

Prime CAT 01 2022 QA

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Section-1

Sec 1

Q.1 [11831809]

Find the number of distinct pairs of non-negative integers (x, y) satisfying $|3 - 2xy| < |3x - 2y| < 9$.

1 ☐ 4

2 ☐ 5

3 ☐ 8

4 ☐ 6

Solution:

Correct Answer : 4

 Answer key/Solution

$$|3 - 2xy| < |3x - 2y|$$

$$\text{Or, } (3 - 2xy)^2 < (3x - 2y)^2$$

$$\text{Or, } 9 + 4x^2y^2 - 12xy < 9x^2 + 4y^2 - 12xy$$

$$\text{Or, } 9 - 9x^2 - 4y^2 + 4x^2y^2 < 0$$

$$\text{Or, } (1 - x^2)(9 - 4y^2) < 0$$

For the product to be negative, either one of the two terms has to be negative. But they cannot simultaneously be 0.

So either $y = 0$ and $|x| > 1$ or $y = 1$ and $|x| > 1$ or $x = 0$ and $|y| \geq 2$.

Case 1: When $y = 0$ and $|x| > 1$

$$|3x - 2y| < 9$$

$$\text{Or, } |3x - 0| < 9$$

So x can be 2.

Case 2: When $y = 1$ and $|x| > 1$

$$|3x - 2y| < 9$$

$$\text{Or, } |3x - 2| < 9$$

So x can be 2, 3.

Case 3: When $x = 0$ and $|y| \geq 2$

$$|3x - 2y| < 9$$

$$\text{Or, } |0 - 2y| < 9$$

So y can be 2, 3, 4.

Hence, the answer is 6.

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Q.2 [11831809]

Jack earns Rs. 20 per hour. To increase the efficiency a bonus scheme is introduced wherein a bonus of 10% of the hourly rate is payable when 100% efficiency is reached and an additional bonus of 2% of the hourly rate is paid for each 1% in excess of 100% efficiency. Find the wages (in Rs.) earned by Jack if he saves 10 hours in a job for which the standard time is 60 hours.

1 ☐ 1,250

2 ☐ 1,300

3 ☐ 1,500

4 ☐ 1,750

Solution:

Correct Answer : 3

 Answer key/Solution

Jack completes 60 hours job in 50 hours.
So, efficiency = $100 \times 60/50 = 120\%$
100% efficiency = 110% hourly rate, additional 20% = 40% hourly rate
So overall wage = $110\% + 40\% = 150\%$ of normal wage.
Hence, net wage = $20 \times 150\% \times 50 = 30 \times 50 = \text{Rs. } 1,500$.

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Q.3 [11831809]

Gopal bought a total of 96 face mask packets and hand sanitizer bottles. The price a packet of face mask was Rs. 40 less than that of a bottle of hand sanitizer. If he paid a total of Rs. 7,200 for bottles of hand sanitizers, and a total of Rs.2,880 for packets of face masks, then find the total price (in Rs.) paid for one bottle of hand sanitizer and one packet of face mask.

1 ☐ 160

2 ☐ 200

3 ☐ 220

4 ☐ 260

Solution:

Correct Answer : 2

 Answer key/Solution

Let the number of bottles of hand sanitizer bought by Gopal be x and the cost per bottle be Rs. y .
Then, number of face mask packets = $96 - x$ and the cost of a packet be Rs. $(y - 40)$.
According to the question,
 $xy = 7200$... (i)
and $(96 - x)(y - 40) = 2880$... (ii)
 $\Rightarrow 96y - xy - 3840 + 40x = 2880$
 $\Rightarrow 96y - 7200 - 3840 + 40 \times 7200/y = 2880$
 $\Rightarrow y^2 - 145y + 3000 = 0$
 $\Rightarrow (y - 120)(y - 25) = 0$

Therefore, $y = 120$ (y cannot be 25.)
So $y - 40 = 80$
Hence, the total price = $120 + 80 = \text{Rs. } 200$.

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Q.4 [11831809]

Ram distributed some gold coins amongst his three sons Lal, Tal, and Bal in the ratio of $4 : 9 : x$. Bal made jewellery out of 45 gold coins. Tal sold 95 of his coins to his friend and Lal donated 20 coins to an NGO. The new ratio of the coins left with Lal, Tal and Bal was $38 : 73 : 64$. What is the value of x ?

