$\Rightarrow a+b = \frac{45}{8} = \frac{p}{q}$

Hence $p+q$ = 45 + 8 = 53, Therefore option D is the correct answer.

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Question 55

How many integer pairs satisfy $p^2+9q^2 \leq 144$, where p, q are integers?

Answer:145

Explanation:
Since p, q are integers, p^2 and $9q^2$ are integers.

The maximum value which p^2 and $9q^2$ can take is 144
Now consider $9q^2 \leq 144$, q can range from -4 to 4.
When q = 0, $p^2 \leq 144$ p can range from -12 to 12 = 25 values
When q = ± 1, $p^2 \leq 135$ p can range from -11 to 11 = 23 values
When q = ± 2, $p^2 \leq 108$ p can range from -10 to 10 = 21 values
When q = ± 3, $p^2 \leq 63$ p can range from -7 to 7 = 15 values
When q = ± 4, $p^2 \leq 0$ p can take one value i.e 0

Number of integral pairs = 25+(23+21+15+1)*2 = 145

145 is the correct answer.

Question 56

What is/are the number of integers of x that satisfy the inequality $|x+3| > 2x^2+11x+11$ is _____.

A 4

B 3

C 1

D 6

Answer: B

Explanation:
Let x>-3,

x + 3 > $2x^2+11x+11$

$0 > 2x^2+10x+8$

$0 > x^2+5x+4$

$0 > (x+4)(x+1)$

x (-4,-1)...but x>-3, thus

x (-3, -1)

Let x<=-3

-x - 3 > $2x^2+11x+11$

$0 > 2x^2+12x+14$

$0 > x^2+6x+7$

x (-4.414, -1.586) ...but x<=-3, thus

x (-4.414, -3]

Set of integers {-2,-3, -4}

Option B

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Question 57

The cost of 5 apples, 7 bananas and 9 mangoes is Rs 204 and the cost of 8 apples, 5 bananas and 2 mangoes is Rs 159. Find the total cost of 1 apple, 1 banana and 1 mango.

Answer:30

Explanation:
Let the cost of 1 apple, 1 banana and 1 mango be a, b and c respectively.
5a + 7b + 9c = 204
8a + 5b + 2c = 159
Coefficients are in AP in both the equations.
The differences of coefficients in the first equation are 2 and the differences of coefficients in the second equation are 3.
Hence, multiply the first equation by 3 and multiply the second equation by 2.
15a + 21b + 27c = 612
16a + 10b + 4c = 318
=> 31a + 31b + 31c = 930
=> a + b + c = 30

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Question 58

$\log(\tan 1^\circ) * \log(\tan 2^\circ) * \log(\tan 3^\circ) \ldots\ldots\ldots\ldots \log(\tan 89^\circ)$

A -1

B 1

C 0

D 90

Answer: C

Explanation:
$log(tan1^0) * log(tan2^0) * log(tan3^0) \ldots\ldots\ldots\ldots log(tan89^0)$

We know that tan 45 =1

log 1 =0

$log(tan1^0) * log(tan2^0) * log(tan3^0) \ldots\ldots\ldots\ldots log(tan89^0)$

= 0

C is the correct answer.

Question 59

A = $(1+a)(1+a^2)(1+a^4)(1+a^8)$ **is written in increasing powers of a, then the sum of first 5 terms when a = 3 is?**

Answer:121

Explanation:
A = $(1+a)(1+a^2)(1+a^4)(1+a^8)$
Multiply both the sides of the equation by $(1-a)$.
A$(1-a)$ = $(1-a)(1+a)(1+a^2)(1+a^4)(1+a^8)$
= $(1-a^2)(1+a^2)(1+a^4)(1+a^8)$
= $(1-a^4)(1+a^4)(1+a^8)$
= $(1-a^8)(1+a^8)$
= $(1-a^{16})$
A = $\frac{1-a^{16}}{1-a}$
= $1+a+a^2+a^3+a^4+\ldots\ldots a^{15}$.....sum of G.P.

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Sum of the first five terms = $1 + a + a^2 + a^3 + a^4$

$= \frac{a^5-1}{a-1}$

$= \frac{3^5-1}{3-1}$

$= \frac{242}{2}$ = 121

121 is the correct answer.

Question 60

For how many integral values of x, the function, $f(x) = \frac{\sqrt{16-x^2}}{\log_{x+2}\left(\left|\frac{x}{5}\right|\right)}$ is defined?

Answer:4

Explanation:

We have, $f(x) = \frac{\sqrt{16-x^2}}{\log_{x+2}\left(\left|\frac{x}{5}\right|\right)}$

We know that the base of a log cannot be 1. The value inside the square should be positive. Also, the argument of the log should be positive.

The argument $\left|\frac{x}{5}\right|$ is always positive. So $x \neq 0$

Also, $\left|\frac{x}{5}\right|$ cannot be 1 as denominator would become 0. Hence $x \neq 5$ and $x \neq -5$

Also, $16 - x^2 \geq 0$ => $-4 \leq x \leq 4$

Now, x+2>0 => x>-2 Also, $x+2 \neq 1$ => $x \neq -1$

Hence, $x \in$ (-2,-1) U (-1,0) U (0,4]
The integral values of x are 1,2,3,4
Hence, there are 4 integral values of x for which f(x) is defined.

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Question 61

A function is defined as f(x) = sinx(sinx-4)+3 for all the real values of x. Find the maximum value of f(x).

Answer:8

Explanation:

The expression f(x) can be written as: f(x) = $\sin^2 x - 4\sin x + 3$ = $\sin^2 x - 4x + 4 - 1$ = $(\sin x-2)^2$-1

To maximize the value of f(x), the value of sinx will be -1.

Hence, the maximum value of f(x) = $(-1-2)^2 - 1 = 9 - 1 = 8$

Question 62

Find the number of ordered pairs of (x, y) where $x + y = 6$ and both x and y are integers.

A 31

B 16

C 24

D 32

E None of the above

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Answer: A

Explanation:

$$\begin{matrix} 2 & 3 & -1 \\ x & + y & = & 6 \end{matrix}$$

$\Rightarrow$ 18x+12y + xy = 0

$\Rightarrow$ (x+12)(y+18) = 216

We have to factorize 216 in prime factor form.

$216 = 2^3 * 3^3$

Total number of factors = (3+1)*(3+1) = 16

Among these 16 values, when we express (x+12)(y+18) = 12 * 18, the values of both x and y is 0. This case is negated.

Hence, we can say that 'x' can take any of these 15 values. We can write (1*216) as (-1*-216) as well hence, 'x' can take 16 negative values as well. Hence, a total of 31 solutions are possible. Therefore, option A is the correct answer.

Question 63

A function f(x) is defined as f(x) = $x^2 - 2x$. Another function g(x) exists such that f(g(x)) = $4x^2 - 1$. The value of g(0) is

A 2

B 1

C -1

D -2

Answer: B

Explanation:

We have, f(x)=$x^2 - 2x$ and f(g(x))=$4x^2 - 1$

Adding 1 to both the expressions, we get f(x)+1 = $x^2 - 2x + 1$ = $(x-1)^2$

Also, f(g(x))+1 = $4x^2$ .....(1)

Replacing x by g(x) in the first expression, we get f(g(x))+1 = $(g(x)-1)^2$ .....(2)

=> Equating 1 and 2, we get, $4x^2 = (g(x)-1)^2$

Put x=0, then, 0=g(0)-1 => g(0)=1

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Question 64

There are 200 students in a class. The number of students who do not watch Money heist is 8 more than the number of students who do not watch Game of Thrones. If the number of students who watch neither of the shows is 6 less than those who watch both, then what is the number of students who watch Money heist?

A 99

B 100

C 101

D 102

Answer: A

Explanation:

Let the number of students who watch both the shows be 'x+6'

Then the number of students who watch neither of the shows will be 'x'

Let the number of students who watch only money heist be 'y'

Given,

The number of students who do not watch Money heist is 8 more than the number of students who do not watch Game of Thrones.

