

PRAAYAS

JEE 2026

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Mathematics

Basic Maths

Lecture - 04

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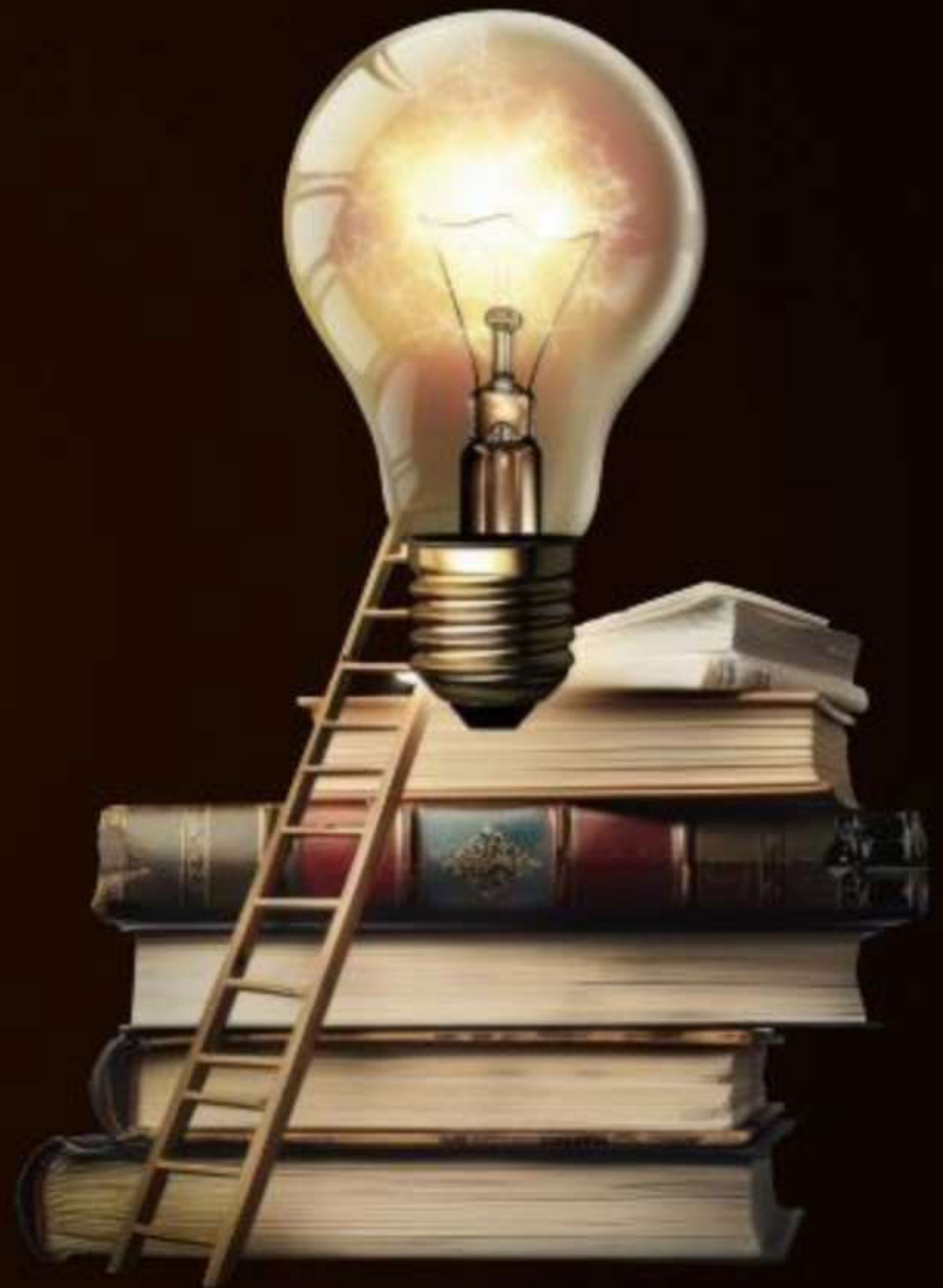


Topics *To be covered*



- A** Some Important Points
- B** Polynomials and their Factorization

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Recap of previous lecture



Fill in the Blanks:

$(x-1)(y-1) = 14$

2	7	(3, 8)
7	2	(8, 3)
1	14	(2, 15)
14	1	(15, 2)
-2	-7	(-1, -6), (-6, -1)
-14	-1	(-13, 0)
-1	-14	(0, -13)

$y-1 = -2$
 $x-1 = -7$

1. If $(x - 1)(y - 1) = 14$ where $x, y \in I$ then (x, y) can be _____

2. If $n = \frac{27}{x} - x$ where $n, x \in N$ then (n, x) can be $x=1, x=3$
 $n \in N$ x should be divisor of 27 $n=26, n=6$ $\rightarrow (26, 1), (6, 3)$

3. 12345x is divisible by 9 then x is 3, 6 $\{0, 1, 2, \dots, 9\}$

4. If 52541x is divisible by 4 then x can be 2, 6

5. $24^2 + 29^2 = \underline{576 + 841 = 1417}$

6. If 6794x is divisible by 6 then x can be 4

$x = \text{even}$ ✓
 $26 + x$ should be divisible by 3

Recap

of previous lecture



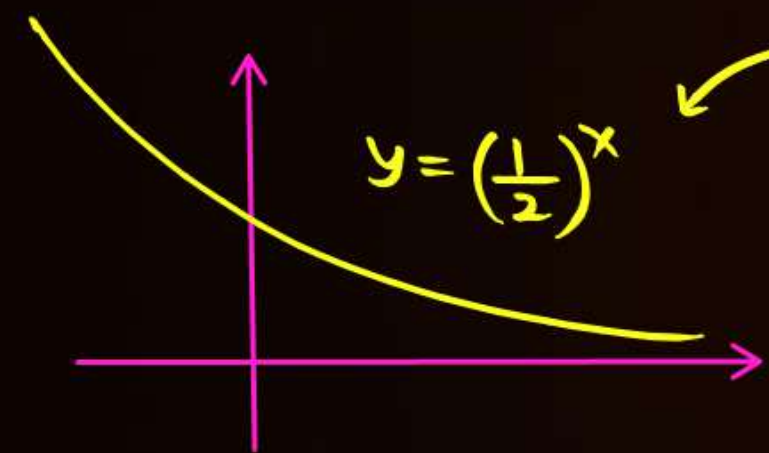
State True or False

$$(-2)^{-4} = \frac{1}{(-2)^4} = \frac{1}{16} > 0 \quad (0)^4 = 0 \quad \text{neither +ve nor -ve}$$

1. Even power of every real number is always positive. (F) (Any real NO:) ≥ 0 Even
2. Odd power of a real number can be positive or negative ^{or zero} depending on number. (T)
3. $x^{2n} \geq 0 \forall x \in \mathbb{R}, n \in \mathbb{N}$ (T) **ATDB.uno**
4. x^{2n+1} is positive if x is positive, $n \in \mathbb{N}$ (T)
5. x^{2n+1} is negative if x is negative, $n \in \mathbb{N}$ (T)
6. If x is a positive real then $x^{\text{any power}}$ is always positive. (T)



Any real NO:
 (Any +ve real) > 0



$\epsilon x: \left(\frac{1}{2}\right)^x > 0$

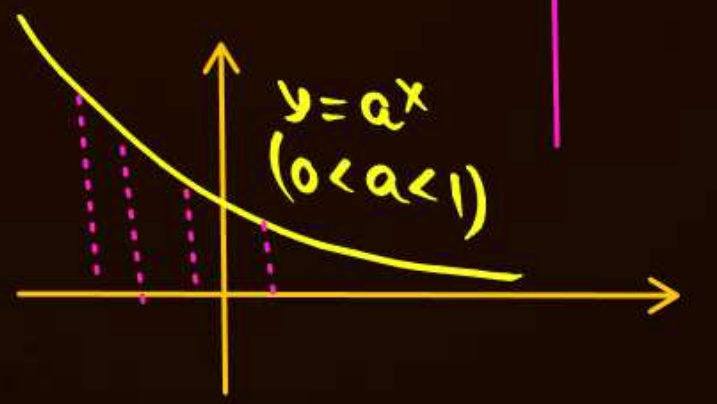
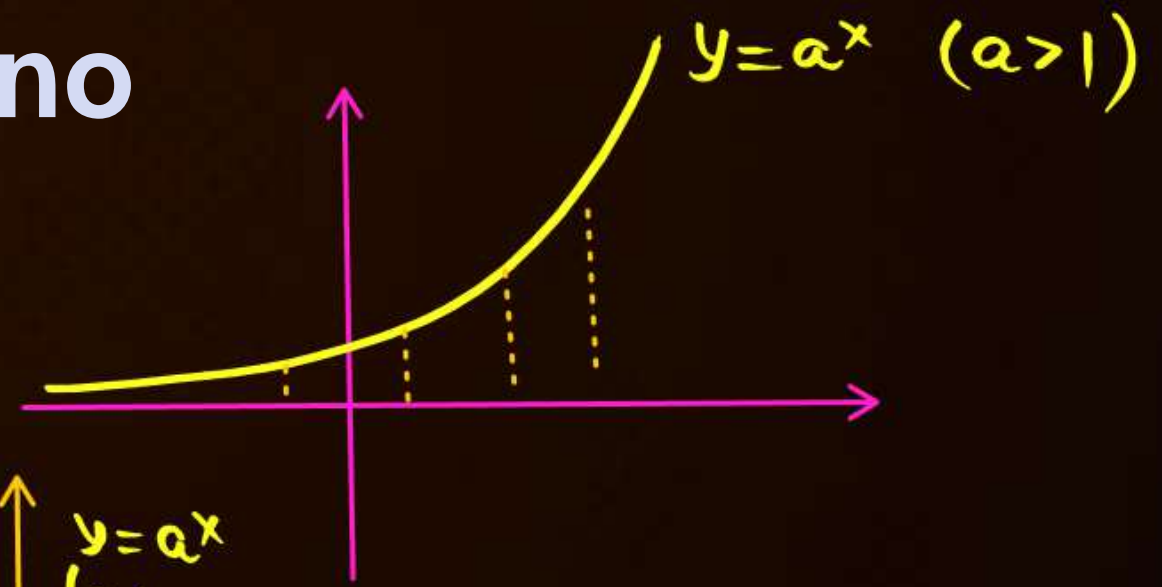
$\epsilon x: 2^{-3} = \frac{1}{2^3} = \frac{1}{8} > 0$

