

A function  $\phi$  is defined for all real  $x$  as  $\phi(x) = \sqrt[3]{|x^3 - 9|}$ . In addition, we define  $\phi^2(x) = \phi(\phi(x))$ ,  $\phi^3(x) = \phi(\phi(\phi(x)))$ , and so on. Find the value of  $\phi^{2019}(5) + \phi^{2020}(5)$ .

*Enter your response (as an integer) using the virtual keyboard in the box provided below.*

## Explanation:

Let's start by observing the pattern for  $\phi(5)$ ,  $\phi^2(5)$ ,  $\phi^3(5)$  and so on.

$$\phi(5) = \sqrt[3]{|125 - 9|} = \sqrt[3]{116}; \quad \phi^2(5) = \sqrt[3]{|116 - 9|} = \sqrt[3]{107}; \quad \phi^3(5) = \sqrt[3]{|107 - 9|} = \sqrt[3]{98}$$

Continuing in this manner, with the number in the  $\sqrt[3]{\phantom{x}}$  sign reducing by 9 each time, we will eventually get a number less than 9 on the 13<sup>th</sup> step

$$\phi^{13}(5) = \sqrt[3]{|17 - 9|} = \sqrt[3]{8} = 2$$

After that, the subsequent steps will look like this:

$$\phi^{14}(5) = \sqrt[3]{|8 - 9|} = \sqrt[3]{1} = 1; \quad \phi^{15}(5) = \sqrt[3]{|1 - 9|} = \sqrt[3]{8} = 2;$$

$$\phi^{16}(5) = \sqrt[3]{|8 - 9|} = \sqrt[3]{1} = 1; \quad \phi^{17}(5) = \sqrt[3]{|1 - 9|} = \sqrt[3]{8} = 2$$

... and so on. We can easily see that this pattern will repeat indefinitely; thus  $\phi^{2019}(5) = 2$  and  $\phi^{2020}(5) = 1$ . So, the required value i.e.,  $\phi^{2019}(5) + \phi^{2020}(5) = 2 + 1 = 3$ .

Therefore, the required answer is 3.

## Correct Answer:

Time taken by you: 0 secs

Avg Time taken by all students: 51 secs

Your Attempt: Skipped

% Students got it correct: 22 %

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In a kilometer race, if A gives B a start of 20 m, both finish the race at the same time. Also, in a half kilometer race C beats A by 50 m. B and C run a half km race. Who should give a start to the slower runner and of how many metres so that they both finish the race at the same time?

- ☐ C, 64 m
- ☐ C, 59 m
- ☐ B, 59 m
- ☐ B, 64 m



### Explanation:



A runs 1000 m; B runs 980 m.

A runs 450 m, C runs 500 m.

$\therefore$  A runs 450 m and B runs 441 m when C runs 500 m.

In a half km race, C can give B a start of  $500 - 441 = 59$  m.

Hence, [2].

### Correct Answer:



Time taken by you: **0 secs**

Avg Time taken by all students: **179 secs**

Your Attempt: **Skipped**

% Students got it correct: **70 %**



If  $6x^2 + mx + 2 \geq 0$  for all real 'x', then how many integer values of can 'm' take?

*Enter your response (as an integer) using the virtual keyboard in the box provided below.*

**Explanation:**

Consider  $6x^2 + mx + 2 \geq 0$

For  $m^2 - 48 < 0$  the curve will not have x-intercept i.e.,  $-4\sqrt{3} \leq m \leq 4\sqrt{3}$

For  $m^2 - 48 = 0$  the curve will have one x-intercept  $m = \pm 4\sqrt{3}$

$$4\sqrt{3} < 7$$

$$\therefore m \in [-6, 6]$$

Thus, 'm' can take 13 values.

Therefore, the required answer is 13.

**Correct Answer:**

Time taken by you: **0 secs**

Avg Time taken by all students: **33 secs**

Your Attempt: **Skipped**

% Students got it correct: **26 %**





If  $R = \frac{(0.15)^{55} + (0.25)^{55}}{(0.15)^{54} + (0.25)^{54}}$  then.

- ☐  $1 < R$
- ☐  $0.6 < R < 1$
- ☐  $0.4 < R < 0.6$
- ☐  $0.2 < R < 0.4$

Explanation:

$$R = \frac{(0.15)^{55} + (0.25)^{55}}{(0.15)^{54} + (0.25)^{54}}$$

Let  $a = 0.25$  and  $b = 0.15$

$$\therefore R = \frac{a^{55} + b^{55}}{a^{54} + b^{54}}$$

$$\therefore R = a + \frac{b^{55} - ab^{54}}{a^{54} + b^{54}}$$

$$\therefore R = a + \frac{b^{54}(b - a)}{a^{54} + b^{54}} = a + \frac{b - a}{\left(\frac{a}{b}\right)^{54} + 1}$$

$$\therefore R = 0.25 + \frac{-(0.1)}{\left(\frac{0.25}{0.15}\right)^{54} + 1}$$

Now,  $\left(\frac{0.25}{0.15}\right)^{54} > > 1$ . Therefore, the denominator is much greater than 2.

$\therefore R$  is only slightly less than 0.25.

Correct Answer:

Time taken by you: 0 secs

Avg Time taken by all students: 69 secs

Your Attempt: Skipped

% Students got it correct: 38 %

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In how many ways can Kunda purchase seven identical garlands from four shops such that she purchases at least one garland from each shop?

*Enter your response (as an integer) using the virtual keyboard in the box provided below.*



### Explanation:



Number of garlands purchased = 7

If a, b, c and d are the number of garlands, she purchased from the four shops, the required answer is the number of solutions to equation  $a + b + c + d = 7$ .