=> Students who watch only game of thrones + students who watch none = 8 + Students who watch only money heist + students who

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watch none

=> Students who watch only game of thrones = y+8

Now,

Only money heist + only game of thrones + both + none = 200

=> (y) + (y + 8) + (x + 6)+x = 200

=> x+ y = 93

∴ number of students who watch Money heist = Students who watch only money heist + both = x+y+6 = 99

Question 65

Ramesh buys some pens, pencils and erasers from stationary. If the total amount of money spent on buying pens and pencils is 300. The amount spent on buying pencils to that spent on buying erasers is 3:7. The costs of 1 pen, 1 pencil and 1 eraser are Rs 5, Rs 7 and Rs 10 respectively. Find the total number of items bought.
(If the answer cannot be determined, enter -1)

Answer:97

Explanation:
Assume the number of pens, pencils and erasers bought is x, y and z respectively.
Then, 5x+7y=300 .....(1)
Also, $\frac{7y}{10z} = \frac{3}{7}$
=> 49y=30z ...(2)
The value of y should be a multiple of 30. So y can be 30, 60, 90 and so on.
From 1, the value of y cannot be 60, 90 and so on because x will become negative.
Hence, the only possible value of y is 30.
=> z= 49 ....(From 2)

On putting y=30 in the equation (1),
5x = 300-7*30 = 90 => x=18

The total number of items = 18+30+49 = 97

Question 66

What is the value of the following expression?

$(1/(2^2-1)) + (1/(4^2-1)) + (1/(6^2-1)) + ... + (1/(20^2-1)$

A 9/19

B 10/19

C 10/21

D 11/21

Answer: C

Video Solution

Explanation:
$(1/(2^2-1)) + (1/(4^2-1)) + (1/(6^2-1)) + ... + (1/(20^2-1)$ = 1/[(2+1)*(2-1)] + 1/[(4+1)*(4-1)] + ... + 1/[(20+1)*(20-1)]

= 1/(1*3) + 1/(3*5) + 1/(5*7) + ... + 1/(19*21)

=1/2 * (1/1 - 1/3 + 1/3 - 1/5 + 1/5 - 1/7 + ... +1/19 - 1/21)

=1/2 * (1 - 1/21) = 10/21

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Question 67

If the domain of $\frac{x^3+3x^2-10x-24}{x^3+4x^2-11x-30} > 2$ **is (x,y) what is |x+y|?**

Answer:11

Explanation:
After factorising , the equation becomes
$\frac{(x+4)(x-3)(x+2)}{(x+2)(x-3)(x+5)}$ >2

$\frac{x+4}{x+5} > 2$

$\frac{x+4}{x+5} - 2 > 0$

$\frac{x+4}{x+5} - \frac{2(x+5)}{x+5}$ >0

$\frac{-(x+6)}{x+5}$ >0

$\frac{(x+6)}{x+5}$ <0

x>-6 and x < -5. Therefore the domain of x is (-5,-6)
|x+y|=11.

Question 68

For all natural numbers greater than 1, $f(n) = f(n-1)[n+1+\frac{1}{n-1}]$
It is known that $f(1) = 1$

Find the value of $n+2$ **for which** $f(1) + f(2) + ...f(n) = 362879$

Answer:10

Explanation:
Given f(1) = 1 = 1*1!

Lets try to find the values of f(2),f(3),f(4),so that we can arrive at a pattern

f(2) = f(1)[2+1+$\frac{1}{2-1}$]

=1*4=4

f(3) = f(2) * [3+1+($\frac{1}{2}$)]
=18

f(4)=f(3)*[4+1*($\frac{1}{3}$)]

=96

If we try to look at the pattern of these numbers

f(2) can be expressed as 2*2!

Similarly f(3)=3*3!,f(4)=4*4!

So f(n)=n*n!
n*n! = (n+1-1)*n!
= (n+1)*n! - n!
= (n+1)! - n!
f(1) + f(2) +.....f(n)
=(2!-1!) + (3!-2!) +(4!-3!) +.....(n+1!-n!)
(n+1)!-1=362879
(n+1)! = 362880
n=8

∴ n= 8

n+2 = 10

Hence 10 is the answer.

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Question 69

$f(x) = max(x^2 + 3x - 10, -x^2 - 10x - 16)$ **where x is real.**

What is the least value of $f(x)$?

A $-\frac{25}{4}$

B $-\frac{45}{4}$

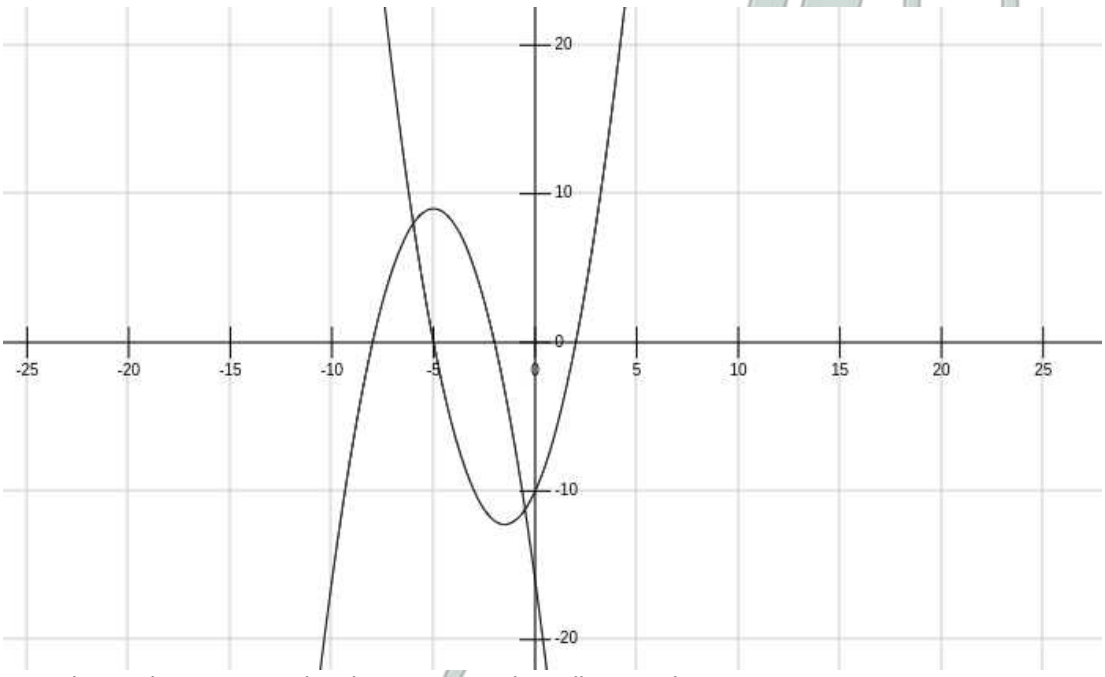
C -24

D $-\frac{37}{2}$

Answer: B

Explanation:

$f(x) = max(x^2 + 3x - 10, -x^2 - 10x - 16)$



From the graph, we can see that the minimum value will occur when

$x^2 + 3x - 10 = -x^2 - 10x - 16$

or, $2x^2 + 13x + 6 = 0$

or, $2x^2 + 12x + x + 6 = 0$

or, $2x(x + 6) + 1(x + 6) = 0$

or, $(x + 6)(2x + 1) = 0$

=> $x = -6$ or $x = -\frac{1}{2}$

So, there are two intersecting points, as was evident from the graph

For $x = -6$, $f(x) = 8$ and for $x = -\frac{1}{2}$, $f(x) = -\frac{45}{4}$

We can see that for $x = -\frac{1}{2}$, $f(x)$ is minimum.

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Thus, the required value is -4

Hence, option B is the correct answer.

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Question 70

One of the roots of the equation $x^2-(m-2)x+6=0$ lies between (0, 2) and the other root lies between (3, 4). It is known that m is an integer. What is the sum of all the possible values of m?