$\epsilon x: 7^{-2} > 0$

$\epsilon x: \left(\frac{1}{3}\right)^{-3} = 27 > 0$

$\epsilon x: 3^0 = 1 > 0$

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Recap *of previous lecture*



7. $x_1^2 + x_2^2 + x_3^2 + \dots + x_n^2 = 0$ where $x_i \in \mathbb{R}$, $i = 1, 2, 3, \dots, n$ then $x_1 = x_2 = x_3 = \dots = x_n = 0$ (T)

8. 6545 is divisible by 7. (T) $654 - 2 \times 5 = 644$

$$64 - 8 = 56$$

9. 32436 is divisible by 4, 6 & 9. (T)

10. $55^2 + 44^2 = \underline{3025 + 1936} = 4961$ ATDB.uno

11. $1 + 3 + 5 + 7 + \dots$ upto 10 terms = $\underline{10^2 = 100}$

Sum of first n odd numbers = n^2

Ex: $1 + 3 + 5 + \dots$ up to n terms

$$= \frac{n}{2} (2 \cdot 1 + (n-1)2)$$

$$= \frac{n}{2} (2 + 2n - 2) = n^2$$



Homework Discussion

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QUESTION



Let a, b, c are real numbers and satisfy $a = 8 - b$ and $c^2 = ab - 16$, then $\frac{a}{b}$ is equal to

$$c^2 = (8 - b)b - 16$$

$$c^2 = 8b - b^2 - 16$$

$$c^2 + b^2 - 8b + 16 = 0$$

$$c^2 + b^2 - 2 \cdot 4 \cdot b + 4^2 = 0$$

$$c^2 + (b - 4)^2 = 0$$

$$c = 0, b = 4$$

QUESTION

(KTK 1)



a, b, c are reals such that $a + b + c = 3$ and $\frac{1}{a+b} + \frac{1}{b+c} + \frac{1}{c+a} = \frac{10}{3}$.

The value $E = \frac{a}{b+c} + \frac{b}{c+a} + \frac{c}{a+b}$ is

- A 9
- B 7
- C 5
- D 3

$$\frac{1}{a+b} + \frac{1}{b+c} + \frac{1}{c+a} = \frac{10}{3}$$



$$\frac{3}{a+b} + \frac{3}{b+c} + \frac{3}{c+a} = 10$$

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$$\frac{(a+b)+c}{a+b} + \frac{a+(b+c)}{b+c} + \frac{a+b+c}{c+a} = 10$$

$$1 + \frac{c}{a+b} + \frac{a}{b+c} + 1 + 1 + \frac{b}{c+a} = 10$$

$$\frac{a}{b+c} + \frac{b}{c+a} + \frac{c}{a+b} = 7$$



$$\frac{x}{a+b} \neq \frac{x}{a} + \frac{x}{b}$$

Gadho/Gadhiyoo aisa
naa karo

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QUESTION**(KTK 2)**

Solve the equations :
$$\begin{cases} 2^x + 3^y = 41 \\ 2^{x+2} + 3^{y+2} = 209 \end{cases}$$

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QUESTION

(KTK 3)



What is the area of an equilateral triangle inscribed in a circle of radius 4 cm?

- A 12 cm^2
- B $9\sqrt{3} \text{ cm}^2$
- C $8\sqrt{3} \text{ cm}^2$
- D $12\sqrt{3} \text{ cm}^2$

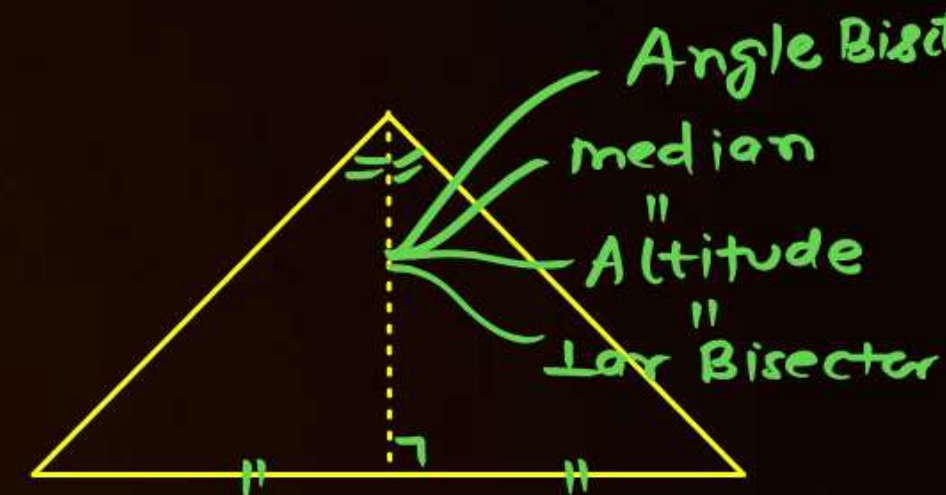
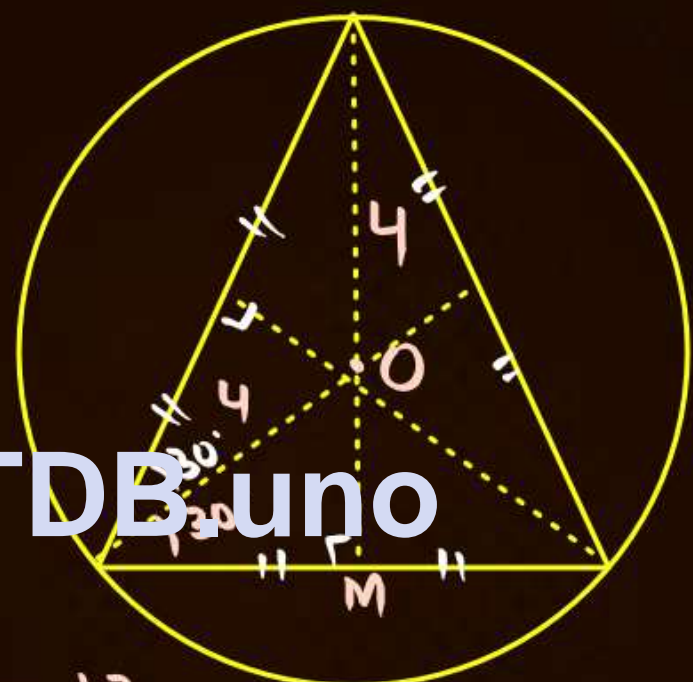
$$\sin 30^\circ = \frac{OM}{4}$$

$$OM = 4 \sin 30^\circ = 2$$

$$h = 4 + 2 = 6$$

Area of

$$\text{Equilateral Triangle} = \frac{h^2}{\sqrt{3}} = \frac{36}{\sqrt{3}} = 12\sqrt{3} \text{ cm}^2$$



Lax Bisector of any chord of a circle passes through its centre

Ans. D



Aao Machaay Dhamaal Deh Swaal pe Deh Swaal

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Appke Doubts Humaray Solutions

DC

Anshika Shahu 11 hours ago

sir agr koi homework question nhi ho tb kia google ya kisi aur platform ki hint ke liye help le skte try krne ke liye ya fr chod de ki aap kara doge

2 Same Doubts • 0 Reported Mark Popular

Recap of previous lecture

State True or False

- Every prime except 2 is odd. (T)
- Every prime ≥ 5 is of type $6k \pm 1, k \in \mathbb{N}$. (T)
- Every number of type $6k \pm 1, k \in \mathbb{N}$ is prime. (F)
- Sum of two primes is also a prime. (F)
- Every composite number has more than two positive factors. (T)
- Every natural number is either prime or composite. (F)

Handwritten notes: 2 is the only even prime, 1 is neither prime nor composite.