If  $a = a' + 1$ ,  $b = b' + 1$ ,  $c = c' + 1$  and  $d = d' + 1$ , where  $a'$ ,  $b'$ ,  $c'$  and  $d'$  are whole numbers, we get  $a' + b' + c' + d' = 3$ .

The number of whole number solutions to this equation is  $\frac{6!}{3!3!} = 20$ .

Therefore, the required answer is 20.

### Correct Answer:



Time taken by you: 0 secs

Avg Time taken by all students: 38 secs

Your Attempt: Skipped

% Students got it correct: 35 %



A solid metal sphere is melted and smaller spheres of equal radii are formed. 10% of the volume of the sphere is lost in the process. The smaller spheres have a radius which is  $\left(\frac{1}{10}\right)^{\text{th}}$  the radius of the larger sphere. Ten litres of paint were needed to paint the larger sphere. How many litres would be needed to paint all the smaller spheres if the thickness of the coat of paint remained the same?

- ☐ 90
- ☐ 81
- ☐ 900
- ☐ 810



Explanation:

$$\text{Volume of the larger sphere} = \frac{4}{3} \pi R^3$$

$$\text{Volume available on melting} = \frac{4}{3} \pi (R)^3 (0.9)$$

$$\text{Number of smaller spheres} = \frac{\frac{4}{3} \pi (R)^3 (0.9)}{\frac{4}{3} \pi \left(\frac{R}{10}\right)^3} = 900.$$

Paint required is proportional to total surface area.

$$\text{Total surface area of the larger sphere} = 4 \pi R^2$$

Total surface area of all the small spheres

$$= (900) 4 \pi \left(\frac{R}{10}\right)^2 = 9 \times 4 \pi R^2.$$

$$\therefore \text{Paint required} = \frac{9 \times 4 \pi R^2}{4 \pi R^2} \times 10 = 90 \text{ litres.}$$

Hence, [1].

Correct Answer:

Time taken by you: 0 secs

Avg Time taken by all students: 156 secs

Your Attempt: Skipped

% Students got it correct: 77 %

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How many natural numbers in base 10 have four digits when expressed in both base 8 and base 11?

*Enter your response (as an integer) using the virtual keyboard in the box provided below.*

**Explanation:**

Decimal numbers between  $8^3$  and  $8^4 - 1$  (both included) have four digits, when expressed in base 8. That means decimal numbers between 512 and 4095 have four digits in base 8.

Similarly, decimal numbers between  $11^3$  and  $11^4 - 1$  (both included) i.e., between 1331 and 14640 have four digits in base 11.

$\therefore$  Decimal numbers from 1331 to 4095 (total 2765) have four digits in both base 8 and base 11.

Therefore, the required answer is 2765.

**Correct Answer:**

Time taken by you: **0 secs**

Avg Time taken by all students: **27 secs**

Your Attempt: **Skipped**

% Students got it correct: **17 %**



A and B wanted to start a business. A saved Rs. 1,000 every month for 12 months while B saved Rs. 2,000 every alternate month (1<sup>st</sup>, 3<sup>rd</sup>, 5<sup>th</sup>, 7<sup>th</sup>, 9<sup>th</sup> and 11<sup>th</sup> months). Both A and B saved their respective amounts in Piggy banks and hence did not earn any interest. After 12 months, A and B joined C to start the business. A and B invested the amounts they saved in their piggy banks while C invested Rs. 15,000. If the business earned a total profit of Rs. 3,900, what was the difference in the profits earned by A and C?

- ☐ 100
- ☐ 500
- ☐ 300
- ☐ None of these

**Explanation:**

Capital of A : Capital of B : Capital of C =  $(12000 \times 1, 2000 \times 6 : 15000)$

$\therefore$  Ratio of profit = 4 : 4 : 5

Profit of A =  $\left(\frac{4}{13}\right) \times 3900 = \text{Rs. } 1,200$

Profit of C =  $\left(\frac{5}{13}\right) \times 3900 = \text{Rs. } 1,500$

$\therefore$  The required difference = 300

Hence, [3].

**Correct Answer:**

Time taken by you: **0 secs**

Avg Time taken by all students: **147 secs**

Your Attempt: **Skipped**

% Students got it correct: **91 %**



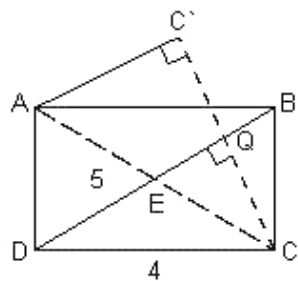


There is a rectangle ABCD with  $AB = 4$  cm and  $BC = 3$  cm. A plane mirror is kept along BD. The image of C is  $C'$  as reflected in the mirror. How far is  $C'$  from A? (The object and image will be symmetrical along the axis of the mirror)

- ☐ 3 cm
- ☐ 1.4 cm
- ☐ 4 cm
- ☐ 2 cm

04:24

Explanation:



In  $\triangle BCD$ ,

$$\frac{1}{2} \times BC \times DC = \frac{1}{2} CQ \times BD$$

$$\frac{1}{2} \times 3 \times 4 = \frac{1}{2} CQ \times 5 \quad \therefore CQ = \frac{12}{5}$$

$C'$  is the mirror image of  $C$ .

$$\therefore \text{In } \triangle BQC, BQ = \sqrt{9 - \frac{144}{25}} = \sqrt{3.24} = 1.8$$

$E$  is mid-point of  $AC$  &  $BD$  and  $Q$  is mid-point of  $CC'$ .

$$\frac{EC}{CQ} = \frac{CQ}{CQ} = \frac{1}{1}$$

Correct Answer:

Time taken by you: 9308  
secs

Avg Time taken by all students: 95 secs

Your Attempt: Skipped

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% Students got it correct: 42 %



In all 4 adults and 6 children can complete a piece of work in 8 days. If 3 adults and 15 children work, they can complete the same piece of work in 6 days. What is the ratio of the work done by an adult to that done by a child in one day?