A 11

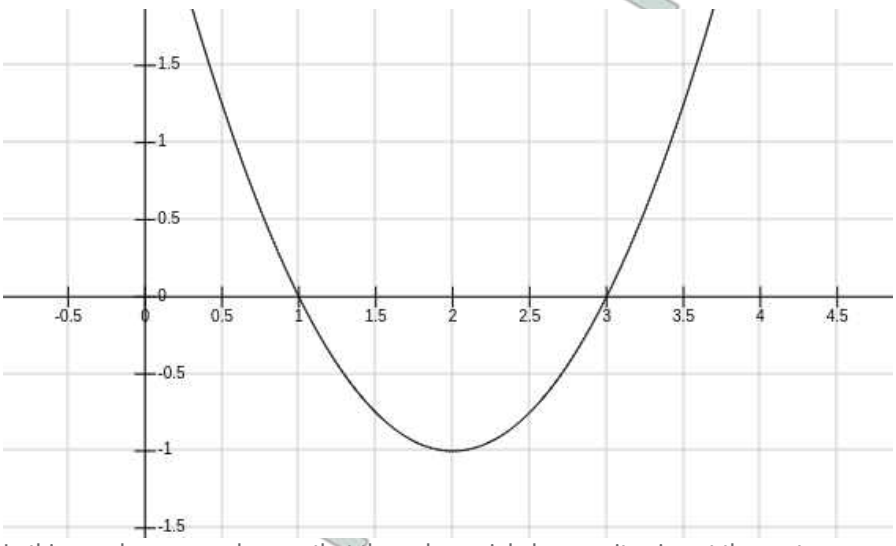
B -3

C 5

D No such value exists

Answer: D

Explanation:
We know that the graph of a quadratic polynomial cuts x-axis at the points which are also the roots of the quadratic equation. Therefore, the value of the polynomial will be opposite in sign on the two points between which the roots lie.



In this graph, we can observe that the polynomial changes its sign at the roots.

In the given question, one of the roots lie between (0, 2) and the other root lie between (3, 4)

Let $f(x)=x^2-(m-2)x+6$

So, $f(0)>0$.....(i)

So, $f(2)<0$.....(i)

So, $f(3)<0$.....(i)

So, $f(4)>0$.....(i)

We can write (i) as $6>0$ which is always true

We can write (ii) as

$(14-2m)<0$

$m>7$

We can write (iii) as

$9-3*(m-2)+6<0$

or $m>7$

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We can write (iv) as

$16 - 4 * (m - 2) + 6 > 0$

or, $m < 7.5$

Therefore, m belongs to $(7, \ 2\frac{1}{5})$

Thus, no integral value of m satisfies it.

Hence, option D is the correct answer.

Question 71

What is the remainder when 123412341234..... (1234 digits) is divided by 625?

Answer:287

Explanation:
625 = 5^4, so we have to check the remainder obtained when the last 4 digits are divided by 625
12341234.....123412
3412 is the last 4 digits
The remainder obtained when 3412 is divided by 625 is 287.
Hence, 287 is the correct answer.

Question 72

After distributing the sweets equally among 25 children, 8 sweets remain. Had the number of children been 28, 22 sweets would have been left after equally distributing. What is the smallest possible total number of sweets ?

A 328

B 348

C 358

D Data inadequate

Answer: C

Explanation:
Let the total number of chocolates be C

let chocolates received by each child = x

After distributing the sweets equally among 25 children, the number of chocolates left = 8
25x+8=C - Eq 1

Had there been 28 children, the number of chocolates that would be required = 22

25x+8-22 should be divisible by 28 - Eq 2

25x-14 should be divisible by 28

28x-(3x+14) should be divisible by 28

(3x+14) should be divisible by 28.

==> x=14

The total number of chocolates = 25x+8 = 25*14+8=358

C is the correct answer.

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Question 73

Sum of two non co-prime numbers a, b and their HCF gives 77. What is the number of possible values of (a, b)?

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Answer:6

Explanation:
Let the HCF be h, then the numbers can be expressed as, a=hx, b=hy , where x,y are co-primes.

h+hx+hy = 77
h(1+x+y) = 77
h can be 1 or 7 or 11
$h \neq 1$ (as a,b are non co-primes)
If h = 7, (1+x+y) = 11
x+y = 10
Now we have to select the values of x,y such that they are co-prime to each other.
x = 1, y = 9
x = 3, y = 7
x = 7, y = 3,
x = 9, y = 1
Hence when HCF is 7, there are 4 possible pairs of (x, y)
If HCF = 11, (1+x+y) = 7
x+y = 6
x = 1, y = 5
x = 5, y = 1
There are two possible values of (x,y).

Total values of a and b = 4+2=6
Hence 6 is the correct answer.

Question 74

ABC is a three-digit number, which is 42 less than 20 times the sum of its digits. Find the sum of its digits.

Answer:15

Explanation:
ABC is a three-digit number, which is 42 less than 20 times the sum of its digits.

100A+10B+C=20(A+B+C)-42

80A= 10B+19C-42

80A-10B=19C-42

80A-10B ends with zero so, 19C-42 should also end with 0=> C=8

80A-10B=110, The only possibile values are A=2 and B=5

∴ ABC= 258

The sum of its digits= 2+5+8=15

Question 75

A three-digit number N has a total 6 factors. N has 3 as one of the prime factors. What can be the maximum value of N?

Answer:981

Explanation:
Assume N = $a^p b^q$....., where a and b are prime factors.
Then the number of factors = (p+1)(q+1).....
Here number of factors = 6 = 2*3
Case 1: 2*3 = (1+1)(2+1) Here p = 1 and q = 2
=> N = ab^2 , where a, b are any distinct prime numbers.
Assuming a=3, The maximum 3-digit value of $3b^2$ = 3*17*17 = 867
If b = 3, then then the largest three digit value of 9a such that a is prime will be 9*109 = 981

Case 2: 6 = 5+1 => p=5
N = a^5
Since, 3 is one of the prime factors, hence 3 is the only possible value of a.
Hence, N = $3^5 = 243$

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Here, the value is greater in 1st case when b=3
Hence the largest possible value of N = 981

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Question 76

For all possible integers n satisfying $2.25 \leq 2 + 2^{n+2} \leq 202$, then the number of integer values of $3 + 3^{n+1}$ is:

Answer:7

Video Solution

Explanation:

$2.25 \leq 2 + 2^{n+2} \leq 202$

$2.25 - 2 \leq 2 + 2^{n+2} - 2 \leq 202 - 2$

$0.25 \leq 2^{n+2} \leq 200$

$\log_2 0.25 \leq n + 2 \leq \log_2 200$

$-2 \leq n + 2 \leq 7.xx$

$-4 \leq n \leq 7.xx - 2$

$-4 \leq n \leq 5.xx$

Possible integers = -4, -3, -2, -1, 0, 1, 2, 3, 4, 5

If we see the second expression that is provided, i.e

$3 + 3^{n+1}$, it can be implied that n should be at least -1 for this expression to be an integer.

So, n = -1, 0, 1, 2, 3, 4, 5.

Hence, there are a total of 7 values.

Question 77

How many numbers will divide 2460 and 2640 leaving the same remainder?

A 15

B 22

C 18

D 21

Answer: C

Explanation:
Suppose a number K leaves the same remainder R when it divides 2460 and 2640.
So, 2460 - R = K*p for some natural number p
Similarly, 2640 - R = K*q for some natural number q
When we subtract the two equations, we get 2640 - 2460 = K*(q-p) or 180 = K*(q-p)
Hence, all the numbers which are factors of the difference (180) between the given numbers will divide both the numbers leaving the same remainder.
So, all the factors of (2640 - 2460) = 180 will be such numbers.
So, we have to find the numbers of factors of 180.
$180 = 2^2 * 3^2 * 5$
Number of factors = (2 + 1)(2 + 1)(1 + 1) = 18
So, there are 18 such numbers which will divide 2460 and 2640 leaving the same remainder.
Hence, option c is the correct answer.

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Question 78

Ram writes down all positive integers consecutively, starting from 1. He skips every multiple of 10 in the process. What is 3000th digit written by him?

A 3

B 7

C 9

D 1

Answer: D

Explanation:

Ram skips every 10th number hence he will skip 10,20,...

So one digit numbers written by Ram = 9 {From 1 to 9}

Two digit numbers written by Ram = 9*9 = 81 {From 11 to 99}

Three digit numbers written by Ram = 9*10*9 = 810 {From 101 to 999}

Exhausting all 3 digit number we will start with four digit number starting from 1001

Four digit numbers from 1001 to 1099 = 9*10 = 90

Four digit numbers from 1101 to 1109 = 9

Total number of digits so far = (1*9) + (2*81) + (3*810) + (4*99) = 2997

3rd digit of next number will be the 3000th digit.

