))$

$= 19 + (1/1 + 1/2 + 1/3 + \ldots + 1/19) - (1/2 + 1/3 + 1/4 + \ldots + 1/20) = 19 + 1 - 1/20 = 20 - 1/20$

Hence, k = 20.

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Q.15 [11831809]

If 3 < x < 200, find the sum of all possible values of x such that x/3 is the square of a prime number.

1 ◯ 114

2 ◯ 261

3 ◯ 453

4 ◯ 195

Solution:

Correct Answer : 2

Answer key/Solution

If x/3 is the square of a prime number, then possible values of x/3 are 2^2, 3^2, 5^2, 7^2 and so on. Therefore, possible values of x are 3×2^2, 3×3^2, 3×5^2, 3×7^2 which is equivalent to 12, 27, 75, 147. Since there are only four values between 3 and 200, the sum of these values is equal to 12 + 27 + 75 + 147 = 261.

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Q.16 [11831809]

A man rows 15 km in 1 hour in still water and in 90 minutes against the current. Find the time (in hours) taken by him to row 40 km with the current and return to the starting point.

Solution:
Correct Answer : 6
Speed in still water = 15/1 = 15 km/hr
90 min = 3/2 hours
Speed against the current = 15/(3/2) = 10 km/hr
Therefore, the speed of water current = 15 – 10 = 5 km/hr
Therefore, the speed with the current = 15 + 5 = 20 km/hr
Hence, time taken to row 40 km with the current and return to the starting point = 40/20 + 40/10 = 6 hours.

Answer key/Solution

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Q.17 [11831809]
In how many ways can 12 different chocolates be divided equally among three identical boxes?

1 $12!/(4!)^3$

2 $12!/3 \times 4!$

3 $12! \times 4!/3$

4 $12! \times (4!)^3$

Solution:
Correct Answer : 1
Number of chocolates in each box = 12/3 = 4
Number of ways of distribution of chocolates = 12!
For each box, the number of ways of distribution of chocolates = 4!
Hence, the required number of ways = $12!/4! \times 4! \times 4! = 12!/(4!)^3$.

Answer key/Solution

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Q.18 [11831809]
For $k \neq 1$, $(1 - k)(1 + 2x + 4x^2 + 8x^3 + 16x^4 + 32x^5) = 1 - k^6$, then what is the value of k/x?

Solution:
Correct Answer : 2

Answer key/Solution

$$(1-k)(1+2x+4x^2+8x^3+16x^4+32x^5)=1-k^6$$

$$\Rightarrow 1+2x+4x^2+8x^3+16x^4+32x^5=\frac{1-k^6}{1-k}$$

$$\Rightarrow 1+2x+(2x)^2+(2x)^3+(2x)^4+(2x)^5=\frac{1-k^6}{1-k}$$

$$\Rightarrow \frac{1-(2x)^6}{1-(2x)}=\frac{1-k^6}{1-k}$$

Hence, $k = 2x \Rightarrow \frac{k}{x}=2.$

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Q.19 [11831809]

A alone can complete a job in 18 days and B alone in 27 days. If C takes five-sixth the time that A and B together take to complete the job, how long (in days) will A and C together take to complete the same work?

Solution:
Correct Answer : 6

Answer key/Solution

As A can do the work in 18 days and B in 27 days, when they work together, they take 54/(3 + 2) = 54/5 days
Given, C takes five-sixth the time that A and B together take.
So C takes 5/6 × 54/5 = 9 days to do the work.
If A and C work together, they can complete the work in (18)/(1 + 2) = 6 days.

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Q.20 [11831809]

How many natural numbers not exceeding 2022 are multiples of 3 or 5 but not 7?

Solution:
Correct Answer : 810

Answer key/Solution

Number of multiples of 3 = [2022/3] = 674
Number of multiples of 5 = [2022/5] = 404
Number of multiples of 15 (3 and 5) = [2022/15] = 134
Number of multiples of 21 (3 and 7) = [2022/21] = 96
Number of multiples of 35 (5 and 7) = [2022/35] = 57
Number of multiples of 105 (3, 5 and 7) = [2022/105] = 19
Hence, answer is = 674 + 404 − 134 − 96 − 57 + 19 = 810.

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Q.21 [11831809]

For $0 < x < 1$, $f(x) = \dfrac{4^x}{4^x + 2}$, then the value of $f\left(\dfrac{1}{40}\right) + f\left(\dfrac{2}{40}\right) + f\left(\dfrac{3}{40}\right) + \ldots + f\left(\dfrac{39}{40}\right) - f\left(\dfrac{1}{2}\right)$ is:

1 ◯ 16

2 ◯ 21

3 ◯ 19

4 ◯ 25

Solution:

Correct Answer : 3

Answer key/Solution

$$f\left(\frac{1}{40}\right) + f\left(\frac{39}{40}\right) = f\left(\frac{1}{40}\right) + f\left(1 - \frac{1}{40}\right)$$
$$= f(x) + f(1 - x)$$

$$f(x) + f(1-x) = \frac{4^x}{4^x + 2} + \frac{4^{1-x}}{4^{1-x} + 2}$$
$$= \frac{4^x}{4^x + 2} + \frac{4}{4^x\left(\frac{4}{4^x} + 2\right)}$$
$$= \frac{4^x}{4^x + 2} + \frac{2}{4^x + 2} = 1$$

Therefore, $f\left(\dfrac{1}{40}\right) + f\left(\dfrac{39}{40}\right) = 1$

Hence, $f\left(\dfrac{1}{40}\right) + f\left(\dfrac{2}{40}\right) + f\left(\dfrac{3}{40}\right) + \ldots + f\left(\dfrac{39}{40}\right) - f\left(\dfrac{1}{2}\right) = 19.$

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Q.22 [11831809]

A money lender lends money under Scheme I at the rate of 30% per annum, where interest is compounded every four months and under Scheme II at the rate of 25% per annum compounded annually. If Ishan borrows Rs.50,000 each under Schemes I and II, then find the total interest (in Rs.) accrued at the end of one year.

Solution:

Correct Answer : 29050

Answer key/Solution

If Rs. 50,000 is borrowed, then amount at the end of the year under:

Scheme I = 50000 × [1 + 30/(3 × 100)]^3 = Rs.66,550

Scheme II = 50000 × 1.25 = Rs.62,500

Hence, total interest accrued = 129050 – 100000 = Rs.29,050.

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