- ☐ 2 : 1
- ☐ 3 : 1
- ☐ 3 : 2
- ☐ 4 : 3



02:53

**Explanation:**

If the amount of work done in a day by an adult is 'A' and that done by a child is 'C', we get the following:

$$8(4A + 6C) = 6(3A + 15C)$$

$$\therefore 32A + 48C = 18A + 90C$$

$$\therefore 14A = 42C$$

$$\therefore A = 3C$$

Hence, [2].

**Correct Answer:**

Time taken by you: **0 secs**

Avg Time taken by all students: **159 secs**

Your Attempt: **Skipped**

% Students got it correct: **83 %**

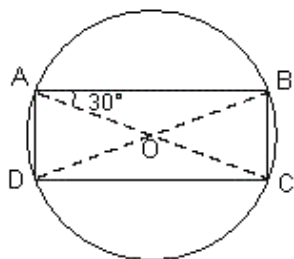


ABCD is a parallelogram such that all the four of its vertices lie on the circumference of a circle with radius 7 units and center O. Further,  $m\angle OAB = 30^\circ$ . What is the length of the inradius of  $\triangle ABC$ ?

- ☐  $\frac{7}{2}(\sqrt{3} + 1)$  units
- ☐  $\frac{7}{2}(\sqrt{3} - 1)$  units
- ☐  $7(\sqrt{3} - 1)$  units
- ☐ Cannot be determined

### Explanation:

ABCD is a cyclic parallelogram. A parallelogram inscribed in a circle is a rectangle. Therefore, ABCD is a rectangle. We have the following:



Diagonals AC and BD are diameters of the circle.  $AC = BD = 14$  units

Given :  $m\angle OAB = 30^\circ$

Therefore, in  $\triangle ABC$ ,  $m\angle CAB = 30^\circ$ ,  $m\angle ACB = 60^\circ$

By  $30^\circ$ - $60^\circ$ - $90^\circ$  theorem,  $BC = 7$  units and  $AB = 7\sqrt{3}$  units

$$A(\triangle ABC) = \frac{1}{2} \times 7 \times 7\sqrt{3} = \frac{49}{2} \sqrt{3} \text{ sq. units.}$$

$$\text{Also, } s = \frac{7 + 14 + 7\sqrt{3}}{2} = \frac{7\sqrt{3}}{2} (\sqrt{3} + 1)$$

Correct Answer:

Time taken by you: 0 secs

Avg Time taken by all students: 179 secs

Your Attempt: Skipped

% Students got it correct: 74 %

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Given  $x = 1 + a + a^2 + \dots \infty$  and  $y = 1 + b + b^2 + \dots \infty$ , where 'a' and 'b' are proper fractions.  $1 + ab + a^2b^2 + \dots \infty$  equals:

☐  $\frac{xy}{x+y-1}$

☐  $\frac{x+y}{x-y}$

☐  $\frac{x^2+y^2}{x-y}$

☐  $\frac{xy}{x^2-y^2}$

Explanation:

$x$  is the sum of infinite terms of a GP with  $r = a$ ;  $\therefore x = \frac{1}{1-a}$  ( $\because a < 1$ )

$$\therefore x - xa = 1$$

$$\therefore xa = x - 1$$

$$\therefore a = \frac{x-1}{x}$$

$y$  is again the sum of infinite terms of a GP with  $r = b$ ; similarly  $b = \frac{y-1}{y}$

( $\because b < 1$ )

$$\text{Now, } ab = \frac{x-1}{x} \times \frac{y-1}{y} = \frac{xy-x-y+1}{xy}$$

$$\text{Now, } S = 1 + ab + a^2b^2 + \dots \infty$$

$$\therefore S = \frac{1}{1-ab} \quad (\because ab < 1)$$

$$= \frac{1}{1 - \frac{xy-x-y+1}{xy}}$$

$$= \frac{xy}{xy - xy + x + y - 1} = \frac{xy}{x + y - 1}. \text{ Hence, [1].}$$

Correct Answer:

Time taken by you: 0 secs

Avg Time taken by all students: 133 secs

Your Attempt: Skipped

% Students got it correct: 79 %

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Riddhi and Siddhi started a business by investing amounts in the ratio 3 : 2. They donate 5% of the profit of the business to a charity and then divide remaining profit in the ratio of their investment in the business. If Riddhi's share in the profit was Rs. 57,000, how much amount was donated to charity?

- ☐ Rs. 500
- ☐ Rs. 5,000
- ☐ Rs. 1,500
- ☐ None of these

Explanation:

Let the profit be  $(100x)$ .

$\therefore (5x)$  was donated to charity

Riddhi's share in the profit =  $57x = 57000$

$\therefore x = 1000$

$\therefore$  Donation to charity = Rs. 5,000

Hence, [2].

Correct Answer:

Time taken by you: **0 secs**

Avg Time taken by all students: **147 secs**

Your Attempt: **Skipped**

% Students got it correct: **85 %**



Suppose set A is a set of five natural numbers as follows:

$$A = \{2, 5, 9, 13, 14\}$$

$N_1$  = number of circular permutations of all the numbers from set A such that the adjacent numbers are relatively prime.