Next number written = 1111

Hence we can say that digit 1 is 3000th digit that is written by Ram.Option D is the correct answer.

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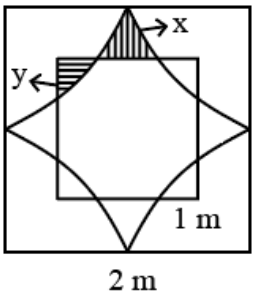
Question 79

A square of length 1 m is inside a square of length 2 m and four quarter circles are joined as shown in the figure. The value of y —x is given by,



A $\frac{8-\pi}{10}$

B $\frac{4-\pi}{5}$

C $\frac{2\pi-1}{8}$

D $\frac{\pi-3}{4}$

Answer: D

Explanation:

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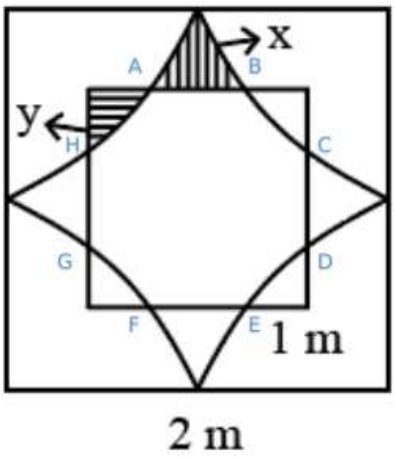


From the above figure area of the region bounded by ABCDEFGH = Are of the square with side 2 - (4*quadrants with side 1cm + 4x)

$=4-\pi -4x$

Which is same as the area of the square with side 1 cm -4y

$4-\pi -4x = 1-4y$

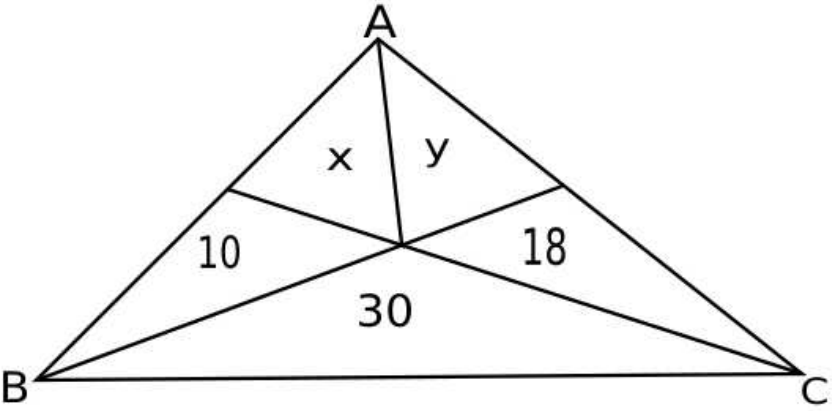
$4x-4y=3-\pi$

$y-x=\frac{\pi-3}{4}$

D is the correct answer.

Question 80

Three lines divide a triangle in 5 areas. The areas of 3 parts have been shown in the figure and two unknown areas have been represented as x and y. Find the value of $\frac{x}{y}$?



A $\frac{6}{7}$

B $\frac{5}{6}$

C $\frac{4}{5}$

D $\frac{7}{8}$

Answer: B

Explanation:
From figure,

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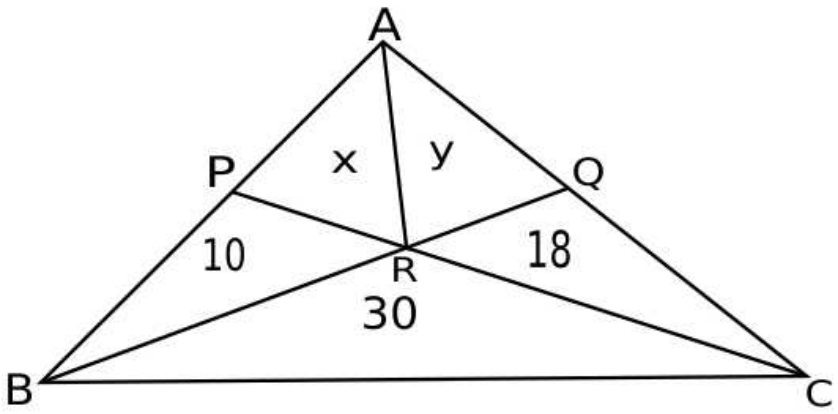

In triangle ABC, BQ divides the triangle into two parts.

Since the altitude from B is same, the ratio of areas of triangles ABQ and CBQ will be the ratio of AQ and CQ.

$\Rightarrow \frac{area(ABQ)}{area(CBQ)} = \frac{AQ}{CQ}$

$\Rightarrow \frac{10+x+y}{48} = \frac{AQ}{CQ}$ .....(1)

Similarly RQ will divide the triangle ARC in the ratio of AQ and CQ.

$\Rightarrow \frac{y}{18} = \frac{AQ}{CQ}$ .....(2)

From 1 and 2, $\frac{y}{18} = \frac{10+x+y}{48}$

=> 30y-18x=180.....(3)

Similarly, the equation for triangles ACP and BCP can be written as,

$\frac{x}{10} = \frac{18+x+y}{40}$

=> 3x-y=18 .....(4)

From 3 and 4, x =10, y=12

Hence, $\frac{x}{y} = \frac{5}{6}$

Question 81

A man standing on the line joining the two poles finds that the top of the poles make an angle of elevation of 60° and 45° respectively. After walking for sometime towards the other pole, the angles change to 30° and 60° respectively. The ratio of the height of the poles is :

A $\frac{\sqrt{3}-1}{2}$

B $\frac{\sqrt{3}+1}{3}$

C $\frac{\sqrt{3}-1}{4}$

D $\frac{\sqrt{3}+1}{4}$

Answer: A

Explanation:

Let 'a' and 'b' be the heights of the two poles

X be the initial position of the man and the angles of elevation be 60^0 and 45^0

Distance between pole 1 and X = $\frac{a}{\sqrt{3}}$ and distance between pole 2 and X = b

Let Y be the position of the man after walking sometime towards the other pole =

Distance between Y and pole 1 = $a\sqrt{3}$ and distance between the pole 2 and Y = $\frac{b}{\sqrt{3}}$

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Since the distance between the poles will remain the same

$\frac{a}{\sqrt{3}}$ + b = $a\sqrt{3}$ + $\frac{b}{\sqrt{3}}$

$\frac{a}{b} = \frac{\sqrt{3}-1}{2}$

A is the correct answer.

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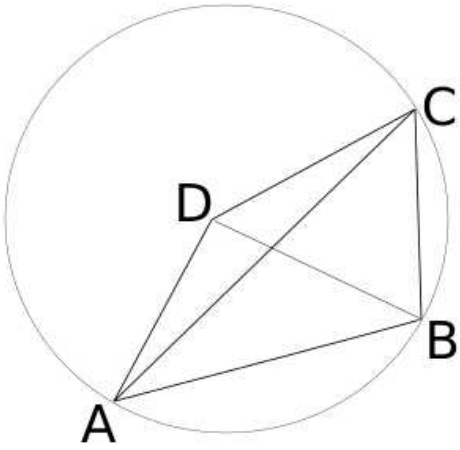
Question 82

In a quadrilateral ABCD, the length of side AD is equal to the length of side CD. If BD is joined, it is found that $\angle DAB = \angle DBA = 24^\circ$. Then the value of $\angle ACB$ (in degrees)

Answer:66

Explanation:
In triangle DAB, $\angle DAB = DBA = 24^\circ$.
Hence, AD = DB
It is given that AB = CD => AD=CD =BD
Taking AB as radius and D as centre,



In triangle ADB, $\angle ADB = 180 - 24 - 24 = 132$
Hence, $\angle ACB = \frac{\angle ADB}{2} = \frac{132}{2} = 66$ (The **angle** subtended by an arc at the **centre** is twice the **angle** subtended at the **circumference**)

Question 83

A walking track AB is the diameter of a circular park of radius 10 m. A pole of height 6 m is standing on the circumference of the circular park and it subtends equal angles at A and B. A point R lies on the line AB and the pole subtends 30° at R. What is the distance of the point R from the center?