Solution:

Correct Answer : 7

Lal, Tal and Bal have gold coins: $4a$, $9a$ and xa respectively.

After using some of the coins, they are left with,

Lal: $4a - 20 = 38y$

Tal: $9a - 95 = 73y$

Bal: $xa - 45 = 64y$

Solve first two equations for a and y and get, $y = 4$ and $a = 43$.

Hence, $x = 7$.

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 Answer key/Solution

Q.5 [11831809]

The first three numbers in a series are in the ratio $2 : 3 : 5$ and the sum of squares of these three numbers is 1368. If the 3rd, 4th and 5th numbers are in the ratio $5 : 7 : 11$, then which of these can be the average of the first five numbers of the series?

1 ☐ -33.2

2 ☐ 41.4

3 ☐ 33.6

4 ☐ 34.8

Solution:

Correct Answer : 3

Given ratio is $2k : 3k : 5k$.

Sum of squares = $4k^2 + 9k^2 + 25k^2 = 1368$

$\Rightarrow 38k^2 = 1368 \Rightarrow k = \pm 6$

$\Rightarrow 2k + 3k + 5k + 7k + 11k = 28 \times (\pm 6) = \pm 168$.

Hence, required average = $\pm 168/5 = \pm 33.6$.

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 Answer key/Solution

Q.6 [11831809]

The janitor steals five litres of pure liquid soap kept in a hotel store room from a container that is full of liquid soap. He then fills it with water to avoid detection. Unable to resist the temptation he steals 5 litres of the mixture again, and fills it with water. When the liquid soap is checked by the supervisor it is found that the new ratio of liquid soap to water is $64 : 17$. What was the initial quantity of the liquid soap in the container if it is known that the liquid soap was not used by anybody else?

1 ☐ 36 litres

2 ○ 48 litres

3 ○ 54 litres

4 ○ 45 litres

Solution:

Correct Answer : 4

[🔍 Answer key/Solution](#)

It can be seen from the ratio 64 : 17 that the proportion of liquid soap to water is 64/81 after two iterations. This means that 8/9th of the liquid soap must have been allowed to remain in the container and hence 1/9th of the container's original liquid soap, would have been drawn out by janitor. Since he takes out 5 litres each time, initially there must have been 45 litres in the container. (as 5 is 1/9th of 45).

Alternative method:

Let x be the initial quantity of liquid soap.

$$\text{Then, } \frac{64}{64+17} = \left(1 - \frac{5}{x}\right)^2$$

$$\Rightarrow \frac{8}{9} = 1 - \frac{5}{x}$$

$$\Rightarrow x = 45 \text{ litres.}$$

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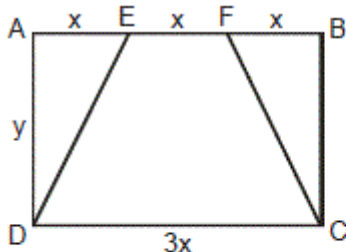
Q.7 [11831809]

ABCD is a rectangle. Points E and F are on side AB such that they trisect AB. If the difference between the areas of trapezium CDEF and the triangle ADE is 12 sq. cm, then what is the area, in sq. cm, of rectangle ABCD?

Solution:

Correct Answer : 24

[🔍 Answer key/Solution](#)



$$\text{Area of trapezium CDEF} = \frac{1}{2} \times (3x + x) \times y = \frac{1}{2} \times 4x \times y$$

$$\text{Area of triangle ADE} = \frac{1}{2} \times x \times y = \frac{1}{2} \times xy$$

According to the question,

$$\frac{1}{2} \times 4x \times y - \frac{1}{2} \times xy = 12$$

$$\Rightarrow 3x \times y = \text{Area of rectangle ABCD} = 24 \text{ sq. cm.}$$

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Q.8 [11831809]

If the equations $2|y| = 6 - 3x$ and $2|x| = 8 - 3y$, then the sum of all values of x and y is

1 ☐ -2

2 ☐ 0

3 ☐ $14/5$

4 ☐ $-7/5$

Solution:

Correct Answer : 3

The given equations are:

$$2|y| = 6 - 3x \Rightarrow 3x + 2|y| = 6 \dots (i)$$

$$2|x| = 8 - 3y \Rightarrow 2|x| + 3y = 8 \dots (ii)$$

Case 1: x and y are both positive.

$$|x| = x \text{ and } |y| = y$$

$$3x + 2|y| = 6 \Rightarrow 3x + 2y = 6$$

$$2|x| + 3y = 8 \Rightarrow 2x + 3y = 8$$

Solving the two equations, we get

$$x = 2/5 \text{ and } y = 12/5$$

This satisfies the assumption that x and y both are positive.