$N_2$  = number of linear permutations of all the numbers from set A such that the adjacent numbers are relatively prime.

$$N_2 - N_1 = ?$$

- ☐ 96
- ☐ 78
- ☐ 60
- ☐ 54



**Explanation:**

Only 2 and 14 are not relatively prime numbers.

The five numbers can be permuted linearly in  $5!$  ways = 120 ways

If 2 and 14 are adjacent, then the number of permutations are  $4! \times 2 = 48$

$$\therefore N_2 = 120 - 48 = 72$$

Number of circular permutations of 5 numbers =  $4! = 24$

If 2 and 14 are adjacent to each other, the number of circular permutations =  $2 \times 3! = 12$

$$\therefore N_1 = 24 - 12 = 12$$

$$\therefore N_2 - N_1 = 72 - 12 = 60.$$

Hence, [3].

**Correct Answer:**

Time taken by you: **0 secs**

Avg Time taken by all students: **78 secs**

Your Attempt: **Skipped**

% Students got it correct: **48 %**



If  $x = -2$ , then which of the following is the largest?

☐  $x^{-0.5x}$

☐  $-x \log_{10} \sqrt{-x}$

☐  $\frac{1}{x^x}$

☐  $5^x$

Explanation:

$$x = -2$$

Substitute  $x = -2$  in all the given options.

$$x^{-0.5x} = -2^{-0.5 \times (-2)} = -2 \quad \dots (i)$$

$$-x \log \sqrt{-x} = \frac{-x}{2} \log(-x)$$

$$= -\left(\frac{-2}{2}\right) \log(2) = \log 2 \quad \dots (ii)$$

Also,  $0 < \log 2 < 1$  ( $\because \log 1 = 0$  and  $\log 10 = 1$ )

$$\frac{1}{x^x} = (-2)^2 = 4 \quad \dots (iii)$$

$$5^x = 5^{-2} = \frac{1}{5^2} = \frac{1}{25} \quad \dots (iv)$$

Therefore, from (i), (ii), (iii) and (iv) we can conclude that  $\frac{1}{x^x}$  is the largest.

Hence, [3].

Correct Answer:

Time taken by you: 0 secs

Avg Time taken by all students: 86 secs

Your Attempt: Skipped

% Students got it correct: 76 %

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A milk-water solution contains milk and water in the ratio 4 : 1. 10 litres of solution is replaced with 10 litres of milk. From the resulting solution 10 litres of solution is again replaced with 10 litres of milk. If the final volume of the solution is 50 litres, what is the ratio of milk and water in the final solution?

- ☐ 7 : 1
- ☐ 109 : 16
- ☐ 103 : 13
- ☐ 21 : 4

02:02 |

### Explanation:

Volume of the solution = 50 litres

Initial volume of milk =  $\left(\frac{4}{5}\right) \times 50 = 40$  litres

Initial volume of water =  $50 - 40 = 10$  litres

After first replacement:

Volume of milk =  $40 - 8 + 10 = 42$  litres

Volume of water =  $10 - 2 = 8$  litres.

After 2<sup>nd</sup> replacement:

Volume of milk =  $42 - 8.4 + 10 = 43.6$  litres

Volume of water =  $8 - 1.6 = 6.4$  litres

Required Ratio =  $436 : 64 = 109 : 16$

Hence, [2].

### Correct Answer:

Time taken by you: **0 secs**

Avg Time taken by all students: **190 secs**

Your Attempt: **Skipped**

% Students got it correct: **76 %**





A natural number 'x' leaves a remainder 1 when divided by 'p'. The resultant quotient, when divided by 'q', leaves a remainder 2. The resultant quotient, when divided by 'r', leaves a remainder 3 and the quotient, thus obtained, is exactly divisible by 5. If p, q and r are all natural numbers, find the least possible value of 'x'.

*Enter your response (as an integer) using the virtual keyboard in the box provided below.*

**Explanation:**

When 'x' is divided by 'p', let the quotient be 'a'.

$$\therefore x = ap + 1 \quad \dots (i)$$

When 'a' is divided by 'q', let the quotient be 'b'.

$$\therefore a = bq + 2 \quad \dots (ii)$$

When 'b' is divided by 'r', let the quotient be 'c'.

$$\therefore b = cr + 3 \quad \dots (iii)$$

When 'c' is divided by 5, let the quotient be 'd'.

$$\therefore c = 5d \quad \dots (iv)$$

Substituting (iv) in (iii), we get,

$$b = 5dr + 3 \quad \dots (v)$$

Substituting (v) in (ii), we get,

$$a = (5dr + 3)q + 2$$

$$\therefore a = 5dqr + 3q + 2 \quad \dots (vi)$$

Substituting (vi) in (i), we get,

**Correct Answer:**

Time taken by you: **0 secs**

Avg Time taken by all students: **36 secs**

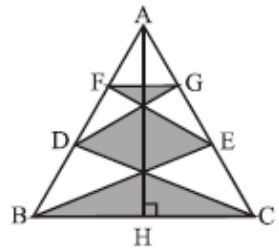
Your Attempt: **Skipped**

% Students got it correct: **16 %**

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$\triangle ABC$  is an isosceles triangle with height  $\ell(AH) = 16$  cm and  $\ell(BC) = 24$  cm. D and E are the midpoints of AB and AC respectively, and F and G are the midpoints of AD and AE respectively. What is the area of the shaded region?