A $2\sqrt{2}$

B $\sqrt{12}$

C $\sqrt{15}$

D $3\sqrt{2}$

Answer: A

Explanation:
As given that pole subtends equal angle at the ends of the diameter AB. Then it will be at perpendicular from the center as given in the figure below.

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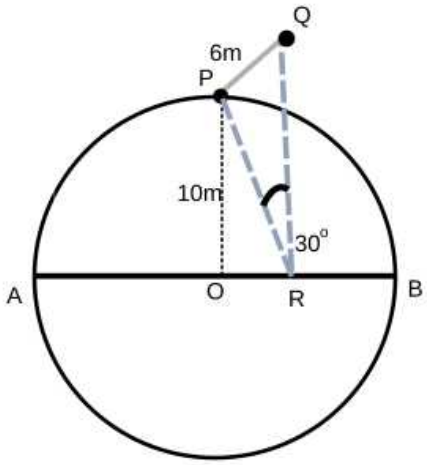


Here suppose the pole PQ subtends 30 ° on the point R.

Then PQ/PR= tan 30 °

PR=$6\sqrt{3}$

Using Pythagoras theorem:

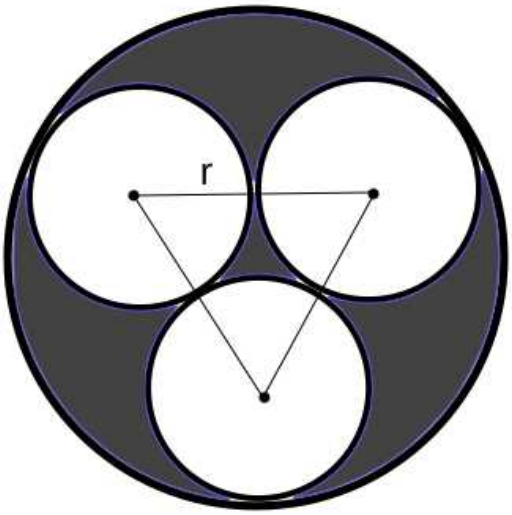
$PR^2 = PO^2 + OR^2$

$36 * 3 = 100 + X^2$

OR = $2\sqrt{2}$

Question 84

Three discs are placed on a bigger disc table, such that the smaller discs touch each other and the edges of the table. What is the area of the shaded region?



A $\frac{\pi r^2\left(4\sqrt{3}-3\right)}{3}$

B $\frac{\pi r^2\left(4\sqrt{3}-2\right)}{3}$

C $\frac{\pi r^2\left(6\sqrt{3}-2\right)}{3}$

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D $\frac{\pi r^2(5\sqrt{2}-2)}{3}$

Answer: B

Explanation:
Area of the smaller discs = $3\pi r^2$

The radius of the bigger disc= 2r/ $\sqrt{3}$+r

Area of the bigger disc= $\frac{\pi r^2(2+\sqrt{3})^2}{3}$

Area of the shaded region= $\frac{\pi r^2(2+\sqrt{3})^2}{3}$ - $3\pi r^2$

= $\frac{\pi r^2(4\sqrt{3}-2)}{3}$

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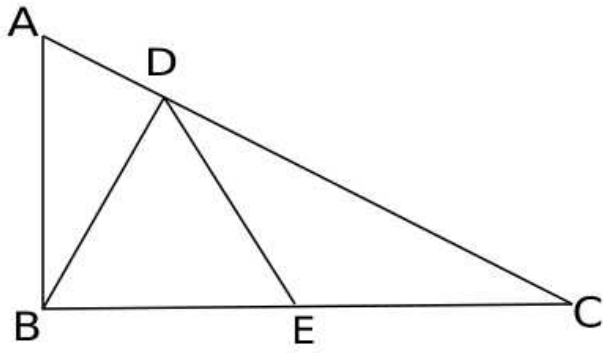
Question 85

A right triangle ABC is drawn such that angle B = 90°. D is a point on AC such that if it is connected to the midpoint E of BC, then ED=EB=EC. If AD = 2 cm and CD = 18 cm then find the length of BD.

Answer:6

Explanation:
We have,



If ED=EB=EC, then BDC is a right triangle and angle D = 90°
In triangles ADB and BDC, $\angle$ DAB = $\angle$ DBC = 90 -$\angle$ ACB
Also, $\angle$ ADB = $\angle$ BDC = 90
Hence, both triangles are similar.
So, $\frac{AD}{BD} = \frac{BD}{CD}$
=> BD = $\sqrt{AD \times CD}$ = $\sqrt{2 \times 18}$ = 6

Question 86

In a rectangle, ABCD, points F and G lie on the diagonal AC such that BF and DG are perpendicular to AC. If the ratio AF: AG = 9:4 and the ratio of sides is equal to m:n, then find the value of m+n if m<n and m and n are co-primes.

Answer:5

Explanation:
We have,

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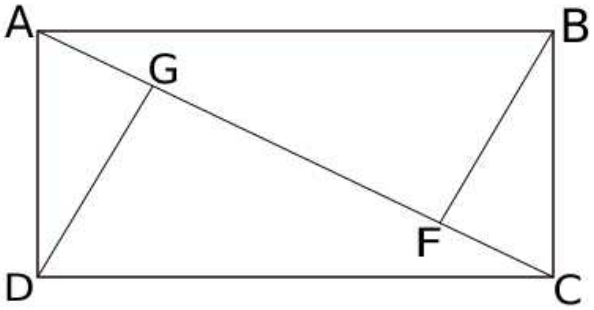
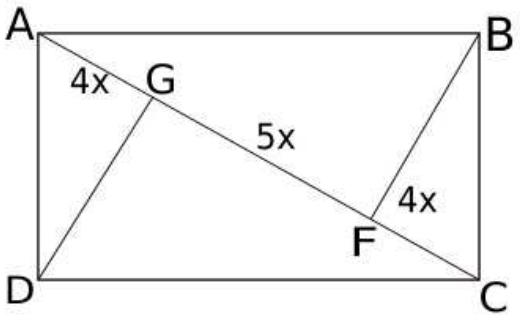


Assuming AG as 9-5 = 4x and AF as 9x and FC = 4x from symmetry.



In right triangles AFB and BFC, angle AFB=angle BFC = 90 and angle BAF = angle CBF = 90-angle BCA
Hence, both triangles are similar.

$$\Rightarrow \frac{BF}{AF} = \frac{CF}{BF}$$

$$\Rightarrow BF^2 = AF \times CF$$ => BF = $\sqrt{4x \times 9x}$ = 6x

Since, angle BAC = angle CBF = 90-angle BCA

=> tan BAC = tan CBF

$$\Rightarrow \frac{BC}{AB} = \frac{FC}{BF}$$

$$\Rightarrow \frac{BC}{AB} = \frac{4x}{6x} = 2:3 = \frac{m}{n}$$

Hence, m+n=2+3=5

Question 87

A paper is in the shape of a sector of a circle of radius $6 + 4\sqrt{3}$ cm such that the central angle is 120 $^\circ$. Now a circle is drawn on this paper. What is the maximum possible radius of this circle?