Doubt 11 hours ago Prashant

sir $2+3=5, 2+5=7$ etc.. prime aa to raha

Recap of previous lecture

State True or False

- Every prime except 2 is odd. (T)
- Every prime ≥ 5 is of type $6k \pm 1, k \in \mathbb{N}$. (T)
- Every number of type $6k \pm 1, k \in \mathbb{N}$ is prime. (F)
- Sum of two primes is also a prime. (F)
- Every composite number has more than two positive factors. (T)
- Every natural number is either prime or composite. (F)

Handwritten notes: 2 is the only even prime, 1 is neither prime nor composite. 6k±1

Doubt 11 hours ago piyush mishra

sir 2 number me agar k ki jagah per 6 lele toh 35 ya 37 ayega lekin 35 prime nahi h

0 Same Doubts

Doubt 21 hours ago Prakhar

sir 1st me 9 odd hai pr prime nahi hai toh ye false hona chaiye tha?

0 Same Doubts

$2^{2x} - 3^{2y} = 55$

$(2^x - 3^y)(2^x + 3^y) = 55 = 11 \times 5 = 55 \times 1$

$(x, y \in \mathbb{N}^+)$

$2^x + 3^y = 11$
 $2^x - 3^y = 5$
 $\hline 2 \cdot 2^x = 16$
 $2^x = 8$
 $x = 3$

OR

$2^x + 3^y = 55$
 $2^x - 3^y = 1$
 $\hline 2 \cdot 2^x = 56$
 $2^x = 28$ not for any $x \in \mathbb{N}^+$
 No integral soln.

$2^x = 2, 2^x = 3$
 $3^y = 1, 3^y = 5$

Doubt 11 hours ago

sir what about -11 & -5

0 Same Doubts

> 11 hours ago

sir 55 ko 2ke power -3 ke power me express krke compare krke x and y ka value nhi nikal skte ?

0 Same Doubts • 0 Reported Mark Popular

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Appke Doubts Humaray Solutions

Handwritten solution for $2^{2x} - 3^{2y} = 55$. The solution shows that $(x, y) \in \mathbb{Z}^+$ and $2^{2x} + 3^{2y} = 55$. It explores various cases for 2^{2x} and 3^{2y} , eventually finding a solution at $x=3, y=2$.

Doubt 11 hours ago

sir agar intejar ke jagah R deta to no of solutions

Handwritten notes: $2^{2x} - 3^{2y} = 55$
 If $x, y \in \mathbb{R}$ NO: of soln = ∞
 $4^x - 9^y = 55 \Rightarrow 4^x = 55 + 9^y$

QUESTION KTK 3

	Column-I	Column-II
(A)	A rectangular box has volume 48, and the sum of the length of the twelve edges of the box is 48. The largest integer that could be the length of an edge of the box, is	(P) 1
(B)	The number of zeroes at the end in the product of first 20 prime numbers, is	(Q) 2
(C)	The number of solutions of $2^{2x} - 3^{2y} = 55$, in which x and y are integers, is	(R) 3
		(S) 4
		(T) 6

Ans. (A) T, (B) P, (C) S

Doubt 11 hours ago

sir esma 4ki power x - 9 ki power x = 55 aur fir hit and trial kar lenaga aur sirf ek hi solution milega

QUESTION KCLS

For each positive number x, let $f(x) = \frac{(x+\frac{1}{x})^6 - (x^6 + \frac{1}{x^6}) - 2}{(x+\frac{1}{x})^3 + (x^3 + \frac{1}{x^3})}$. The minimum value of f(x) is

Options: (A) 1, (B) 2, (C) 3, (D) 4, (E) 6

Handwritten solution shows $x + \frac{1}{x} = 2$ and uses AM-GM inequality to find the minimum value is 2.

Doubt 11 hours ago

sir direct min 2 put karke solve kare to ans 6 hi ara hai pls check

0 Same Doubts



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① $V = lwh = 48$
 $4(l + h + w) = 48$
 $l + h + w = 12$
 Switch $l = 12 - h - w$
 $4(12 - h - w) = 48$
 $12 - h - w = 12$
 $-h - w = 0$
 $h = -w$
 $h = 4$
 $w = 2$

Doubt 11 hours ago

Sir A nahi samjh aa raha hai aap add aur multiply dono kar rahe hai kyu batayega n

QUESTION
 ***** KCLS *****
 For each positive number x, let $f(x) = \frac{(x+\frac{1}{x})^6 - (x^6 + \frac{1}{x^6}) - 2}{(x+\frac{1}{x})^3 + (x^3 + \frac{1}{x^3})}$. The minimum value of f(x) is

(A) 1
 (B) 2
 (C) 3
 (D) 4
 ⚡ 6

$(x + 1/x)^6 + (x^6 + 1/x^6) - 2$
 $(x + 1/x)^3 + (x^3 + 1/x^3)$

Doubt 11 hours ago

sir mein yah bhi to kar sakte the ki Main X Plus 1/ x ki minimum value direct likh Li as similarly others mein bhi kar liya and you answer a raha tha vah to sis a raha hai kyunki x positive diya hai toh min 2 max infinity hoti and in denominator same X + 1 by x wali form thi toh fx min krne ke denominator max kr dete fx=0 a jata hope you understand!!

QUESTION
 ***** KCLS *****
 For each positive number x, let $f(x) = \frac{(x+\frac{1}{x})^6 - (x^6 + \frac{1}{x^6}) - 2}{(x+\frac{1}{x})^3 + (x^3 + \frac{1}{x^3})}$. The minimum value of f(x) is

(A) 1
 (B) 2
 (C) 3
 (D) 4
 ⚡ 6

Doubt 11 hours ago

Sir itna bada karne ki kya jarurat hai agar $x^6 + 1/x^6$ woh bhi 2 ke equal ya badi hogi toh harr jagah 2 substitute kardo ans 6 hi aa rahi hai



Appke Doubts Humaray Solutions

QUESTION

★★★★KCLS★★★★

For each positive number x , let $f(x) = \frac{(x+\frac{1}{x})^6 - (x^6 + \frac{1}{x^6}) - 2}{(x+\frac{1}{x})^3 + (x^3 + \frac{1}{x^3})}$. The minimum value of $f(x)$ is

A 1
B 2
C 3
D 4
E 6

Handwritten solution:

$x + \frac{1}{x} \geq 2, x + \frac{1}{x^2} \geq 3, x + \frac{1}{x^3} \geq 4$
 $3(x + \frac{1}{x}) \geq 6 \Rightarrow E \geq 6$

$E = \frac{t^6 - (t^6 + 9t^4 - 6t^2 - 2) - 2}{t^3 + t^3 + 3t}$
 $= \frac{6t^4 - 9t^2}{2t^3 + 3t} = \frac{3t^2(2t^2 - 3)}{t(2t^2 + 3)}$
 $E = 3(2t^2 + 3) \geq 3 \cdot 2 = 6$
 Min = 6

Doubt 21 hours ago

Sir numerator minimum aur denominator maximum karne par hoga?

2 Same Doubts

Handwritten solution:

minimum value of $(1a^2 + 2a^2 + 1)(1b^2 + 5b^2 + 1)(1c^2 + 7c^2 + 1)$
 $a^2 + 2a^2 + 1 \Rightarrow a^2(a^2 + 3 + 1) \Rightarrow a^2(a^2 + 4)$
 $b^2 + 5b^2 + 1 \Rightarrow b^2(b^2 + 1 + 5)$
 $c^2 + 7c^2 + 1 \Rightarrow c^2(c^2 + 1 + 7)$

$\frac{a^2 + 4}{a^2} \cdot \frac{b^2 + 6}{b^2} \cdot \frac{c^2 + 8}{c^2}$
 $(2+3) \cdot (2+5) \cdot (2+7)$
 $5 \times 7 \times 9 \Rightarrow 315$

Doubt 21 hours ago

sir a b c ko 1 rakhne pe ans aa ja raha h , is I m wrong anywhere?

0 Same Doubts

QUESTION

Given that $x^2 + y^2 = 8x + 6y + 11$, where x and y are integers. What is the smallest possible value of $|4x - 2y|$.