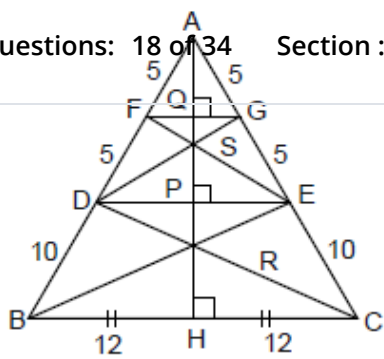


- ☐ 100 cm<sup>2</sup>
- ☐ 192 cm<sup>2</sup>
- ☐ 96 cm<sup>2</sup>
- ☐ 120 cm<sup>2</sup>

05:57

Explanation:





Consider similar triangles FGS and DES

$$\frac{A(\triangle FGS)}{A(\triangle DES)} = \frac{FG^2}{DE^2} = \frac{1}{4}$$

Similarly, for  $\triangle DER$  and  $\triangle BCR$

$$\frac{A(\triangle DER)}{A(\triangle BCR)} = \frac{DE^2}{BC^2} = \frac{1}{4}$$

But  $\triangle DER = \triangle DES$

∴ Area of the shaded portion =

Correct Answer:



Time taken by you: 0 secs

Avg Time taken by all students: 59 secs

Your Attempt: Skipped

% Students got it correct: 22 %

If  $a$ ,  $b$  and  $c$  are in harmonic progression, which of the following statement/s is/are true?

I.  $a = \frac{b(a+c)}{2c}$       II.  $a = \frac{c(a-b)}{b-c}$       III.  $a = \frac{b-c}{a-c}$

- ☐ I only
- ☐ I and II
- ☐ II only
- ☐ II and III

Explanation:

$a$ ,  $b$  and  $c$  are in H.P.

$$\Rightarrow \frac{1}{a}, \frac{1}{b}, \frac{1}{c} \text{ are in A.P.} \Rightarrow \frac{1}{c} - \frac{1}{b} = \frac{1}{b} - \frac{1}{a}$$

$$\Rightarrow \frac{b-c}{bc} = \frac{a-b}{ab}$$

Multiplying both the sides by  $abc$ , we get,

$$\Rightarrow a(b-c) = c(a-b) \Rightarrow a = \frac{c(a-b)}{b-c}$$

[II] is true.

Also,

$$\frac{1}{c} - \frac{1}{b} = \frac{1}{b} - \frac{1}{a} \Rightarrow \frac{2}{b} = \frac{1}{c} + \frac{1}{a} \Rightarrow \frac{2}{b} = \frac{c+a}{ac}$$

$$\Rightarrow a = \frac{b(a+c)}{2c} \quad \therefore \text{[I] is true.}$$

Hence, [2].

Correct Answer:

Time taken by you: 0 secs

Avg Time taken by all students: 107 secs

Your Attempt: Skipped

% Students got it correct: 69 %





A distillation unit in an acid factory has two large tanks ( $D_1$  and  $D_2$ ). 'x' litres of water is stored in tank  $D_1$  and 'y' litres of acid is stored in tank  $D_2$ . An apprentice takes out 'z' litres of water from  $D_1$ , 'z' litres of acid from  $D_2$  and in a single operation pours 'z' litres of water into the acid ( $D_1$  to  $D_2$ ) and 'z' litres of acid into the water ( $D_2$  to  $D_1$ ). To his chagrin, he finds that after the operation the ratio of acid to water is the same for  $D_1$  and  $D_2$ . An older worker makes a detailed enquiry and reveals to the apprentice that this was caused due to the fact that the value of 'z' he had used was equal to:

☐  $\frac{xy(x-y)}{(x+y)^2}$

☐  $\frac{xy}{x+y}$

☐  $\frac{xy}{x-y}$

☐  $\frac{x+y}{x-y}$

Explanation:

|                 | D <sub>1</sub> |       | D <sub>2</sub> |       |
|-----------------|----------------|-------|----------------|-------|
|                 | acid           | water | acid           | water |
| Initially       | 0              | x     | y              | 0     |
| After operation | z              | x - z | y - z          | z     |

Since the ratio of acid to water is the same in D<sub>1</sub> and D<sub>2</sub> we get,

$$\frac{z}{x-z} = \frac{y-z}{z}$$

$$\Rightarrow z^2 = (x - z)(y - z)$$

$$\Rightarrow z = \frac{xy}{x+y}$$

Hence, [2].

Correct Answer:

Time taken by you: 0 secs

Avg Time taken by all students: 149 secs

Your Attempt: Skipped

% Students got it correct: 84 %



The Vice President of an organization decided to form a committee to look into the feasibility of shifting one of the departments to a new office. There are 4 managers and 9 executives to choose from. In how many ways a committee of 6 people can be chosen such that it consists of at least 2 managers including the manager of the department which is shifting?

- ☐  ${}^{13}C_6$
- ☐  $({}^4C_2 \times {}^9C_4) + ({}^4C_3 \times {}^9C_3) + ({}^4C_4 \times {}^9C_2)$
- ☐  ${}^{12}C_5$
- ☐  $({}^3C_1 \times {}^9C_4) + ({}^3C_2 \times {}^9C_3) + ({}^3C_3 \times {}^9C_2)$

**Explanation:**

Since the manager of the department which is shifting should always be selected on the committee, the problem is now reduced to selecting 5 members out of 3 managers and 9 executives and at least 1 manager must be selected which can be done in

${}^3C_1 \times {}^9C_4 + {}^3C_2 \times {}^9C_3 + {}^3C_3 \times {}^9C_2$  ways.

Hence, [4].

**Correct Answer:**

Time taken by you: **0 secs**

Avg Time taken by all students: **87 secs**

Your Attempt: **Skipped**

% Students got it correct: **63 %**



Pipe P fills half of empty tank in 10 minutes, while pipes P and Q take 12 minutes to fill the entire tank together. What part of the tank will Q fill in 20 minutes?