A 8

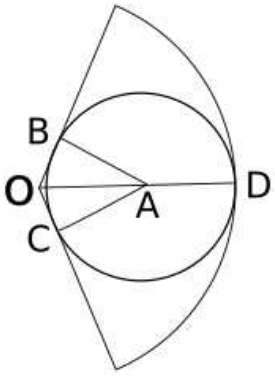
B $2\sqrt{3}$ cm

C $3\sqrt{3}$ cm

D 6 cm

Answer: D

Explanation:



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Using symmetry, $\angle BOA = \angle COA$
Since, $\angle BOC = 120^\circ$ = $\angle BOA + \angle COA$ = 2$\angle BOA$
=> $\angle BOA$ = 60°
Since OB is tangent to the smaller circle, $\angle OBA = 90^\circ$
In right triangle BOA, $\angle BAO = 90 - \angle BOA = 90 - 60 = 30^0$
Now, OA cos$\angle BAO$ = AB = r => $\frac{OA\sqrt{3}}{2} = r$
=> OA = $\frac{2r}{\sqrt{3}}$
Now, OD = $6 + 4\sqrt{3}$ = r + $\frac{2r}{\sqrt{3}}$
=> r = $\frac{(6+4\sqrt{3})\sqrt{3}}{2+\sqrt{3}}$
=> r = $\frac{12+6\sqrt{3}}{2+\sqrt{3}}$ = $\frac{6(2+\sqrt{3})}{2+\sqrt{3}}$ = 6 cm

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Question 88

A semicircle with centre O is drawn inside rectangle ABCD such that the longer side BC is the diameter of the circle. Point E divides AB in the ratio 5:4. Line DE is tangent to the semicircle. If the area of the triangle DEO is 65 square units, then the area (in sq. units) of the rectangle will be

A 260

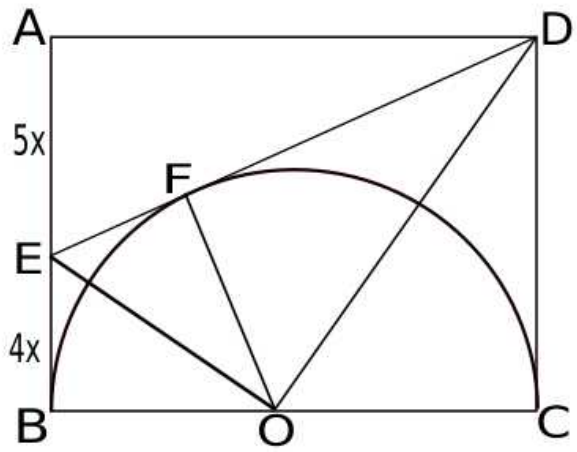
B 180

C 130

D 360

Answer: B

Explanation:
Assuming AE=5x and BE=4x, we have,



Since, AB=DC => DC = 5x+4x = 9x
Now, BE=EF= 4x (Tangent from the same external point) .....(1)
Similarly, DC=FD = 9x .....(2)
In triangles EFO and EBO, EO is common, BE=FE = 4x and BO=FO= radius, Hence, both triangles are congruent.
Similarly, DFO and DCO are congruent.
Hence, $\angle$ FOE = $\angle$ BOE and $\angle$ DOF = $\angle$ DOC
Since, $\angle$ BOC = 180 (angle on a straight line)
=> $\angle$ FOE +$\angle$ BOE +$\angle$ FOD+ $\angle$ COD= 180
=> 2($\angle$ FOE+$\angle$ FOD) = 180
=> $\angle$ EOD = 90
Hence, DOE is a right triangle.

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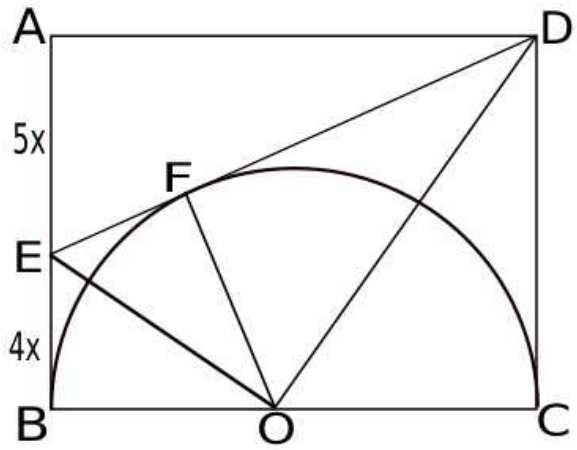
Now, in triangles EFO and OFE, $\angle$ EFO = $\angle$ OFE = 90, $\angle$ FEO = $\angle$ FOD = 90- $\angle$ ODF
Hence, the two triangles are similar.
=> $\frac{FE}{FO} = \frac{FO}{FD}$
=> FO = $\sqrt{EF \times FD}$ = $\sqrt{4x \times 9x}$ = 6x
The area of triangle DEO = $\frac{1}{2} \times FO \times DE$ = $\frac{1}{2} \times 6x \times 13x$ = 39x^2 = 65 => x^2 = $\frac{5}{3}$
Area of the rectangle = 9x $\times 2 \times radius$ = 9x $\times 12x$ = 108x^2 = $108 \times \frac{5}{3} = 180 sq.units$

Alternate Solution:

Assuming AE=5x and BE=4x, we have,



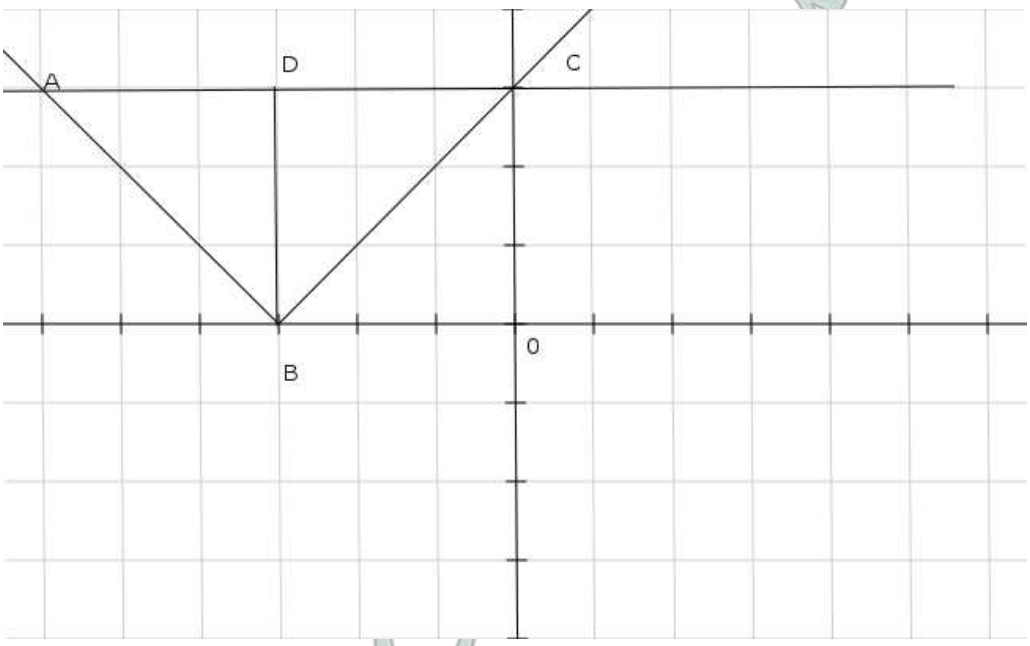
Since, AB=DC => DC = 5x+4x = 9x
Now, BE=EF= 4x (Tangent from the same external point) .....(1)
Similarly, DC=FD = 9x .....(2)
Area of the triangle DOE = $\frac{1}{2} \times FO \times DE = \frac{1}{2} \times FO \times (EF + FD) = \frac{1}{2} \times r \times 13x = 65$
=> rx = 10 (where r = radius)
Now, area of the rectangle = AB*BC = 9x*2r = 18*10 = 180 sq units.

Question 89

For any positive number, 'p', what is the area bounded by the graph y = |x+p| and y = 6

Answer:36

Explanation:



Look at the figure.

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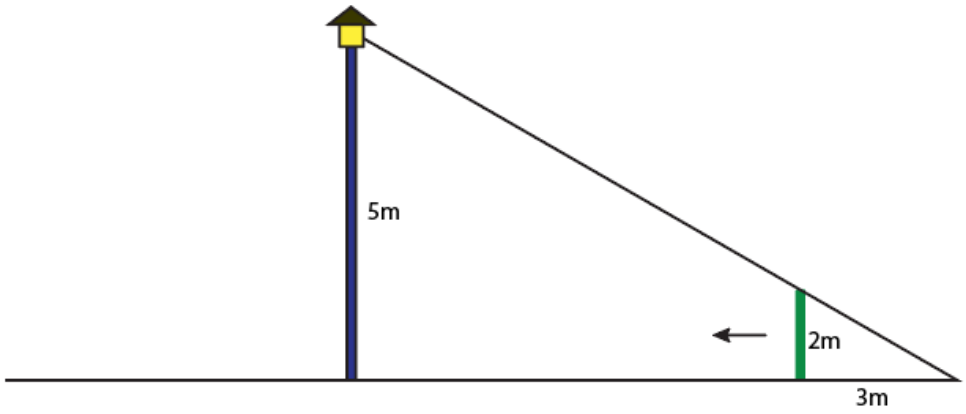
Since slope of the lines is 1
Anfle CBO = Angle DCB = 45
BD = DC = 6
Similarly AD = 6
Area = 1/2 *12*6 = 36

Question 90

A person of height 2m is travelling toward a lamp post of height 5m as shown below. At the given point of time, the length of the shadow of the person formed on the road is 3m. He travels x meters forward and the length of the shadow becomes 1m. Which of the following can be the value of x?