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Diamond Points to Note



P₄: $\sqrt{x^2} = |x|$ Square root of a positive real number is always positive

❖ $\sqrt{\text{Zero}} = \sqrt{0} = 0$

$\sqrt[3]{-8} = -2$,
 $\sqrt[5]{-32} = -2$

$\sqrt[2]{-4}$ — Not defined in real

★ \sqrt{x} or $\sqrt[2n]{x}$ is defined in real NO: only if $x \geq 0$

★ $\sqrt[2n]{x} \geq 0 \quad \forall x \geq 0$

★ $\sqrt{x^2} = |x|$, $\sqrt[4]{x^4} = |x|$..., $\sqrt[2n]{x^{2n}} = |x|$

★ $\sqrt[3]{x}$, $\sqrt[5]{x}$, ... $\sqrt[2n+1]{x}$ is defined $\forall x \in \mathbb{R}$

★ $\sqrt[2n+1]{x} = \begin{cases} +ve & x > 0 \\ -ve & x < 0 \\ 0 & x = 0 \end{cases}$

★ $\sqrt[2n+1]{x^{2n+1}} = x$



Ex: $\sqrt{(-4)^2} \neq -4$ sahi $\sqrt{(-4)^2} = |-4| = 4$

b'waz $\sqrt{(-4)^2} = \sqrt{16} = 4$

Ex: $\sqrt[6]{(-3)^6} = |-3| = 3$

Ex: $\sqrt[5]{(-4)^5} = -4$

Ex: $\sqrt[7]{(-6)^7} = -6$

Ex: $\sqrt[3]{2^3} = 2$

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$$2n\sqrt{x}$$

stands for non-ve
no. whose $(2n)^{\text{th}}$
power is x

$$2n+1\sqrt{x}$$

stands for a real
no. whose $(2n+1)^{\text{th}}$
power is x



NICHOD!!



➤ ${}^{2n}\sqrt{x} = y \geq 0$ i.e. even root of any non negative real is non negative.

➤ $\sqrt{x^2} = |x|$

➤ $\sqrt[4]{x^4} = |x|, \sqrt[6]{x^6} = |x| \dots\dots\dots$

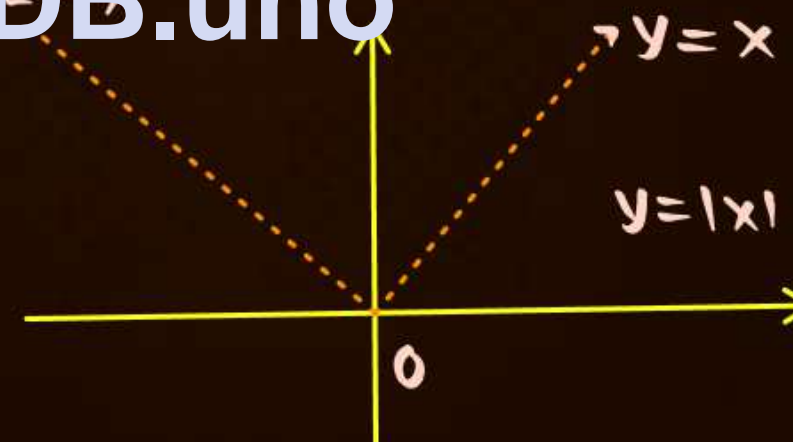
➤ ${}^{2n}\sqrt{x^{2n}} = |x|, n \in \mathbb{N}$

➤ $\sqrt[3]{x^3} = x, \sqrt[5]{x^5} = x \dots\dots\dots$

➤ ${}^{2n+1}\sqrt{x^{2n+1}} = x, n \in \mathbb{N}$

$$|x| = \begin{cases} x & x \geq 0 \\ -x & x < 0 \end{cases}$$

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* $|x| \geq 0$

* $|x| = x \Leftrightarrow x \geq 0$

* $|x| = -x \Leftrightarrow x \leq 0$



IQ Test

★ $|x| > x$ if $x \in \underline{(-\infty, 0)}$

★ $|x| < x$ if $x \in \underline{\phi}$

★ $|x| = x$ if $x = \underline{\pm 2}$

★ $|x| = \sqrt{2}$ if $x = \underline{\pm \sqrt{2}}$

★ $|x| = -1$ if $x = \underline{\text{Not possible.}}$

Ex: $| -2 | > -2$

$| -5 | > -5$



$$|-2| = 2 \text{ "School mai"}$$



$$|-2| = -(-2) = 2 \text{ "IIT mai"}$$

↪ -ve

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$$\sqrt{-2} = -1.414$$

$\sqrt{-2}$

$$(1.414 - j) i$$



Yaad Rakhnaa



When quantity inside modulus is non-negative, it comes out as it is, and when the quantity inside modulus is negative, it comes out with minus sign

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Teacher

"Find the value of $\sqrt{7 - 4\sqrt{3}} + \sqrt{7 + 4\sqrt{3}}$ "

Kallu:
$$\sqrt{2^2 + \sqrt{3}^2 - 2 \cdot 2 \cdot \sqrt{3}} + \sqrt{2^2 + \sqrt{3}^2 + 2 \cdot 2 \cdot \sqrt{3}}$$

$$\sqrt{(2 - \sqrt{3})^2} + \sqrt{(2 + \sqrt{3})^2}$$

$$= 2 - \sqrt{3} + 2 + \sqrt{3} = 4$$

Lallu:
$$\sqrt{\sqrt{3}^2 + 2^2 - 2 \cdot 2 \cdot \sqrt{3}} + \sqrt{\sqrt{3}^2 + 2^2 + 2 \cdot 2 \cdot \sqrt{3}}$$

$$\sqrt{(\sqrt{3} - 2)^2} + \sqrt{(\sqrt{3} + 2)^2}$$

$$= \sqrt{3} - 2 + \sqrt{3} + 2$$

$$= 2\sqrt{3}$$

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Dono galat

Tillu:
$$\sqrt{\sqrt{3}^2 + 2^2 - 2 \cdot 2 \cdot \sqrt{3}} + \sqrt{\sqrt{3}^2 + 2^2 + 2 \cdot 2 \cdot \sqrt{3}}$$

$$\sqrt{(\sqrt{3} - 2)^2} + \sqrt{(\sqrt{3} + 2)^2}$$

$$= |\sqrt{3} - 2| + |\sqrt{3} + 2|$$

-ve
+ve

$$= -(\sqrt{3} - 2) + \sqrt{3} + 2$$

$$= 4$$

QUESTION



Let $n = \sqrt{6 + \sqrt{11}} + \sqrt{6 - \sqrt{11}} - \sqrt{22}$, then

$$\frac{2}{\sqrt{2}} = \frac{\sqrt{2} \times \sqrt{2}}{\sqrt{2}} = \sqrt{2}$$

A $n \geq 1$

B $0 < n < 1$

C $n = 0$

D $-1 < n < 0$

$$n = \sqrt{6 + \sqrt{11}} + \sqrt{6 - \sqrt{11}} - \sqrt{22}$$

$$n = \frac{\sqrt{2} \cdot \sqrt{6 + \sqrt{11}}}{\sqrt{2}} + \frac{\sqrt{2} \cdot \sqrt{6 - \sqrt{11}}}{\sqrt{2}} - \sqrt{22}$$

$$= \frac{\sqrt{12 + 2\sqrt{11}} + \sqrt{12 - 2\sqrt{11}}}{\sqrt{2}} - \sqrt{22}$$

$$= \frac{\sqrt{\sqrt{11}^2 + 1^2 + 2 \cdot \sqrt{11} \cdot 1} + \sqrt{\sqrt{11}^2 + 1^2 - 2\sqrt{11}}}{\sqrt{2}} - \sqrt{22}$$

$$= \frac{\overset{+ve}{\sqrt{11+1}} + \overset{+ve}{\sqrt{11-1}}}{\sqrt{2}} - \sqrt{22} = \frac{\sqrt{11+1} + \sqrt{11-1}}{\sqrt{2}} - \sqrt{22}$$

$$= \frac{2\sqrt{11}}{\sqrt{2}} - \sqrt{22} = \sqrt{2} \times \sqrt{11} - \sqrt{22} = \sqrt{22} - \sqrt{22} \rightarrow n=0$$

QUESTION



Tahoi

If $x = \sqrt{33 - 20\sqrt{2}}$ & $y = \sqrt{54 - 20\sqrt{2}}$ then value of $x - y$ is equal to

A $3(1 + \sqrt{2})$

B $7(\sqrt{2} - 1)$

C $\frac{-7}{1 + \sqrt{2}}$

D $7(1 + \sqrt{2})$

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Ans. C

QUESTION



Tah 02

If $S_n = \frac{1}{\sqrt{1} + \sqrt{4}} + \frac{1}{\sqrt{4} + \sqrt{7}} + \frac{1}{\sqrt{7} + \sqrt{10}} + \dots$ n terms then -

A $S_8 = \frac{4}{3}$

B $S_{16} = 2$

C $S_{33} = 3$

D $S_{40} = \frac{10}{3}$

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QUESTION



Let $0 < x < 1$ then $\sqrt{(x-1)^2} + \sqrt[4]{(2x+1)^4} - \sqrt[3]{\left(x-\frac{1}{2}\right)^3}$ is equal to