- ☐  $\frac{1}{3}$
- ☐  $\frac{1}{5}$
- ☐  $\frac{2}{3}$
- ☐ None of these



### Explanation:

Work done by P in 1 minute =  $\frac{1}{20}$

Let the work done by Q in 1 minute be  $\left(\frac{1}{Q}\right)$ .

By the given condition,

$$\frac{1}{20} + \frac{1}{Q} = \frac{1}{12} \Rightarrow \frac{1}{Q} = \frac{1}{30}$$

$\therefore$  In 20 minutes, Q fills  $20 \times \left(\frac{1}{30}\right) = \frac{2}{3}$  of the tank.

Hence, [3].

### Correct Answer:

Time taken by you: **0 secs**

Avg Time taken by all students: **112 secs**

Your Attempt: **Skipped**

% Students got it correct: **87 %**




A  $5 \times 5$  square is made of square tiles of dimensions  $1 \times 1$ . A mouse can leap along the diagonal or along the side of square tiles. In how many ways can the mouse reach the right lower corner vertex of the square from the lower left corner vertex of the square leaping exactly 5 times?

*Enter your response (as an integer) using the virtual keyboard in the box provided below.*

### Explanation:

I. If the mouse makes only horizontal leaps along the sides.

i.e., 


∴ The number of ways = 1

II. If the mouse makes only 1 leap along the diagonal in upward direction then there will certainly be a leap along the diagonal in the downward direction. i.e., there will be 2 leaps along the diagonal of tiles out of 5 leaps. These two leaps can be placed in  ${}^5C_2$  ways.

∴ The number ways of reaching  ${}^5C_2 = 10$

i.e., 

III. If the mouse makes 2 leaps along the diagonal in the upward direction then there will certainly be 2 leaps along the diagonal in the downward direction. There are 2 cases when the mouse makes 2 upward leaps.

Case I: 

2 consecutive upwards  
or downwards leaps

A leap sideways can be placed in  ${}^5C_1$  ways.

∴ The number of ways of reaching =  ${}^5C_1 = 5$ .

Case II: 

Alternate upwards or  
downwards leaps

Correct Answer:

Time taken by you: 0 secs

Avg Time taken by all students: 2 secs

Your Attempt: Skipped

% Students got it correct: 1 %

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How many positive integral values of 'x' and 'y' satisfy the equation  $x^y = (y + 1)^4$ ?

*Enter your response (as an integer) using the virtual keyboard in the box provided below.*

### Explanation:



By trial and error,

if  $y = 1$ ,  $x = 16$

$y = 2$ ;  $x = 9$

$y = 4$ ;  $x = 5$

$y = 8$ ;  $x = 3$

$y = 12$ ;  $x = 13^{\frac{1}{3}}$

We have to check for all factors and multiples of 4 i.e., 1, 2, 4, 8, 12, 16 etc. Since  $x$

and  $y$  are positive integers and  $x = (y + 1)^{\frac{4}{y}}$ . For  $y > 8$ , no integer value of  $x$  would exist.

Thus, 4 possible solutions exist.

Therefore, the required answer is 4.

### Correct Answer:



Time taken by you: **0 secs**

Avg Time taken by all students: **22 secs**

Your Attempt: **Skipped**

% Students got it correct: **14 %**





The sum of four consecutive natural numbers, when divided by a prime number, becomes a prime number. Which of the following can be the average of the middle two numbers among the four consecutive numbers?

- ☐ 61.5
- ☐ 100.5
- ☐ 70.5
- ☐ 53.5



### Explanation:



Let the four consecutive numbers be  $x, x + 1, x + 2$  and  $x + 3$ .

The,  $x + (x + 1) + (x + 2) + (x + 3) = 4x + 6 = 2(2x + 3)$

i.e.,  $2(2x + 3)$  when divided by a prime number becomes a prime number.

$\Rightarrow (2x + 3)$  is a prime number and the average of middle two numbers  $= \frac{2x + 3}{2}$

i.e., twice the average of the middle two numbers should be a prime number.

Among the given options only  $53.5 \times 2 = 107$  is a prime number.

Hence, [4].

### Correct Answer:



Time taken by you: **0 secs**

Avg Time taken by all students: **153 secs**

Your Attempt: **Skipped**

% Students got it correct: **65 %**



Consider a sequence of numbers  $x_1, x_2, \dots$  where  $x_1 = 10$  and  $x_2 = 0.5$ . If  $x_j = \frac{x_{j-1}}{x_{j-2}}$  for  $j > 2$ .

Find the product of first 598 terms of this sequence.

- ☐ 0.5
- ☐ 0.2
- ☐ 10
- ☐ 0.025

Explanation:

$$x_1 = x_1; x_2 = x_2; x_3 = \frac{x_2}{x_1}$$

$$x_4 = \frac{x_3}{x_2} = \frac{1}{x_1}$$

$$x_5 = \frac{x_4}{x_3} = \frac{1}{x_2}$$

$$x_6 = \frac{x_5}{x_4} = \frac{x_1}{x_2}$$

$$x_7 = \frac{x_6}{x_5} = x_1$$

$$x_8 = \frac{x_7}{x_6} = x_2$$

$$x_9 = \frac{x_8}{x_7} = \frac{x_2}{x_1}$$

and so on.

$$\text{Thus, } x_1 \times x_2 \times x_3 \times x_4 \times x_5 \times x_6 = x_1 \times x_2 \times \frac{x_2}{x_1} \times \frac{1}{x_1} \times \frac{1}{x_2} \times \frac{x_1}{x_2} = 1$$

Thus, product of every 6 terms in the required product = 1.

$$598 = 99 \times 6 + 4$$

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

Correct Answer:

Time taken by you: 0 secs

Avg Time taken by all students: 169 secs

Your Attempt: Skipped

% Students got it correct: 69 %

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Shyam buys 120 litres of milk and mixes it with 30 litres of water. He then sells 50 litres of this mixture and leaves his shop. His son then adds water to the remaining mixture to make 150 litres. If a customer buys 15 litres of this mixture, find the amount of pure milk (in litres) that he gets.