A 6m

B 3m

C 5m

D More than one option correct.

Answer: D

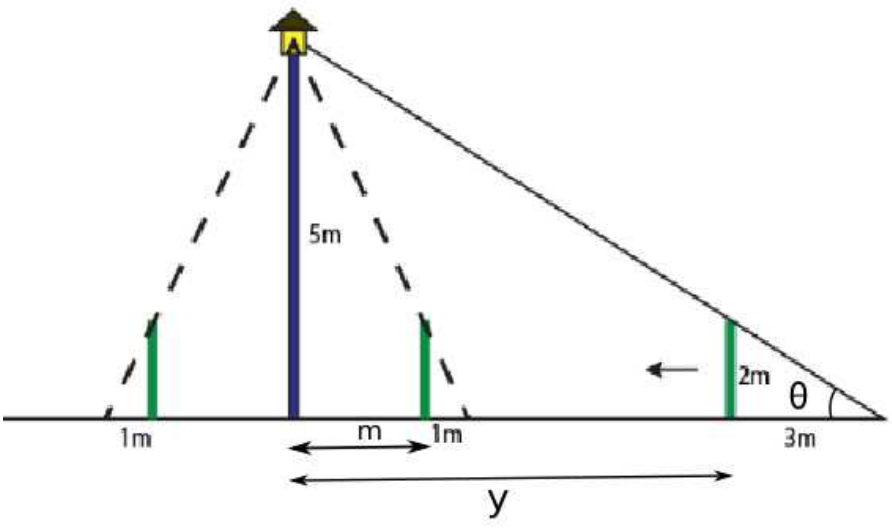
Explanation:
Let the distance of the pole from the person= y

$$\tan\theta = \frac{2}{3} = \frac{5}{y+3}$$

y = 4.5m

Let the person be m meters away from the pole when its shadow's length is 1m.

We will get equal shadows on both sides of the lamp.



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$\frac{2}{1} = \frac{5}{1+m}$

Now,

m = 1.5m

But there will be two positions where the man will form a shadow of 1m, on both the sides of the pole.

x = 4.5-1.5 = 3m or x = 4.5+1.5 = 6m

i.e x can be 3m or 6m

Option D

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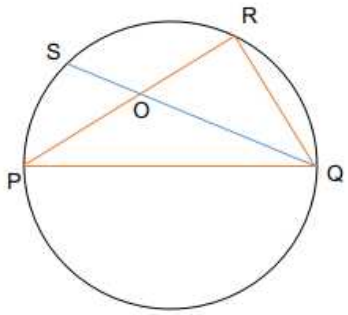
Question 91

In the below figure, PQ is the diameter of the circle. QS is the angular bisector such that QO: OS = 2:1. Then the measure of angle PQR is



A 30^0

B 60^0

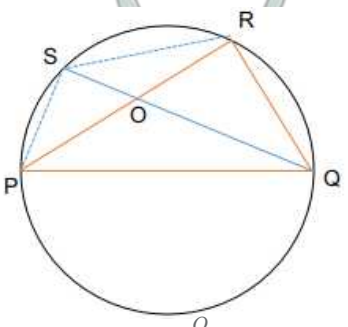
C 45^0

D 75^0

Answer: B

Explanation:

Join P and S.



$\angle$ SQR = $\angle$ SPR = $\frac{Q}{2}$ [Angle on the same chord]

Let SO = a then QO = 2a

Let PO = b

In $\triangle$ SOP

Sin $\angle$ SPR = sin $\frac{Q}{2} = \frac{SO}{PO} = \frac{a}{b}$

b = $\frac{a}{sin\frac{Q}{2}}$

In $\triangle$ POQ

$\frac{OQ}{sinOPQ} = \frac{OP}{sinOQP}$

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$\frac{2a}{sinOPQ} = \frac{b}{sin\frac{Q}{2}}$

$\frac{2a}{cosQ} = \frac{b}{sin\frac{Q}{2}}$ [$\because \angle P + \angle Q = 90$]

$\frac{a}{sin\frac{Q}{2}}$

$\frac{2a}{cosQ} = sin\frac{Q}{2}$

$\frac{2}{1-2sin^2\frac{Q}{2}} = \frac{1}{sin^2\frac{Q}{2}}$

$sin^2\frac{Q}{2} = \frac{1}{4}$

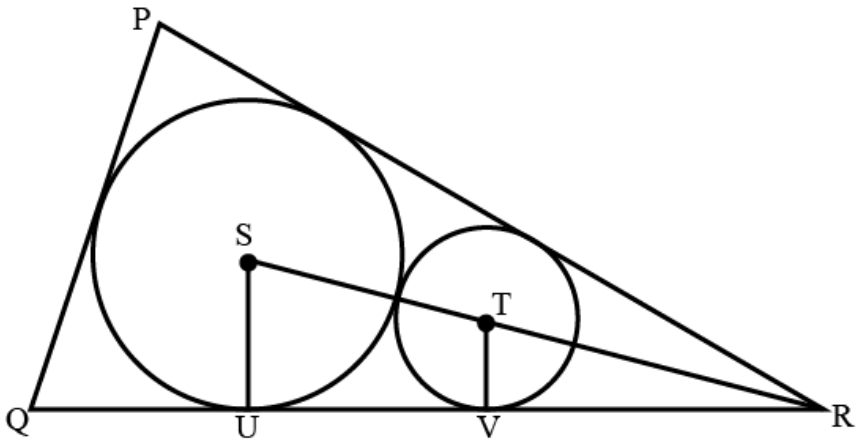
$\frac{Q}{2} = 30$

$Q = 60^0$

B is the correct answer.

Question 92

In the figure, PQR is a triangle. A circle with centre S is inscribed inside the triangle such that it touches QR at U. Another circle with centre T is drawn such that it touches sides QR (at point V), PR and the circle with center S. If the radii of the circles with centres at S and T are 8 cm and 2 cm, what is the length of UR?



A 12cm

B 8.66cm

C 10.66cm

D 9cm

Answer: C

Explanation:

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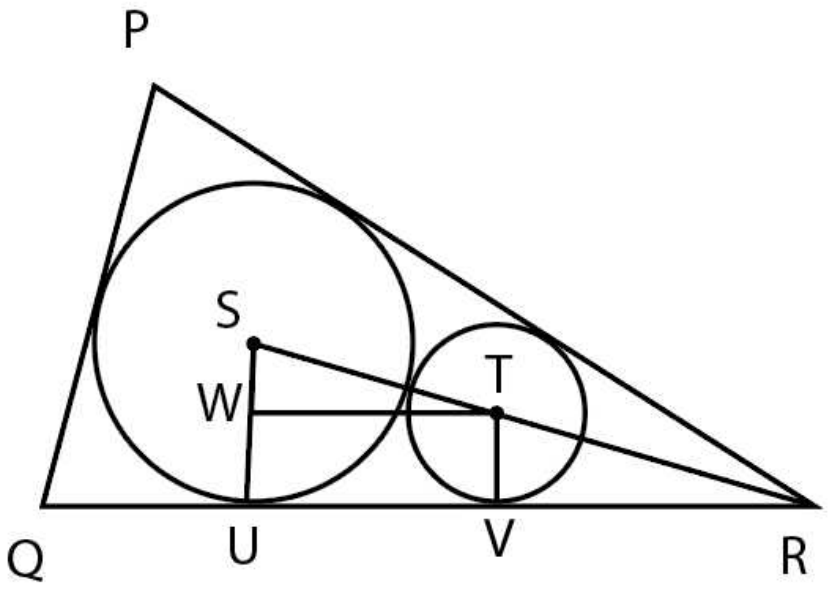

US and VT are perpendicular to QR.