~~A~~ $\frac{5}{2}$

B $\frac{1}{2}$

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

D dependent of x

let $v = |x-1| + |2x+1| - \left(x-\frac{1}{2}\right)$

\swarrow \swarrow \swarrow

$-ve$

Now $0 < x < 1 \Rightarrow x-1 = -ve$

$0 < x < 1 \Rightarrow 0 < 2x < 2 \Rightarrow 2x+1 = +ve$

~~$V = -(x-1) + 2x+1 - x + \frac{1}{2}$~~

~~$V = \frac{5}{2}$~~

Ans. A

QUESTION



Tah03

If $x = \sqrt{2 + \sqrt{3}} + \sqrt{4 - \sqrt{15}}$ then value of $\sqrt{2}x$ is equal to

A $\sqrt{5} - \sqrt{3}$

B $\sqrt{5} - 1$

C $\sqrt{3} + \sqrt{5}$

D $\sqrt{5} + 1$

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Ans. D

QUESTION



Let $x = \sqrt[3]{2 + \sqrt{5}} + \sqrt[3]{2 - \sqrt{5}}$, then $x^3 + 3x$ is equal to

A 1

B 2

C 3

D 4

CBS

$$x^3 = 2 + \sqrt{5} + 2 - \sqrt{5} + 3 \cdot \sqrt[3]{2 + \sqrt{5}} \cdot \sqrt[3]{2 - \sqrt{5}} \cdot \left(\sqrt[3]{2 + \sqrt{5}} + \sqrt[3]{2 - \sqrt{5}} \right)$$

x

$$x^3 = 4 + 3 \cdot \sqrt[3]{4 - 5} \cdot x$$

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$$x^3 = 4 + 3 \sqrt[3]{-1} \cdot x = 4 - 3x$$

$$x^3 + 3x = 4$$

Ans. D

QUESTION



Tahoy

If $a = \sqrt{6 + 2\sqrt{5}} - \sqrt{6 - 2\sqrt{5}}$; $b = \sqrt[3]{6\sqrt{3} + 10} + \sqrt[3]{10 - 6\sqrt{3}}$, then the value of (ab) is equal to

A 8

B 12

C 4

D 6

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QUESTION



If $|x^2 - 1| + (x - 1)^2 + \sqrt{x^2 - 3x + 2} = 0$, then value of x is :

- ~~A~~ 1
- B 4
- C -2
- D None of these

$$|x^2 - 1| = 0 \quad \text{---} \quad x^2 - 1 = 0 \Rightarrow x = \pm 1$$

$$\text{? } (x - 1) = 0 \Rightarrow x = 1$$

$$\text{? } x^2 - 3x + 2 = 0 \Rightarrow x = 1, 2$$

$$x = 1$$

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QUESTION



The number of real solutions of the equation $(x-1)^4 + (x-2)^4 + (x-3)^4 = 0$, is

A 4

B 2

C 1

~~**D** 0~~

$(x-1)^4 \geq 0$ $(x-2)^4 \geq 0$ $(x-3)^4 \geq 0$

$(x-1)^4 = 0 \rightarrow x=1$
 $(x-2)^4 = 0 \rightarrow x=2$
 $(x-3)^4 = 0 \rightarrow x=3$

$\cap \rightarrow x \in \phi$

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QUESTION

Find the number of solutions for the equation $|x - 3|^2 + |x - 4| + x^2 + 7 = 0$.

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Ashish Sir's Novel Concepts (ASNC)



Simon's Factoring Technique

$$\begin{aligned} \textcircled{1} \quad pq - p - q &= p(q-1) - q + 1 - 1 \\ &= p(q-1) - 1(q-1) - 1 \\ &= (p-1)(q-1) - 1 \end{aligned}$$

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$$\begin{aligned} \textcircled{2} \quad pq + p + q &= p(q+1) + q + 1 - 1 \\ &= p(q+1) + 1 \cdot (q+1) - 1 \\ &= (p+1)(q+1) - 1 \end{aligned}$$

QUESTION



If $m, n \in \mathbb{N}$ then find the number of ordered pairs (m, n) such that $\frac{2}{m} + \frac{2}{n} = 1$.

M(1)

Ans: 3 ordered pairs

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

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

$$2m + 2n = mn$$

$$2m + 2n - mn = 0$$

$$2m - n(m-2) = 0$$

$$2m - 4 + 4 - n(m-2) = 0$$

$$2(m-2) - n(m-2) + 4 = 0$$

$$(2-n)(m-2) = -4$$

$$-(n-2)(m-2) = -4$$

$$(m-2)(n-2) = 4$$

$m-2$	$n-2$	(m, n)
1	4	(3, 6) ✓
4	1	(6, 3) ✓
2	2	(4, 4) ✓
-4	-1	(-2, 1)
-1	-4	(1, -2)
-2	-2	(0, 0)

QUESTION



If $m, n \in \mathbb{N}$ then find the number of ordered pairs (m, n) such that $\frac{2}{m} + \frac{2}{n} = 1$.

M2

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

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

$$2m + 2n = mn$$

$$2n = mn - 2m$$

$$2n = m(n-2)$$

$$m = \frac{2n}{n-2} = \frac{2n-4+4}{n-2} = \frac{2(n-2)}{n-2} + \frac{4}{n-2}$$

$$m = 2 + \frac{4}{n-2}$$





$$m = 2 + \frac{4}{n-2}$$

$n-2$ should be a divisor of 4

$$n-2 = -1, -2, -4, 1, 2, 4$$

$$n = 1, 0, -2, 3, 4, 6$$

$$m = -2, -, -, 6, 4, 3$$

$$(m, n) = (6, 3), (3, 6), (4, 4)$$

QUESTION



Tan05

If x & y are positive integers, such that $\frac{1}{x} + \frac{1}{y} = \frac{1}{6}$ & $x \geq y$, then the number of ordered pairs of (x, y) is

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Polynomials



An algebraic expression of the form

$$p(x) = a_n x^n + a_{n-1} x^{n-1} + a_{n-2} x^{n-2} + \dots + a_1 x^1 + a_0 x^0, \text{ where}$$

(i) $a_n \neq 0$

(ii) power of x is whole number, is called a polynomial in one variable.

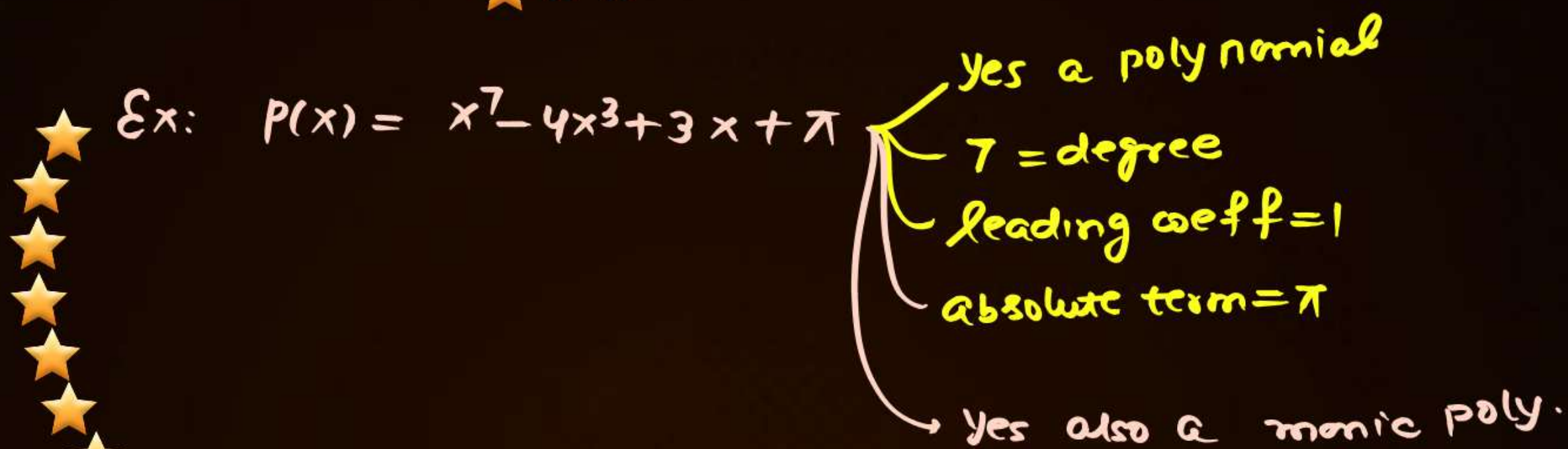
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Hence, $a_n, a_{n-1}, a_{n-2}, \dots, a_0$ are coefficients of x^n, x^{n-1}, \dots, x^0 respectively and $a_n x^n, a_{n-1} x^{n-1}, a_{n-2} x^{n-2}, \dots$ are terms of the polynomial. Here the term $a_n x^n$ is called the **Leading term** and its coefficient a_n , the leading coefficient.

