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PRAYAS

JEE 2026

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Mathematics

Basic Maths

Lecture -05

By – Ashish Agarwal Sir
(IIT Kanpur)

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Topics *to be covered*

A Polynomials and their Factorization

B An Important Point

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Recap of previous lecture

Fill in the Blanks:

1. $x^2 + y^2 + 16z^2 - 4x - 4y + 8z + 9 = 0, x, y, z \in R$ then $x + y + \frac{1}{z} =$ 0

$x^2-4x+4+y^2-4y+4+(4z)^2+2\cdot 4z\cdot 1+1^2=0$

$(x-2)^2+(y-2)^2+(4z+1)^2=0 \Rightarrow x=2, y=2, z=-1/4$

2. $(x^2+1)+\frac{1}{(x^2+1)}$ has minimum value 2 which is attained at $x =$ 0

$x^2+1=1$

$\Downarrow$

$x^2=0$

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3. $(x^2-4)^2+(y-2)^4+(z-\cot \pi/2)^6=0$ then $x+y+z$ can be 0, 4

$x^2=4 \quad y=2, \quad z=\cot \pi/2=0$

$x=-2,2$

$x+y+z=4, 0$

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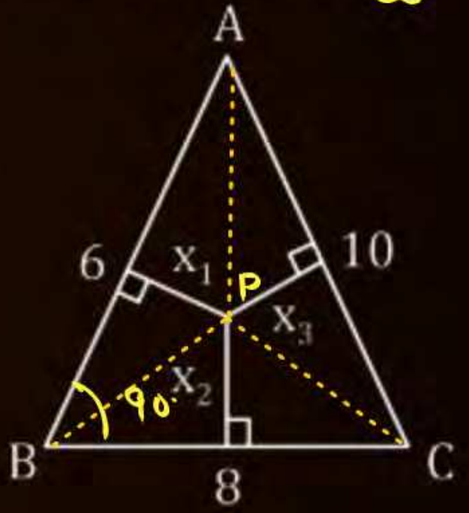
Recap of previous lecture

4. The sides of a $\triangle ABC$ are as shown in the figure. Let P be any internal point of this triangle and x_1, x_2 & x_3 denote the distance between P and sides of triangle. The value of $\left(\frac{3x_1+4x_2+5x_3}{6}\right)$ is

$6^2+8^2=10^2 \Rightarrow \angle ABC=\frac{\pi}{2}$



ar $\Delta_{BPC} = \frac{1}{2} \cdot 8 \cdot x_2$

ar $\Delta_{APC} = \frac{1}{2} \cdot 10 \cdot x_3$

ar $\Delta_{APB} = \frac{1}{2} \cdot 6 \cdot x_1$

$\oplus$

$3x_1+4x_2+5x_3$

$=$

$ar(\Delta_{ABC})$

$=$

$\frac{1}{2} \cdot 6 \cdot 8 = 24$

$\frac{3x_1+4x_2+5x_3}{6} = 4.$

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Recap of previous lecture

5. Perpendicular bisector of chord of a circle passes through it's Centre

6. Area of equilateral triangle of height h ⇒ $\Delta = \frac{h^2}{\sqrt{3}}$

7. $P(x) = x^3 - 6x^2 + 11x - 6$ has $(x-1)$, $(x-2)$ & $(x-3)$ as factors.

$P(1) = 1 - 6 + 11 - 6 = 0 \Rightarrow (x-1)$ is a factor.

$P(2) = 8 - 24 + 22 - 6 = 0 \Rightarrow (x-2)$ is a factor

$P(3) = 27 - 54 + 33 - 6 = 0 \Rightarrow x-3$ is a factor

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8. Remainder when a polynomial of degree 5 is divided by a quadratic polynomial is of the form $ax+b$

9. $P(x) = x^4 - 6x^3 + 2x^2 + 2x + 1$ then $P(1) = 1 - 6 + 2 + 2 + 1 = 0$ means $x-1$ is a factor of $P(x)$.