Case 2: x and y are both negative.

$$|x| = -x \text{ and } |y| = -y$$

$$3x - 2y = 6$$

$$-2x + 3y = 8$$

Solving these equations, we get

$$x = 34/5 \text{ and } y = 36/5$$

Since this is contradictory. So we discard this case.

Case 3: x is positive and y is negative.

$$|x| = x \text{ and } |y| = -y$$

$$3x - 2y = 6$$

$$2x + 3y = 8$$

Solving these equations, we get

$$x = 34/13 \text{ and } y = 12/13$$

Since this is contradictory. So we discard this case.

Case 4: x is negative and y is positive.

$$|x| = -x \text{ and } |y| = y$$

$$3x + 2y = 6$$

$$-2x + 3y = 8$$

Solving these equations, we get

$$x = 2/13 \text{ and } y = 36/13$$

Since this is contradictory. So we discard this case.

Hence, sum of the required values = $2/5 + 12/5 = 14/5$.

 Answer key/Solution

Bookmark

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Q.9 [11831809]

P, Q, R run in the clockwise direction around a circular track that is 600 m long, with speeds of 9 km/hr, 18 km/hr and 27 km/hr respectively. They all start from point X, simultaneously. How much time after the start will they all meet again for the first time at X?

1 ☐ 6 minutes

2 ☐ 8 minutes

3 ☐ 4 minutes

4 ☐ 3 minutes

Solution:

Correct Answer : 3

Given length of the circular track = 600 m

Speed of P = $9 \times 5/18 = 2.5$ m/s

Speed of Q = $18 \times 5/18 = 5$ m/s

Speed of R = $27 \times 5/18 = 7.5$ m/s

They will meet for the first time at a time which is the LCM of (600/2.5, 600/5, 600/7.5).

= LCM of (240, 120, 80) is 240 seconds.

Hence, they will meet after 4 minutes.

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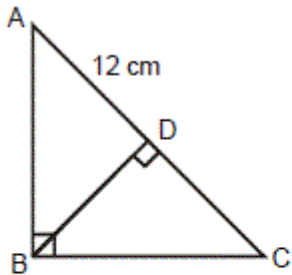
[Answer key/Solution](#)

Q.10 [11831809]

Triangle ABC is right angled at B. If AC = 12 cm and BD is perpendicular to AC, then what is the maximum length (in cm) of BD?

Solution:

Correct Answer : 6



The length of BD would be maximum when $AB = BC$.

$AB = BC = 6\sqrt{2}$ cm

In right angled triangle BDC,

$$BC^2 = BD^2 + CD^2$$

$$\Rightarrow (6\sqrt{2})^2 = BD^2 + 6^2$$

$$\Rightarrow BD = 6 \text{ cm.}$$

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[Answer key/Solution](#)

Q.11 [11831809]

Let t_1, t_2, t_3, \dots be real numbers such that $t_{n+2} = t_{n+1} + 2n - 1$ for all $n \geq 1$. If $t_k - t_2 = 8100$, then k is equal to

Solution:**Correct Answer : 92**[🔍 Answer key/Solution](#)

$$t_{n+2} = t_{n+1} + 2n - 1 \text{ for all } n \geq 1.$$

$$\text{For } n = 1, t_3 = t_2 + 2 - 1 = t_2 + 1$$

$$\text{For } n = 2, t_4 = t_3 + 4 - 1 = t_2 + 1 + 3$$

$$\text{For } n = 3, t_5 = t_4 + 6 - 1 = t_2 + 1 + 3 + 5$$

$$\text{For } n = 4, t_6 = t_5 + 8 - 1 = t_2 + 1 + 3 + 5 + 7$$

$$\text{So } t_k = t_2 + 1 + 3 + 5 + \dots + (k-2)\text{th term}$$

$$\Rightarrow t_k - t_2 = 1 + 3 + 5 + \dots + (k-2)\text{th term}$$

$$\Rightarrow 8100 = 1 + 3 + 5 + \dots + (k-2)\text{th term}$$

$$\Rightarrow 8100 = \frac{(k-2)}{2} [2 \times 1 + (k-2-1) \times 2]$$

$$\Rightarrow (k-2)^2 = 90^2 \Rightarrow k = 92.$$

[Bookmark](#)[FeedBack](#)**Q.12 [11831809]**

Neeta had Rs.3 lakh and she lent a part of it at 5% simple interest and the remaining at 20% simple interest. The total amount received by her after 5 years was Rs. 2,40,000. If the same amounts were lent at the same rates but at compound interest per annum for 3 years, then what would be the interest received by Neeta?