If leading coefficient is '1' then the polynomial is called as **monic polynomial**.

$$\begin{aligned} \text{Ex: } p(x) &= x^3 - 6x^2 + \frac{7}{x} - 3x \\ \text{Ex: } p(x) &= x^6 - 6x^5 - 4x^3 + 7x + \sqrt{x} \end{aligned}$$

Handwritten notes:
 - Green arrows point from $\frac{7}{x}$ to $7 \cdot x^{-1}$ and from \sqrt{x} to $x^{\frac{1}{2}}$.
 - Red text: $a_n = \text{leading coeff}$
 $a_0 = \text{constant term / absolute term.}$



Ex: $P(x) = x^7 - 4x^3 + 3x + \pi$

- Yes a polynomial
- 7 = degree
- leading coeff = 1
- absolute term = π

Yes also a monic poly.

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Degree of Polynomial



Degree of the polynomial in one variable is the largest exponent of the variable.

For example, the degree of the polynomial $3x^7 - 4x^6 + x + 9$ is 7 and the degree of the polynomial $5x^6 - 4x^2 - 6$ is 6.

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Degree of Polynomial



$$0 \cdot x^7, 0 \cdot x^3, 0x^{10}$$

Polynomials classified by degree

Degree	Name	General form	Example
(undefined)	Zero polynomial	0	0
0	(Non-zero) constant polynomial	$a; (a \neq 0)$	1
1	Linear polynomial	$ax + b; (a \neq 0)$	$x + 1$
2	Quadratic polynomial	$ax^2 + bx + c; (a \neq 0)$	$x^2 + 1$
3	Cubic polynomial	$ax^3 + bx^2 + cx + d; (a \neq 0)$	$x^3 + 1$

Usually, a polynomial of degree n , for n greater than 3, is called a polynomial of degree n , although the phrases quadratic polynomial and quintic polynomial are sometimes used.



Remainder & Factor Theorem



Remainder Theorem

Let $P(x)$ be a polynomial of degree ≥ 1 and 'a' is any real number. If $P(x)$ is divided by $(x - a)$, then the remainder is $P(a)$.

Ex: find remainder when

$P(x) = x^4 - x^3 + 3x^2 - 2x + 1$ is divided by

a) $x - 1 \rightarrow \text{Rem} = P(1) = 1 - 1 + 3 - 2 + 1 = 2$

b) $x + 1 \rightarrow \text{Rem} = P(-1) = 1 + 1 + 3 + 2 + 1 = 8$

Factor Theorem

Let $P(x)$ be a polynomial of degree ≥ 1 and 'a' be any real constant such that $P(a) = 0$, then $(x - a)$ is a factor of $P(x)$. Conversely, if $(x - a)$ is a factor of $P(x)$, then $P(a) = 0$.

Divisor

$$x + a$$

$$x - a$$

$$ax + b$$

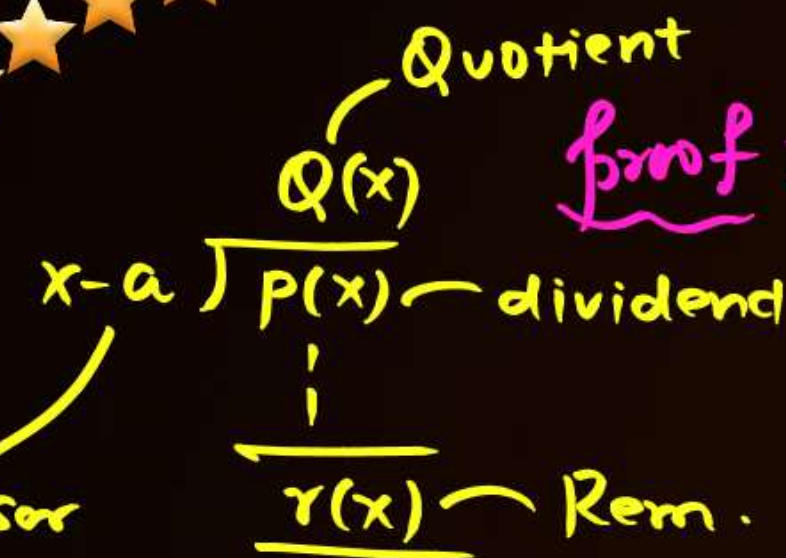
Rem

$$P(-a)$$

$$P(a)$$

$$P(-b/a)$$

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proof: $P(x) = (x-a)Q(x) + \text{Rem}$

put $x=a$

$P(a) = 0 \cdot Q(a) + \text{Rem}$

$P(a) = \text{Remiander}$

Remainder Theorem

Dividend = Quotient \times Divisor + Rem

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degree Rem $<$ degree of divisor

Factor Thm

If Rem = 0 i.e $P(a) = 0$

\Downarrow
 $(x-a)$ is a factor of $P(x)$



Note:

Let $P(x)$ be any polynomial of degree greater than or equal to one. If leading coefficient of $P(x)$ is 1 then $P(x)$ is called monic. (Leading coefficients means coefficients of highest power.)

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**Don't Forget to
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Retry all the class illustrations**



Today's KTK



No Selection **TRISHUL** Selection with Good Rank
Apnao IIT Jao



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QUESTION

(KTK 1)



The expression $\sqrt{12 + 6\sqrt{3}} + \sqrt{12 - 6\sqrt{3}}$ simplifies to

- A** 4
- B** $2\sqrt{3}$
- C** $3\sqrt{3}$
- D** 6

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Ans. D

QUESTION

(KTK 2)



Let p, q be real numbers satisfying $p^2 - q^2 = 4$ and $2pq = 3$ then $(p^2 + q^2)$ is equal to

- A** 1
- B** 9
- C** 16
- D** 5

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Ans. D

QUESTION**(KTK 3)**

Value of x satisfying the equation $\sqrt{x^2 + 2x - 63} + |x^2 - 9x + 14| = 0$ is

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QUESTION

(KTK 4)



The expression $\sqrt{(28 + 10\sqrt{3})} + \sqrt{(28 - 10\sqrt{3})}$ simplifies to

- A** 10
- B** 12
- C** $2\sqrt{3}$
- D** 5

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Ans. A

QUESTION**(KTK 5)**

Find all the integral solutions of the equation $xy = 2x - y$.

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Ans. $(0, 0), (-2, 4), (1, 1), (-3, 3)$



Solution to Previous TAH

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QUESTION

If a, b, c are distinct real numbers such that $a^2 - b = b^2 - c = c^2 - a$, then
 $(a + b) (b + c) (c + a) =$ _____

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Piyush Bhadohi UP

TAH 01

Given: $a^2 - b = b^2 - c = c^2 - a$

We have,

$$a^2 - b = b^2 - c$$

$$a^2 - b^2 = b - c$$

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

lly, $b+c = \frac{c-a}{b-c}$ and $a+c = \frac{b-a}{a-c}$

$$\text{Now, } (a+b)(b+c)(c+a) = \frac{(b-c)(c-a)(b-a)}{(b-c)(a-b)(a-c)} = 1 \quad \checkmark$$





Q-11 If a, b, c are distinct real numbers such that $a^2 - b = b^2 - c = c^2 - a$, then $(a+b)(b+c)(c+a) = ?$

Soln

$$a^2 - b = b^2 - c = c^2 - a$$

$$a^2 - b = b^2 - c \Rightarrow a^2 - b^2 = b - c \quad \text{--- (i)}$$

$$\text{or, } (a-b)(a+b) = (b-c) \quad \text{--- (i)}$$

$$b^2 - c = c^2 - a \Rightarrow b^2 - c^2 = c - a$$

$$\text{or, } (b+c)(b-c) = (c-a) \quad \text{--- (ii)}$$

$$a^2 - b = c^2 - a \Rightarrow a^2 - c^2 = b - a$$

$$\text{or, } (a+c)(a-c) = (b-a) \quad \text{--- (iii)}$$

(i) x (ii) x (iii):

$$(a+b)(b+c)(c+a)(a-b)(b-c)(a-c)$$

$$= (b-c)(c-a)(b-a)$$

$$\text{or, } (a+b)(b+c)(c+a) \cancel{(a-b)} \cancel{(b-c)} \cancel{(c-a)} \times \cancel{(a-b)} \cancel{(b-c)} \cancel{(c-a)}$$

$$= \cancel{(b-c)} \cancel{(c-a)} \cancel{(a-b)} \times \cancel{(a-b)} \cancel{(b-c)} \cancel{(c-a)}$$

$$\text{or, } (a+b)(b+c)(c+a) = 1$$

\therefore Ans. = 1.

$\left[\begin{array}{l} \because a, b, c \text{ are} \\ \text{distinct} \\ \Downarrow \\ a-b \neq b-c \neq c-a \\ \neq 0 \end{array} \right]$

TAH 01
SAYANTAN MANNA

QUESTION

If x , y & z are three real numbers such that $x^2 + 4y^2 + 9z^2 - 2x - 4y - 6z + 3 = 0$ then find the value of $\frac{1}{x} + \frac{1}{y} + \frac{1}{z}$.