Thus SW= 8-2= 6cm

ST=R1+R2= 8+2= 10cm

The length of WT= $\sqrt{10^2 - 6^2}$

UV= WT = 8cm

Let VR=a

In triangle SUR

a/a+8 = 2/8

8a=2a+16

a=16/6

a=8/3

UR= 8+2.66=10.66cm

Option C

Question 93

The Sum S(n) is defined as the sum of the digits of the number till a single-digit number is obtained, order O(n) is defined as the number of times S(n) is performed. The number of 3 digit numbers such that the S(n) is 8 and O(n) = 2.

For instance, n = 96 S(n) = 9+6 = 15 =1+5 = 6, O(n) = 2

A 64

B 45

C 27

D 55

Answer: A

Explanation:
Let abc be the 3 digit number.

Since the order is 2, the single-digit number is obtained after the second addition.
So 8 can be obtained if the two-digit numbers are 17, 71, 26, 62, 35, 53 and 44
The sum of the digits of the three-digit numbers should be 17, 71, 26, 62, 35, 53 and 44.

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But the maximum sum of digits for a three-digit number will be 9+9+9 = 27. So only 17 and 26 are possible.

a+b+c = 17, a+b+c = 26

Case 1: a+b+c = 17

Let a= 9-x, b= 9-y, c= 9-z

9-x+9-y+9-z = 17

x+y+z = 10

Number of ways = ${}^{10+3-1}C_{3-1}$

As a is the first digit so has to be greater than zero, therefore x cannot be equal to 10 and 9.

From this we have to remove the cases when x = 9, 10

When x = 10,y = z = 0 , so 3 cases

When x = 9, y+z=1, 2 cases

So the number of cases = 66-5 = 61

Case 2: when a+b+c = 26

(998), (989), (899) --- 3 cases

The total number of ways = 64

A is the correct answer.

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Question 94

A deck of cards is shuffled, four cards are picked in random and all of them turned out to be red. What is the probability that two of the cards are kings?

A $\frac{6}{325}$

B $\frac{3}{375}$

C $\frac{9}{325}$

D $\frac{6}{375}$

Answer: A

Explanation:

A deck of cards is shuffled, four cards are picked in random and all of them turned out to be red.

The number of ways 4 red cards are selected= ${}^{26}C_4$ ways.

If two cards are Kings, then the remaining two cards can be selected in ${}^{24}C_2$ ways

The probability that two of the cards are kings= $\frac{{}^{24}C_2}{{}^{26}C_4}$

$= \frac{6}{325}$

Option A

Question 95

Rinesh and Dinesh visit a cafeteria every day between 8 PM and 9 PM. Each person spends exactly 10 minutes inside the cafe. However, the cafe closes at 9 PM every day. Each person must leave the cafeteria at exactly 9 PM irrespective of the time they entered the cafe. What is the probability that they both meet in the cafe?

A $\frac{9}{16}$

B $\frac{25}{36}$

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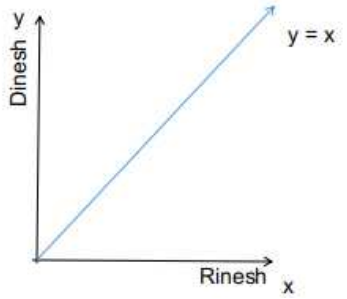
C $\frac{11}{36}$

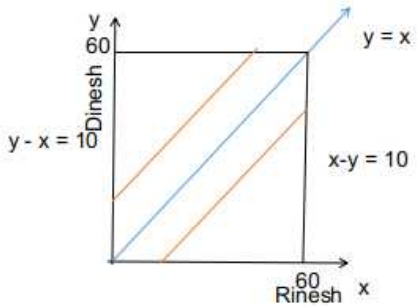
D $\frac{7}{16}$

Answer: C

Explanation:
Both Rinesh and Dinesh can come in a timespan of 60 minutes.
Let us represent the time(in minutes) when Rinesh comes on x-axis and Dinesh on the y-axis.



Both of them will wait at the stop for 10 minutes.
Since both of them have to meet, the difference between their arrival time has to be less than or equal to 10 minutes.



The area between the blue and the orange coloured lines is the required region. ($|x-y| \leq 10$)
= 60*60 - 2* $\frac{1}{2}$ *50*50 = 1100
Probability that both of them would meet = $\frac{1100}{3600}$
= $\frac{11}{36}$

C is the correct answer.

Question 96

12 buses were ordered for painting, the painters were asked to paint the buses in any colour among Black, Yellow and Pink such that there should be minimum one bus of each colour. What is the probability that exactly 6 buses were painted Yellow?

A 1/11

B 1/9

C 3/11

D 7/55

Answer: A

Explanation:
Let a, b and c buses are painted Black, Yellow and Pink.

a+b+c=12

There should be minimum one bus of each colour.

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a'-1+b'-1+c'-1=12

a'+b'+c'=9

Non-negative integral solution = 11C2=55

Exactly 6 buses were painted Yellow

a=6

b+c=6

b'+c'=4

Non-negative integral solution = 5C1=5

The probability that exactly 6 buses were painted Yellow= 5/55

=1/11

Option A

CAT Percentile Predictor

Question 97

In a triangle PQR, there are 4, 7, 6 points on its sides excluding the vertices P, Q, R. How many triangles can be formed using these points and the vertices P, Q, R?

A 980

B 1081

C 1440

D 890

Answer: A

Explanation:
Total number of points = Vertices P, Q, R (3) + 4 + 7 + 6 = 20
4 + 2 vertices (P, Q) are collinear on the side PQ, 9 points are collinear on side QR and 8 points are collinear on side PR.
To form a triangle 3 non-collinear points are required.
Hence the number of triangles = $^{20}C_3 \ - \ (^6C_3 + ^9C_3 + ^8C_3)$

=1140- (20+56+84)

=980

A is the correct answer.

Question 98

What is the total number of ways in which Stefen can distribute 10 distinct chocolates among his 9 wives such that each wife gets at least one chocolate?

A 11!/2

B 11!

C 90*9!

D 45*9!

Answer: D

Explanation:
The number of ways of selecting 9 chocolates out of 10 = 10c9=10.

The number of ways in which he can distribute 9 chocolates such that each wife gets one chocolate= 9!

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Remaining one chocolate can be distributed among any of the wives.

.'. The total number of ways = (10*9!*9)/2! =45*9!

Question 99

Janaki starts walking from her school such that she takes a total of 4 steps of equal lengths. She takes each step in any one of the four directions i.e. East, West, North and South. What is the total number of ways in which Janaki will be back at her starting point (school) after completing the above-mentioned operation?

Answer:36

Explanation:
To ensure that Janaki ends up at the same location as her starting point after taking 4 steps in each direction, we have the following:

Case 1: Take 2 steps in North and 2 steps in South direction

Total arrangements = $\frac{4!}{2!*2!}$ = 6

Case 2: Take 2 steps in East and 2 steps in the West direction

Total arrangements = $\frac{4!}{2!*2!}$ = 6

Case 3: Take a step in each of the four directions

Total arrangements = 4! = 24

Total number of ways in which Janaki can reach her school after completing 6+6+24 = 36

36 is the correct answer.

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Question 100

Three consecutive natural numbers are selected at random out of first 101 natural numbers. What is the probability that the product of these three numbers is a multiple of 9?

A 1/3

B 2/3

C 1/9

D 1/2

Answer: A

Explanation:
Three consecutive whole numbers are selected at random.

One of these numbers must be a multiple of 9.

(1,2,3) (2,3,4) (3,4,5) (4,5,6) (5,6,7) (6,7,8) (7,8,9) (8,9,10) (9,10,11)

These 9 pairs will repeat the same pattern.

(10,11,12) (11,12,13) (12,13,14) (13,14,15) (14,15,16) (15,16,17) (16,17,18) (17,18,19) (18,90,20)

.....

(91,92,93) (92,93,94) (93,94,95) (94,95,96) (95,96,97) (96,97,98) (97,98,99) (98,99,100) (99, 100,101)

Last three pairs will be a multiple of 9.

The probability that the product of these three numbers is a multiple of 9= 3/9=1/3

Option A

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