1 ☐ Rs.1,72,770

2 ☐ Rs.1,60,160

3 ☐ Rs.2,12,770

4 ☐ Rs.1,92,160

Solution:

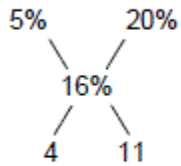
Correct Answer : 1

[Answer key/Solution](#)

Annual interest received = $240000/5 = \text{Rs.}48,000$.

Interest of Rs.48,000 on a principal of Rs.3 lakh means 16% average rate of interest.

This 16% is obtained by mixing the two loans @ 5% and 20% respectively.



The ratio in which the two loans should be allocated would be 4 : 11.

The amount lent at 20% would be $11/15 \times 300000 = \text{Rs.}2,20,000$

and the amount lent at 5% would be Rs.80,000

Interest earned by lending these amounts at the same rates but at compound interest
 $= 220000 \times 1.2^3 + 80000 \times 1.05^3 - 300000 = 380160 + 92610 - 300000 = \text{Rs.}1,72,770$.

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Q.13 [11831809]

Kiran's project report on 'Survival and dignity', consists of 30 pages each of 75 lines with 80 characters in each line. In case the number of lines is reduced to 64 but the number of characters is increased to 90 per line, what is the percentage change in the number of pages? (Assume the number of pages to be a whole number.)

1 ☐ -3.33%

2 ☐ +6.67%

3 ☐ +3.33%

4 ☐ -5%

Solution:

Correct Answer : 2

[Answer key/Solution](#)

Total characters in the report = $30 \times 75 \times 80$.

Let new number of pages be n.

Then $n \times 64 \times 90 = 30 \times 75 \times 80$

$\Rightarrow n = 31.25 = 32$ (approx. whole number.)

This means Kiran now need 32 pages to complete the report which is the increase by 6.67%.

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Q.14 [11831809]

The perimeter of a field in the shape of a rhombus is equal to the perimeter of a square of area 225 sq. m. If the difference between the diagonals of the rhombus is 6 m, then the cost (in Rs.) of mowing it at the rate of Rs. 5 per sq. m is

1 ☐ 1080

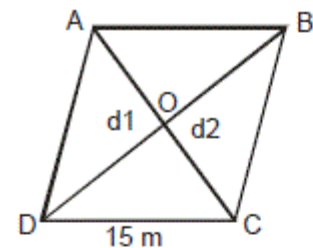
2 ☐ 1000

3 ☐ 1125

4 ☐ 1296

Solution:

Correct Answer : 1



Side length of the rhombus = side length of the square = 15 m

$$\Rightarrow \left(\frac{d1}{2}\right)^2 + \left(\frac{d2}{2}\right)^2 = 225 \quad \dots (i)$$

$$d1 - d2 = 6 \Rightarrow (d1 - d2)^2 = 36$$

$$\Rightarrow (d1)^2 + (d2)^2 - 2d1d2 = 36$$

$$\Rightarrow \left(\frac{d1}{2}\right)^2 + \left(\frac{d2}{2}\right)^2 - \frac{1}{2}d1d2 = 9$$

$$\Rightarrow 225 - \frac{1}{2}d1d2 = 9 \quad (\text{From (i)})$$

$$\Rightarrow \frac{1}{2}d1d2 = 225 - 9 = 216 \text{ sq. m}$$

This is area of the rhombus.

Hence, cost of its mowing = $216 \times 5 = \text{Rs. } 1,080$.

Alternate method:

Side of the rhombus = 15 m

$\triangle DOC$ is a right angled triangle.

9, 12, 15 is a triplet.

So diagonals of the rhombus are 18 m and 24 m.

Area of $\triangle DOC = \frac{1}{2} \times 9 \times 12 = 54 \text{ sq. m}$.

Therefore, area of rhombus ABCD = $4 \times 54 = 216 \text{ sq. m}$.