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* TRH-02:-

solⁿ

$$x^2 + 4y^2 + 9z^2 - 2x - 4y - 6z + 3 = 0$$

⇓

1+1+1 (split)

$$x^2 - 2x + 1 + 4y^2 - 4y + 1 + 9z^2 - 6z + 1 = 0$$

$$(x-1)^2 + (2y-1)^2 + (3z-1)^2 = 0$$

$x - 1 = 0$	$2y - 1 = 0$	$3z - 1 = 0$
$x = 1$	$y = \frac{1}{2}$	$z = \frac{1}{3}$

find

$$\frac{1}{x} + \frac{1}{y} + \frac{1}{z} = \frac{1}{1} + \frac{1}{\frac{1}{2}} + \frac{1}{\frac{1}{3}} = 1 + 2 + 3 = 6$$

2) Tah 02

If x, y & z are three real numbers such that
 $x^2 + 4y^2 + 9z^2 - 2x - 4y - 6z + 3 = 0$, then find
 the value of $\frac{1}{x} + \frac{1}{y} + \frac{1}{z}$.

$$x^2 - 2x + 1 + 4y^2 - 4y + 1 + 9z^2 - 6z + 1 = 0$$

$$(x-1)^2 + (2y-1)^2 + (3z-1)^2 = 0$$

$$x-1 = 0$$

$$\underline{\underline{x=1}}$$

$$2y-1 = 0$$

$$2y = \frac{1}{2} //$$

$$3z-1 = 0$$

$$z = \frac{1}{3}$$

$$\frac{1}{x} + \frac{1}{y} + \frac{1}{z} = \frac{1}{1} + \frac{1}{\frac{1}{2}} + \frac{1}{\frac{1}{3}}$$

$$= 1 + 2 + 3$$

$$= 6 //$$





Q-2: If x, y, z are three real numbers such that $x^2 + 4y^2 + 9z^2 - 2x - 4y - 6z + 3 = 0$; then find the value of $\frac{1}{x} + \frac{1}{y} + \frac{1}{z}$.

Soln $x^2 + 4y^2 + 9z^2 - 2x - 4y - 6z + 3 = 0$.

or, $x^2 - 2x + 4y^2 - 4y + 9z^2 - 6z + 3 = 0$.

or, $x^2 - 2 \cdot x \cdot 1 + 1^2 - 1^2 + (2y)^2 - 2 \cdot 2y \cdot 1 + 1^2 - 1^2 + (3z)^2 - 2 \cdot 3z \cdot 1 + 1^2 - 1^2 + 3 = 0$.

or, $(x-1)^2 - 1 + (2y-1)^2 - 1 + (3z-1)^2 - 1 + 3 = 0$.

or, $(x-1)^2 + (2y-1)^2 + (3z-1)^2 - 3 + 3 = 0$.

or, $(x-1)^2 + (2y-1)^2 + (3z-1)^2 = 0$.

$\therefore x=1$ $\left\{ \begin{array}{l} 2y=1 \\ \text{or, } y = \frac{1}{2} \end{array} \right. \left\{ \begin{array}{l} 3z=1 \\ \text{or, } z = \frac{1}{3} \end{array} \right.$

$\therefore \frac{1}{x} + \frac{1}{y} + \frac{1}{z}$
 $= \frac{1}{1} + \frac{1}{1/2} + \frac{1}{1/3}$
 $= 1 + 2 + 3$
 $= 6$ (Ans.)

TAH 02
SAYANTAN MANNA
WEST BENGAL

QUESTION



Let a , b , c are real numbers and satisfy $a = 8 - b$ and $c^2 = ab - 16$, then $\frac{a}{b}$ is equal to

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TAH 3

$$(a+b) = 8 \quad \leftarrow \text{sq}$$

$$a^2 + b^2 + 2ab = 64 \quad \text{--- (I)}$$

$$a = 8 - b$$

$$c^2 = ab - 16 \Rightarrow ab = c^2 + 16 \quad \text{--- (II)}$$

put ab in (I) eq

$$a^2 + b^2 + 2(c^2 + 16) = 64$$

$$\Rightarrow (a-b)^2 + 2ab + 2(c^2 + 16) = 64$$

$$\Rightarrow (a-b)^2 + 4c^2 + 64 = 64$$

$$\Rightarrow (a-b)^2 + 4c^2 = 0$$

$$\text{and } c = 0$$

$$\therefore a = b$$

$$\boxed{\frac{a}{b} = 1} \text{ Ans.}$$

Ash Man
Maity





Let a, b, c are real numbers and $a = 8 - b$ and $c^2 = ab - 16$, then $\frac{a}{b}$ is equal to

$$c^2 = (8 - b)b - 16$$

$$c^2 = 8b - b^2 - 16$$

$$c^2 = -b^2 + 8b - 16$$

$$c^2 = -(b^2 - 8b + 16)$$

$$c^2 \in \mathbb{R}, c^2 \geq 0$$

$$-(b^2 - 8b + 16) \geq 0$$

$$b^2 - 8b + 16 \geq 0$$

$$(b - 4)(b - 4) \geq 0$$

$$(b - 4)^2 \geq 0$$

$$b - 4 = 0$$

$$\underline{\underline{b = 4}}$$

$$a = 8 - b$$

$$a = 8 - 4$$

$$= 4 //$$

$$\frac{a}{b} = \frac{4}{4} = 1 //$$

$$S = -8$$

$$P = 16$$

$$-4 \quad -4$$



Solution to Previous KTKs

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QUESTION

(KTK 1)



a, b, c are reals such that $a + b + c = 3$ and $\frac{1}{a+b} + \frac{1}{b+c} + \frac{1}{c+a} = \frac{10}{3}$.

The value $E = \frac{a}{b+c} + \frac{b}{c+a} + \frac{c}{a+b}$ is

A 9

B 7

C 5

D 3

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(KTK-1) a, b, c are reals such that $a+b+c=3$

and $\frac{1}{a+b} + \frac{1}{b+c} + \frac{1}{c+a} = \frac{10}{3}$ Then value

$$x = \frac{a}{b+c} + \frac{b}{a+c} + \frac{c}{a+b}$$

Solⁿ: $\rightarrow a+b+c=3$ — (i) **Abhishek Kumar**

$$\frac{1}{a+b} + \frac{1}{b+c} + \frac{1}{c+a} = \frac{10}{3} \text{ — (ii)}$$

eq (i) x (ii)

$$1 + \frac{c}{(a+b)} + 1 + \frac{a}{(b+c)} + 1 + \frac{b}{(a+c)} = 10$$

$$\frac{a}{(b+c)} + \frac{b}{(a+c)} + \frac{c}{(a+b)} = 10 - 3 = 7$$

7

Problem 3

a, b, c are reals such that $a+b+c=3$ and $\frac{1}{a+b} + \frac{1}{b+c} + \frac{1}{c+a} = \frac{10}{3}$, Find $E = \frac{a}{a+c} + \frac{b}{c+a} + \frac{c}{a+b}$

Solⁿ: $E = \frac{a}{a+c} + \frac{b}{c+a} + \frac{c}{a+b}$

$\rightarrow \frac{1}{a+b} + \frac{1}{b+c} + \frac{1}{c+a} = \frac{10}{3}$ given

Soumay Pandey

$$\frac{a+b+c}{a+b} + \frac{a+b+c}{b+c} + \frac{a+b+c}{c+a} = 10$$

$$\frac{(a+b+c)}{(a+b)} + \frac{(a+b+c)}{(b+c)} + \frac{(a+b+c)}{(c+a)} = 10$$

$$\rightarrow \left(\frac{1+c}{a+b} \right) + \left(\frac{1+a}{b+c} \right) + \left(\frac{1+b}{c+a} \right) = 10$$

Finally

$$\frac{a}{b+c} + \frac{b}{c+a} + \frac{c}{a+b} = 10 - 3 = 7 \text{ Ans}$$

QUESTION

(KTK 2)



Solve the equations :
$$\begin{cases} 2^x + 3^y = 41 \\ 2^{x+2} + 3^{y+2} = 209 \end{cases}$$

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Ans. $x = 5$ and $y = 2$



Q-31:- Solve the equations!

$$\begin{cases} 2^x + 3^y = 41 \\ 2^{x+2} + 3^{y+2} = 209 \end{cases}$$

Soln:-

$$2^x + 3^y = 41 \quad \text{--- (i)}$$

$$2^{x+2} + 3^{y+2} = 209$$

or $2^x \times 4 + 3^y \times 9 = 209$

$$\text{or, } 4 \cdot 2^x + 9 \cdot 3^y = 209 \quad \text{--- (ii)}$$

Let $2^x = t$, $3^y = s$.

$$t + s = 41 \quad \text{--- (i) } \times 4$$

$$4t + 9s = 209 \quad \text{--- (ii)}$$

$$\begin{array}{r} 4t + 4s = 164 \\ 4t + 9s = 209 \\ \hline \end{array}$$

(Subtract)

$$5s = 45$$

or, $s = 9$

or, $3^y = 9$

or, $3^y = 3^2$

or, $y = 2$

$$\therefore t = 41 - 9$$

or, $t = 32$

or, $2^x = 32$

or, $2^x = 2^5$

or, $x = 5$

\therefore Ans. $\rightarrow x = 5, y = 2$

KTK 2
SAYANTAN MANNA
WEST BENGAL

QUESTION

(KTK 3)



What is the area of an equilateral triangle inscribed in a circle of radius 4 cm?