*Enter your response (as an integer) using the virtual keyboard in the box provided below.*



### Explanation:



120 litres milk + 30 litres water = 150 litres of mixture

50 litres of this mixture contains 10 litres water + 40 litres milk

∴ After selling 50 litres, the mixture has 20 litres of water and 80 litres of milk.

50 litres of water is then added.

∴ Proportion of water to milk in this new mixture is 70 : 80.

The customer who buys 15 litres of this mixture gets 8 litres of pure milk.

Therefore, the required answer is 8.

### Correct Answer:



Time taken by you: **0 secs**

Avg Time taken by all students: **118 secs**

Your Attempt: **Skipped**

% Students got it correct: **82 %**





The time between 7 o'clock and 8 o'clock when the hour hand and the minute hand coincide is approximately [hr:min:sec]:

- ☐ 7:35:00
- ☐ 7:37:30
- ☐ 7:36:24
- ☐ 7:38:11

01:29

Explanation:

Angle between the hour hand and the minute hand at 7 o'clock =  $210^\circ$

Speed of minute hand =  $6^\circ$  per minute

Speed of hour hand =  $0.5^\circ$  per minute

$\therefore$  Minute hand and hour hand are together after  $\frac{210}{6-0.5} = 38.18 \text{ minutes} \approx 38 \text{ minutes}$

11 seconds after 7 o'clock. Hence, [4].

Correct Answer:

Time taken by you: **0 secs**

Avg Time taken by all students: **99 secs**

Your Attempt: **Skipped**

% Students got it correct: **67 %**



A tank has three pipes referred to as 'P', 'Q' and 'R' attached to it. These pipes can be used as either inlet pipes or outlet pipes. All the three pipes are started simultaneously when the tank is initially empty. However, two of these three pipes are used as inlet pipes and the third pipe is used as an outlet pipe. If P and Q are used as inlet pipes and R is used as an outlet pipe, the tank is completely filled in  $18\frac{2}{3}$  hours. If P and R are used as inlet pipes and Q is used as an outlet pipe, the tank is completely filled in  $11\frac{1}{5}$  hours. If Q and R are used as inlet pipes and P is used as an outlet pipe, the tank is completely filled in  $9\frac{1}{3}$  hours. In how much time will a tank that is initially empty be completely filled if all the three pipes are used as inlet pipes?

- ☐ 7 hours
- ☐ 4 hours
- ☐  $2\frac{2}{3}$  hours
- ☐  $4\frac{2}{3}$  hours

### Explanation:

Given:

When P & Q are inlets and R is an outlet, time taken =  $18\frac{2}{3} = \frac{56}{3}$  hours.

When P & R are inlets and Q is an outlet, time taken =  $11\frac{1}{5} = \frac{56}{5}$  hours.

When Q & R are inlets and P is an outlet, time taken =  $9\frac{1}{3} = \frac{28}{3}$  hours.

Suppose the capacity of the tank = 56 litres (LCM of the three numbers).

If P, Q and R fill in/drain out P, Q and R litres per hour respectively, we have the following:

$$P + Q - R = 3$$

$$P + R - Q = 5$$

$$Q + R - P = 6$$

Adding the three equations, we get  $P + Q + R = 14$ .

Therefore, the time taken when all the three pipes are used as inlet pipes =  $\frac{56}{14} = 4$  hours.

Hence, [2].

### Correct Answer:

Time taken by you: **0 secs**

Avg Time taken by all students: **170 secs**

Your Attempt: **Skipped**

% Students got it correct: **81 %**



Rohan bought a bike for Rs. 70,000. This total amount was paid in installments. After paying the initial deposit of Rs. 25,000 by Rohan, the rest of the amount was paid by Arun, Rohan and his wife in the ratio 4 : 4 : 1 every month for six months.

After six months the bike met with an accident and had to be sold for Rs. 28,000. What is the amount received by Rohan, if the amount received is proportional to his investment on the bike? (Assume that no interest is charged on pending installments.)

*Enter your response (as an integer) using the virtual keyboard in the box provided below.*

Rs.



01:13

Explanation:

Amount paid by Rohan =  $25000 + \frac{4}{9} \times 45000 = \text{Rs. } 45,000$

Rohan's amount =  $\frac{45}{70} \times 28000 = 9 \times 2000 = \text{Rs. } 18,000$

Therefore, the required answer is 18000.

Correct Answer:

Time taken by you: **0 secs**

Avg Time taken by all students: **115 secs**

Your Attempt: **Skipped**

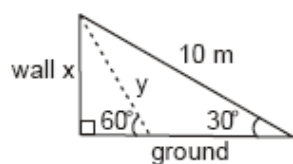
% Students got it correct: **58 %**



A ladder of length 10 m is lying against the wall making an angle of  $30^\circ$  with the ground. How many meters of the ladder should be cut off so that it reaches the same height, making an angle of  $60^\circ$  with the ground?

- ☐  $\left(10 - \frac{10}{\sqrt{2}}\right) \text{ m}$
- ☐  $\left(10 - \frac{10}{\sqrt{3}}\right) \text{ m}$
- ☐  $\left(10 - \frac{5}{\sqrt{3}}\right) \text{ m}$
- ☐ None of these

Explanation:



$$\sin 30^\circ = \frac{x}{10} \Rightarrow 10 = 2x \Rightarrow x = 5$$

$$\text{Now, } \sin 60^\circ = \frac{5}{y} \Rightarrow \frac{5}{\sqrt{3}} = y \Rightarrow y = \frac{10}{\sqrt{3}}$$

$\therefore \left(10 - \frac{10}{\sqrt{3}}\right)$  m is the length that should be cut off. Hence, [2].