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Recap of previous lecture

10. Remainder when a polynomial of degree 11 is divided by a cubic polynomial is of the form ax^2+bx+c

11. We say K(x) is a divisor P(x) if remainder = 0

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12. Remainder when $P(x) = x^3 - x^2 + 1$ is divided by $2x - 3$ is

$P(3/2) = (3/2)^3 - (3/2)^2 + 1$

$= \frac{27}{8} - \frac{9}{4} + 1$

$= \frac{27-18+8}{8} = 17/8$

$P(x) \div ax+b$ Rem $= P(-\frac{b}{a})$

$P(x) \div ax-b$ Rem $= P(b/a)$

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Homework Discussion

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QUESTION

TAH 02

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

4, 7, 10 - - -

$T_n = a + (n-1)d$

$= 4 + (n-1)3 = 3n+1$

$S_n = \frac{1}{\sqrt{4}+\sqrt{1}} + \frac{1}{\sqrt{7}+\sqrt{4}} + \frac{1}{\sqrt{10}+\sqrt{7}} + - - - - + \frac{1}{\sqrt{3n+1}+\sqrt{3n-2}}$

$S_n = \frac{1}{3}\left[(\sqrt{4}-\sqrt{1}) + (\sqrt{7}-\sqrt{4}) + (\sqrt{10}-\sqrt{7}) + - - - + (\sqrt{3n+1}-\sqrt{3n-2})\right]$

$S_n = \frac{\sqrt{3n+1}-1}{3}$

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

B $S_{16} = 2$

C $S_{33} = 3$

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

Ans. A, B, C, D

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QUESTION

TAH 05

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

$$\frac{x+y}{xy}=\frac{1}{6}$$

$$6(x+y)=xy$$

$$6x+6y-xy=0$$

$$6x-36-y(x-6)=0-36$$

$$6(x-6)-y(x-6)=-36$$

$$(x-6)(y-6)=36.$$

$x-6$	$y-6$	(x,y)
6	6	(12,12)
9	4	(15,10)
12	3	(18,9)
36	1	(42,7)
18	2	(24,8)

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Ans. 5

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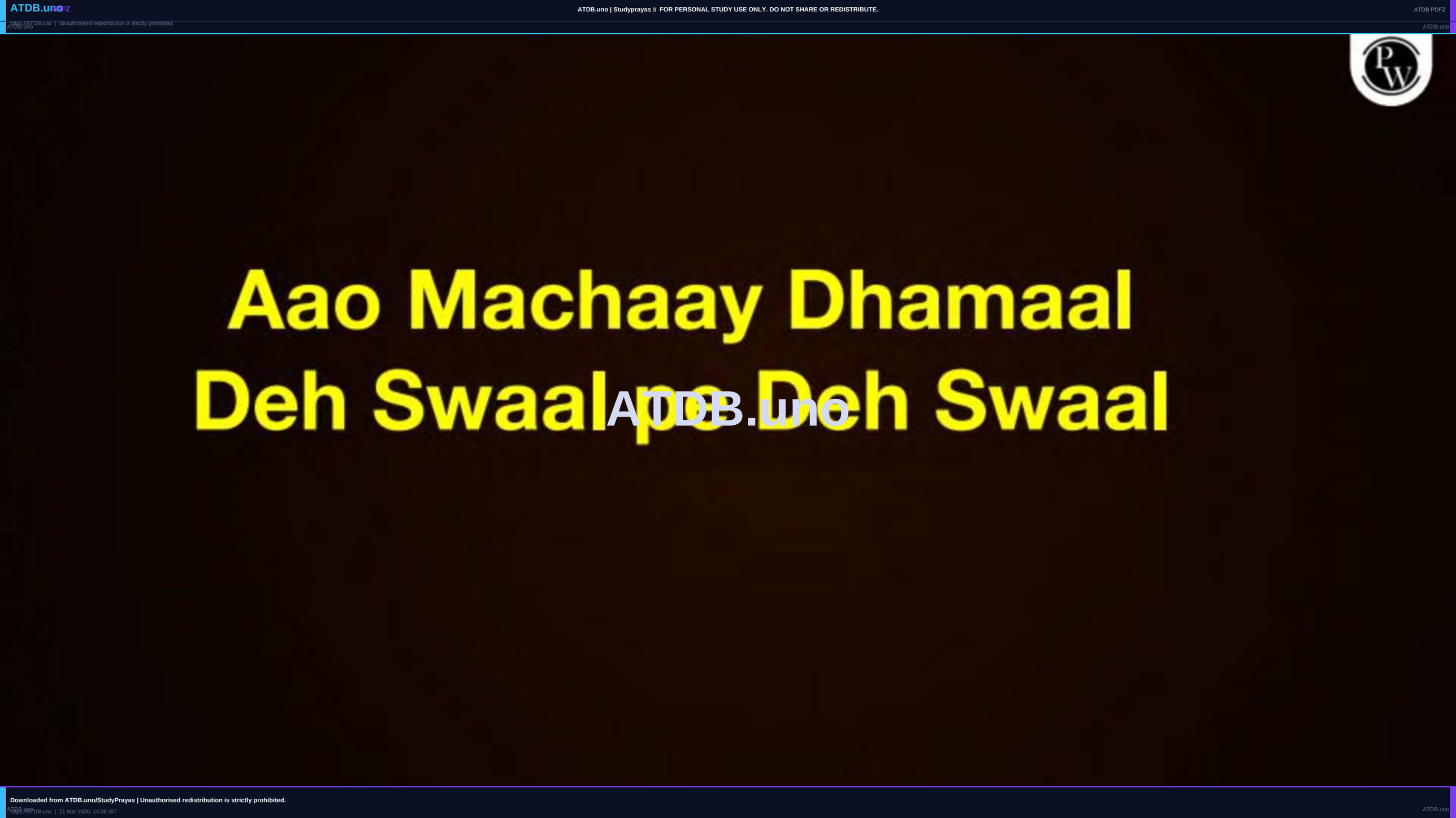