- A** 12 cm^2
- B** $9\sqrt{3} \text{ cm}^2$
- C** $8\sqrt{3} \text{ cm}^2$
- D** $12\sqrt{3} \text{ cm}^2$

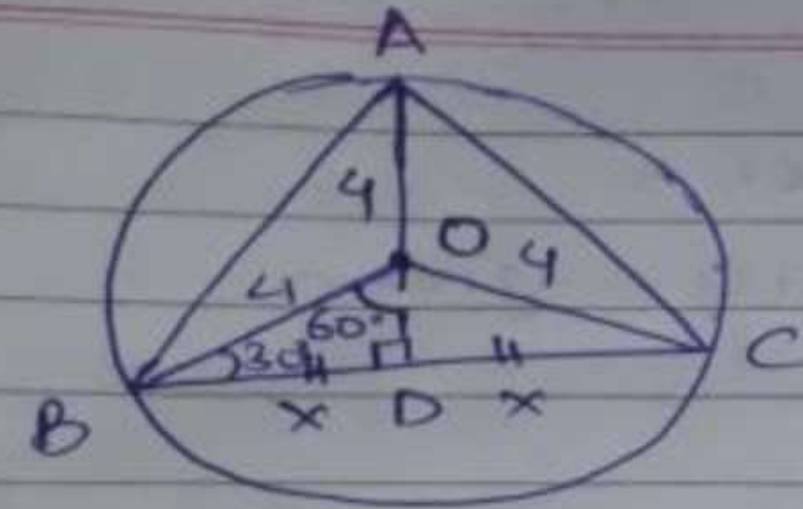
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Ans. D

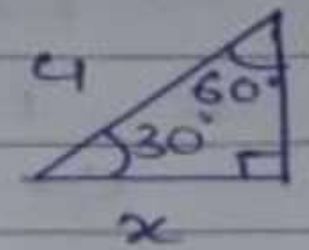


KTK 03 = lect 3

What is the area of an equilateral triangle inscribed in circle of radius of 4cm?



In ΔOBD ,



$$\sin 60^\circ = \frac{P}{H} = \frac{x}{4}$$

$$\frac{\sqrt{3}}{2} = \frac{x}{4}$$

$$x = 2\sqrt{3}$$

Now

$$BC = 2x = 2(2\sqrt{3}) = 4\sqrt{3}$$

$$\text{Area of } \Delta ABC = \frac{\sqrt{3}}{4} a^2$$

$$= \frac{\sqrt{3}}{4} \cdot 4\sqrt{3} \cdot 4\sqrt{3}$$

$$= 12\sqrt{3} \text{ cms}$$

**Richard Feynman
Jharkhand**

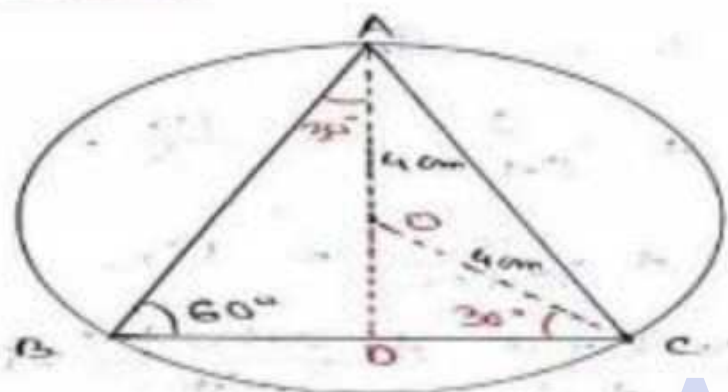


- Q-2? What is the area of an equilateral triangle inscribed in a circle of radius 4 cm?

(A) 12 cm^2 (B) $9\sqrt{3} \text{ cm}^2$ (C) $8\sqrt{3} \text{ cm}^2$ (D) $12\sqrt{3} \text{ cm}^2$

Soln:

→ method-1!



KTK 03 PART 1
SAYANTAN MANNA
WEST BENGAL

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in ΔCOD ,

$$\sin 30^\circ = \frac{OD}{OC}$$

$$\text{or, } \frac{1}{2} = \frac{OD}{4}$$

$$\text{or, } OD = 2 \text{ cm.}$$

Height of ΔABC

$$= AD$$

$$= AO + OD$$

$$= 4 + 2 = 6 \text{ cm.}$$

in ΔCOD ,

$$\cos 30^\circ = \frac{CD}{OC}$$

$$\text{or, } \frac{\sqrt{3}}{2} = \frac{CD}{4}$$

$$\text{or, } CD = 2\sqrt{3}$$

side of triangle

$$ABC = BC$$

$$= BD + CD$$

$$= 2 \times CD$$

$$= 2 \times 2\sqrt{3}$$

$$= 4\sqrt{3} \text{ cm.}$$

$$\therefore \text{Area} = \frac{1}{2} \times \text{Base} \times \text{Height}$$

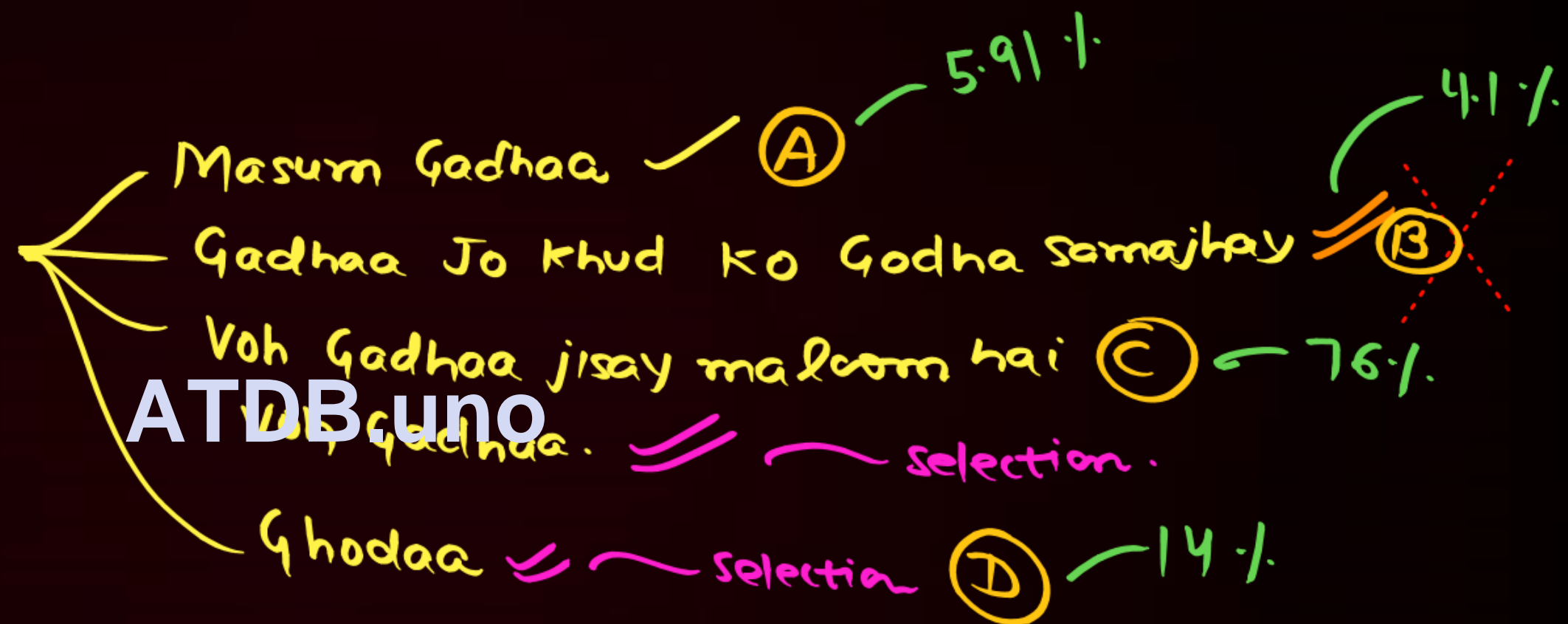
$$= \frac{1}{2} \times 8 \times 4\sqrt{3}$$

$$= 12\sqrt{3} \text{ cm}^2.$$

$$\therefore \text{Ans.} \Rightarrow \text{(D) } 12\sqrt{3} \text{ cm}^2$$



Mann Ki Baat





THANK YOU

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