Hence, cost of its mowing = $216 \times 5 = \text{Rs. } 1,080$.

[Answer key/Solution](#)

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Q.15 [11831809]

In the year 2020, the laptop industry in the country had two major manufacturers – Dell and HP – with market shares of 30% and 70%, respectively. In 2021, the overall market for the product increased by 20% and a new player Asus also entered the market and captured 15% of the new market share. If we know that the market share of Dell increased to 50% in 2021, then the percentage decrease in market share of HP was

Solution:

Correct Answer : 50

 Answer key/Solution

Market share of HP in 2021 = $100 - 15 - 50 = 35\%$

Hence, percentage decrease in market share of HP = $\frac{70 - 35}{70} \times 100 = 50\%$.

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Q.16 [11831809]

If repetition of digits is not allowed, then how many numbers between 3000 and 5000 can be formed using the digits 0 to 8?

Solution:

Correct Answer : 672

 Answer key/Solution

Since the numbers between 3000 to 5000 will be of 4 digits.

So the thousands place can be filled by 3 or 4 i.e., 2 ways.

Since repetition is not allowed, therefore hundreds, tens, units place can be filled in 8, 7, 6 ways.

Hence, total number of numbers formed = $2 \times 8 \times 7 \times 6 = 672$.

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Q.17 [11831809]

A chord AB is drawn inside a circle of radius OA with center O such that $OA = AB = 4$ cm. Now, two circles are drawn, one on each side of the chord AB, each touching the chord at its midpoint C and the original circle. The ratio of the areas of the bigger inscribed circle and the smaller inscribed circle is

1 ☐ $(5 + 3\sqrt{2}) : (5 - 3\sqrt{2})$

2 ☐ $(7 + 4\sqrt{3}) : (7 - 4\sqrt{3})$

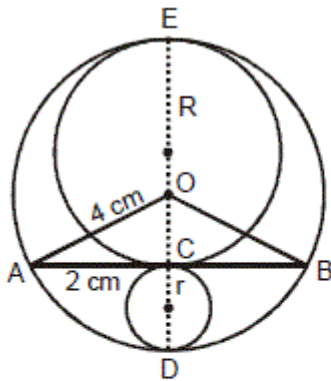
3 ☐ $(3 + \sqrt{2}) : (3 - \sqrt{2})$

4 ☐ $(2 + \sqrt{3}) : (2 - \sqrt{3})$

Solution:

Correct Answer : 2

[Answer key/Solution](#)



Let R and r be radii of the bigger inscribed circle and the smaller inscribed circle respectively.

$$OC = 4^2 - 2^2 = 2\sqrt{3} \text{ cm}$$

$$\text{Radius of bigger inscribed circle} = R = (4 + 2\sqrt{3})/2 = (2 + \sqrt{3}) \text{ cm}$$

$$\text{Radius of smaller inscribed circle} = r = (4 - 2\sqrt{3})/2 = (2 - \sqrt{3}) \text{ cm}$$

$$\text{Hence, required ratio} = \frac{\pi R^2}{\pi r^2} = \frac{\pi(2 + \sqrt{3})^2}{\pi(2 - \sqrt{3})^2} = \frac{7 + 4\sqrt{3}}{7 - 4\sqrt{3}}$$

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Q.18 [11831809]

Mohan, Rohan and Sohan can paint a room in 4, 6 and 9 hours, respectively. At the most only one person can work each hour and nobody can work for two consecutive hours. Find the minimum number of hours that they will be required to paint the room.

1 ☐ 5 hours 30 minutes

2 ☐ 5 hours

3 ☐ 4 hours 30 minutes

4 ☐ 4 hours 40 minutes

Solution:

Correct Answer : 4

Let the total work be 36 units, LCM of (4, 6, 9).

To complete the work in minimum time the most efficient should start the work.

Mohan, Rohan and Sohan complete 9 units, 6 units and 4 units respectively per hour.

After 4 hours total work done = $9 + 6 + 9 + 6 = 30$ units

Remaining work = 6 units, Mohan will complete the remaining work in 40 minutes.

Total time required to complete the work = 4 hours 40 minutes.