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QUESTION

If $(x^3 + ax^2 + bx + 6)$ has $(x - 2)$ as a factor and leaves a remainder 3 when divided by $(x - 3)$

(A) sum of absolute value of $(a + b)$ is 4

(B) product of ab is 3

(C) difference of a & b is 14

(D) a^b is defined $(-3)^{-1} = \frac{1}{(-3)^1} = -\frac{1}{3}$

Since $x-2$ is a factor of $P(x) = x^3+ax^2+bx+6$

$\Rightarrow P(2)=0 \Rightarrow 8+4a+2b+6=0$

$2a+b=-7$ — (I)

Also $P(3)=3$ (By Rem Thm)

$27+9a+3b+6=3$

$9a+3b=-30$

$3a+b=-10$ — (II)

(I) − (II)

$-a=3$

$a=-3$

$b=-1$

(A) $|a+b|=|-3-1|=4$

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Ans. A, B, D

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QUESTION

If $81x^5 + 27x^3 - 9x^2 + 50$ is divided by $(3x + 2)$ then remainder is λ then

A $\frac{3\lambda - 42}{10}$ is equal to 4

B if $\lambda = \frac{p}{q}$ then $(p + q)$ is divisible by 17 (where p & q are coprime)

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C λ is a natural number

D $\left(\lambda - \frac{1}{3}\right)$ is divisible by 3

Ans. A, B, D

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QUESTION

Suppose p(x) is a polynomial with integer coefficients. The remainder when p(x) is divided by x – 1 is 1 and the remainder when p(x) is divided by x – 4 is 10. If r(x) is the remainder when p(x) is divided by (x – 1) (x – 4), find the value of r(2006).

$P(x) \div (x-1)$ Rem = 1 — $P(1) = 1$

$P(x) \div (x-4)$ Rem = 10 — $P(4) = 10$

$P(x) \div (x-1)(x-4)$ Rem = r(x)

Rem theorem is applicable for linear Divisors

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$P(x) = Q(x) \cdot (x-1)(x-4) + (ax+b)$, i.e $r(x) = ax+b$.

$(x-1)(x-4)$: degree 2

Now put $x=1$: $P(1) = a+b = 1$

put $x=4$: $P(4) = 4a+b = 10$

$3a = 9$

$a = 3$

$b = -2$

$r(x) = 3x-2$

$r(2006) = 6018-2 = 6016$

Ans. 6016

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QUESTION

Tah02

Let $f(x) = x^{135} + x^{125} - x^{115} + x^5 + 1$. If $f(x)$ is divided by $x^3 - x$ then the remainder is some function of x say $g(x)$. Find the value of $g(10)$.

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Ans. 21

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QUESTION

Polynomial P(x) contains only terms of odd degree. When P(x) is divided by $(x-3)$ the remainder is 6. If P(x) is divided by (x^2-9) then remainder is g(x). Find value of g(2).

P(x) — contains terms of only odd degree

Ex: $P(x) = x^7 - 6x^3 + 5x$

$P(x) = x^9 + 5x^3 - 2x$

observe!! $P(-x) = -P(x)$

$P(-x) = -x^7 + 6x^3 - 5x$

$= -(x^7 - 6x^3 + 5x)$

$= -P(x)$

Now

$P(x) \div x-3$ — Rem = 6 = P(3)

$P(-3) = -P(3) = -6$

$P(x) \div x^2-9$ — Rem = ?