Correct Answer:

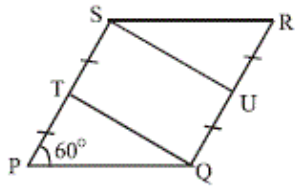
Time taken by you: **0 secs**

Avg Time taken by all students: **137 secs**

Your Attempt: **Skipped**

% Students got it correct: **84 %**

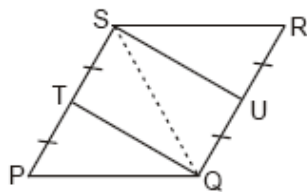




□ PQRS is a rhombus. If  $TQ = 4.5$  units, find area of  $\triangle SPQ$ .

- ☐ 11.68 sq. units
- ☐ 23.36 sq. units
- ☐ 46.71 sq. units
- ☐ 34.72 sq. units

Explanation:



□ PQRS is a rhombus.  $\angle P = \angle R = 60^\circ$ .

Also,  $\angle S = \angle Q = 120^\circ$

Note that  $SR = RQ \Rightarrow \angle RSQ = \angle SQR = 60^\circ$  and

$PQ = SP \Rightarrow \angle PSQ = \angle PQS = 60^\circ$

Thus,  $\triangle SPQ$  and  $\triangle SQR$  are equilateral triangles, TQ and SU are respective medians.

$\triangle PTQ \cong \triangle STQ \cong \triangle QUS$

$\therefore A(\square TQUS) = A(\triangle STQ) + A(\triangle QUS) = A(\triangle STQ) + A(\triangle PTQ) = A(\triangle SPQ)$

Now,  $TQ = 4.5 = \frac{9}{2} = \text{height of } \triangle STQ$

$\therefore TQ = \frac{\sqrt{3}}{2} \times PQ \therefore PQ = \frac{2}{\sqrt{3}}(TQ)$

$\Rightarrow A(\triangle SPQ) = \frac{\sqrt{3}}{4}(PQ)^2 = \frac{\sqrt{3}}{4}\left(\frac{2}{\sqrt{3}}TQ\right)^2 = \frac{\sqrt{3}}{3} \times \frac{81}{4} = \frac{27\sqrt{3}}{4}$

$\approx 11.68$  sq. units. Hence [11]

Correct Answer:

Time taken by you: 0 secs

Avg Time taken by all students: 142 secs

Your Attempt: Skipped

% Students got it correct: 66 %

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The inequality  $|x - 1| < \sqrt{|13 - x^2|}$  is not true for what percentage of integers from  $-5$  to  $5$  (both inclusive)?

- ☐ 27.3%
- ☐ 72.7%
- ☐ 54.5%
- ☐ 63.63%

Explanation:

$$\therefore |x - 1| < |\sqrt{13 - x^2}|$$

Squaring both sides, we get,

$$|x - 1|^2 < 13 - x^2$$

$$\therefore x^2 - 2x + 1 < 13 - x^2$$

$$\therefore 2x^2 - 2x - 12 < 0$$

$$\therefore x^2 - x - 6 < 0$$

$$\therefore (x - 3)(x + 2) < 0$$

Case 1:  $x - 3 < 0$  and  $x + 2 > 0$

$$\therefore x < 3 \text{ and } x > -2$$

$$\therefore -2 < x < 3$$

Case 2:  $x - 3 > 0$  and  $x + 2 < 0$

$$\therefore x > 3 \text{ and } x < -2, \text{ which is not possible}$$

$$\therefore x \text{ takes integer values from } (-2, 3) \text{ i.e., } -1, 0, 1 \text{ and } 2.$$

$$\therefore \text{The required percentage is } \frac{7}{11} \times 100 \approx 63.63\%.$$

Hence, [4].

*Alternatively,*

No need to simplify the expression. There are only 11 integers from  $-5$  to  $5$ . One by one, we can substitute and check.

Correct Answer:

Time taken by you: 0 secs

Avg Time taken by all students: 123 secs

Your Attempt: Skipped

% Students got it correct: 56 %

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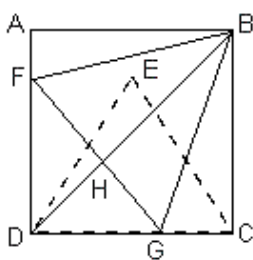
Exit Review



If 'x' is the side of the largest equilateral triangle that can be drawn inside a square of side 1, what can be said about 'x'?

- ☐  $0.7 < x < 1$
- ☐  $x = 1$
- ☐  $1 < x < 1.1$
- ☐  $x > 1.1$

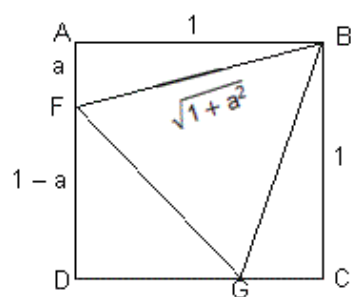
Explanation:



There are two possibilities for the largest equilateral triangle,  $\triangle DEC$  and  $\triangle BFG$  as shown in the figure.

$\triangle DEC$  clearly has a side of 1. Let the side of  $\triangle BFG$  be  $x$ .

We have,



Correct Answer:

Time taken by you: 0 secs

Avg Time taken by all students: 28 secs

Your Attempt: Skipped

% Students got it correct: 16 %

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