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[Answer key/Solution](#)

Q.19 [11831809]

Let $2^{(x+y)} = 20$, $2^{(y+z)} = 40$ and $2^{(z+x)} = 80$ where x , y and z are any three real numbers. The value of $2^x - 2^z$ is:

1 ☐ $2\sqrt{10}$

2 ☐ $4\sqrt{10}$

3 ☐ $8\sqrt{10}$

4 ☐ $\sqrt{10}$

Solution:

Correct Answer : 1

 Answer key/Solution

$$2^{(x+y)-(y+z)} = \frac{20}{40}$$

$$\Rightarrow 2^{(x-z)} = 2^{(-1)}$$

$$2^{(x-z)+(z+x)} = 2^{(-1)} \times 80$$

$$\Rightarrow 2^{2x} = 40$$

$$\Rightarrow 2^x = \sqrt{40}$$

$$\text{And, } 2^{(y+z)-(x+y)} = \frac{40}{20}$$

$$\Rightarrow 2^{(z-x)} = 2$$

$$2^{(z-x)+(z+x)} = 2 \times 80$$

$$\Rightarrow 2^{2z} = 160$$

$$\Rightarrow 2^z = \sqrt{160} = 4\sqrt{10}$$

$$\text{Hence, } (2^z - 2^x) = 4\sqrt{10} - 2\sqrt{10} = 2\sqrt{10}.$$

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Q.20 [11831809]

A trader of pulses marks up the price of his goods by 20% and gives a discount of 10% to the customer. He also uses a 900 gram weight instead of a 1 kilogram weight. Find his gain (in Rs.) after selling a 5 kg sack of pulses that cost him Rs.450.

Solution:

Correct Answer : 90

[Answer key/Solution](#)

If we assume that his cost price is Re.1 per gram, then the cost for 1000 grams would be Rs.1,000.

For a supposed 1 kg sale his MP would be Rs.1,200 and after a 10% discount his SP would be Rs.1,080.

Now, we know that he has a 900 g weight instead of 1000 g, so the CP for him would be Rs.900.

Thus he is buying at Rs.900 and selling at Rs.1,080 of a profit percentage of 20%.

Hence, required gain = $450 \times 20/100 = \text{Rs.}90$.

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Q.21 [11831809]

For a real number k , $f(x) = 2^{kx} + 9$. If $3f(3) = f(6)$ and $f(9) - f(3) = N$, where N is a natural number. Find the sum of the digits of N .

Solution:

Correct Answer : 3

[Answer key/Solution](#)

Given: $f(x) = 2^{kx} + 9$ and $3f(3) = f(6)$

$$\frac{f(3)}{f(6)} = \frac{2^{3k} + 9}{2^{6k} + 9} = \frac{1}{3} \text{ and } f(9) - f(3) = 2^{9k} + 9 - 2^{3k} - 9 = 2^{9k} - 2^{3k} = N$$

$$3(2^{3k} + 9) = 2^{6k} + 9$$

$$\Rightarrow 2^{6k} - 3 \times 2^{3k} - 18 = 0$$

$$\Rightarrow 2^{3k} = 6 \text{ or } 2^{3k} = -3$$

Valid value $2^{3k} = 6$

Therefore, $2^{9k} - 2^{3k} = N$

$$\Rightarrow (2^{3k})^3 - 2^{3k} = N$$

$$\Rightarrow 6^3 - 6 = N$$

$$\Rightarrow 210 = N$$

Hence, the sum of the digits of $N = 2 + 1 + 0 = 3$.

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Q.22 [11831809]

How many integral solutions are possible for $(x-1)^{(\log_{10} x)^2 - \log_{10} x^2} = (x-1)^3$.

1 ☐ 0

2 ☐ 1

3 ☐ 2

4 ○ More than 2

Solution:

Correct Answer : 3

When $x \neq 1, 2$

$$\Rightarrow (x-1)^{(\log_{10} x)^2 - \log_{10} x^2} = (x-1)^3$$

$$\Rightarrow (\log_{10} x)^2 - \log_{10} x^2 = 3$$

$$\Rightarrow (\log_{10} x)^2 + \log_{10} x - 3\log_{10} x - 3 = 0$$


$$\Rightarrow (\log_{10} x - 3)(\log_{10} x + 1) = 0$$

$$\Rightarrow \log x = 3\log 10 \text{ or } \log x = -1\log 10$$

$$\Rightarrow x = 1000 \text{ or } x = \frac{1}{10}$$

And, when $x - 1 = 1$, $x = 2$

Hence, two integral values of x are possible.

 Answer key/Solution

Bookmark

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