$P(x) = (x^2-9)Q(x) + ax+b$, $g(x) = ax+b$

$P(3) = 0 + 3a + b = 6$

$P(-3) = 0 - 3a + b = -6.$

$2b = 0 \rightarrow b = 0$

$a = 2$

$g(x) = 2x$

$g(2) = 4$

Ans. 4

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Factors of a Polynomial

$(x-1)^2(x-2)=0$

roots 1, 1, 2

soln : 1, 2

- $ax^2 + bx + c \begin{cases} \alpha \\ \beta \end{cases} \Rightarrow ax^2 + bx + c = a(x-\alpha)(x-\beta)$

- $ax^3 + bx^2 + cx + d \begin{cases} \alpha \\ \beta \\ \gamma \end{cases} \Rightarrow ax^3 + bx^2 + cx + d = a(x-\alpha)(x-\beta)(x-\gamma)$

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- $ax^4 + bx^3 + cx^2 + dx + e \begin{cases} \alpha \\ \beta \\ \gamma \\ \delta \end{cases} \Rightarrow ax^4 + bx^3 + cx^2 + dx + e = a(x-\alpha)(x-\beta)(x-\gamma)(x-\delta)$

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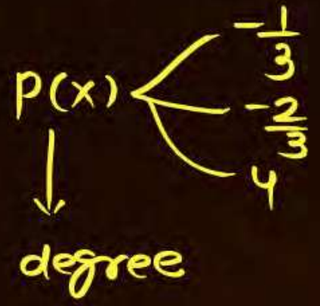
QUESTION

Find three degree polynomial P(x) whose zeroes are $\frac{-1}{3}, \frac{-2}{3}, 4$ and P(1) =1



$P(x) = a\left(x-\left(-\frac{1}{3}\right)\right)\left(x-\left(-\frac{2}{3}\right)\right)(x-4)$

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$P(x) = a\left(x+\frac{1}{3}\right)(x+2/3)(x-4)$

$P(1) = a(4/3)(5/3)(-3) = 1$

$a\left(\frac{-20}{3}\right) = 1$

$a = -3/20$

$P(x) = \frac{-3}{20}(x+1/3)(x+2/3)(x-4)$

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QUESTION

★★★KCLS★★★

If 4 degree polynomial P(x) is such that P(1) = 1, P(2) = 2, P(3) = 3 and P(4) = 4. Then find P(5) (leading coefficient is 1).

$g(x) = x^4 + (\ )x^3 + (\ )x^2 + (\ )x + c - x$

$P(x)$

degree $g(x) = 4$
leading coeff = 1

Consider $g(x) = P(x) - x$

$g(1) = P(1) - 1 = 0$

$g(2) = P(2) - 2 = 0$

$g(3) = P(3) - 3 = 0$

$g(4) = P(4) - 4 = 0$

$g(x)$ ← 1, 2, 3, 4

$g(x) = 1 \cdot (x-1)(x-2)(x-3)(x-4)$

$P(x) - x = (x-1)(x-2)(x-3)(x-4)$

$P(x) = (x-1)(x-2)(x-3)(x-4) + x$

$P(5) = (5-1)(5-2)(5-3)(5-4) + 5$

$= 4! + 5 = 29$

Concept : Consider $g(x) = P(x) -$ Jo apko Lagay $P(x)$ hai

Mazdoori naa kare

$P(x) = ax^4 + bx^3 + cx^2 + dx + e$

$P(1) = 1 \Rightarrow a + b + c + d + e = 4$

$P(2) = 2 \Rightarrow 16a + 8b + 4c + 2d + e = 2$

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QUESTION

Tan 03

If p(x) is a polynomial of 3 degree for which p(1) = 1, p(2) = 4, p(3) = 9 then find the value of p(5) and leading coefficient be 2.

$g(x) = p(x) - x^2$

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Ans. 73

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QUESTION

2. $P(1)=1$ 3. $P(2)=2$ 4. $P(3)=3$ 5. $P(4)=4$ 6 $P(5)=6$

★★★KCLS★★★

There is a 4 degree polynomial p(x) with

$P(1)=\frac{1}{2}, P(2)=\frac{2}{3}, P(3)=\frac{3}{4}, P(4)=\frac{4}{5}$ and $P(5)=\frac{5}{6}$ then find P(6).

Consider $g(x)=h(x)-x \Longrightarrow g(x)=(x+1)P(x)-x$

$g(x)$ degree = 5

$g(1)=2\cdot P(1)-1=0$

$g(2)=0,\ g(3)=0,\ g(4)=0,\ g(5)=0$

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$g(x)$ ← 2, 3, 4, 5.

$g(x)=a(x-1)(x-2)(x-3)(x-4)(x-5)$

$(x+1)\cdot P(x)-x=a(x-1)(x-2)(x-3)(x-4)(x-5)$

$P(x)=\dfrac{a(x-1)(x-2)\cdots(x-5)+x}{(x+1)}$

But P(x) is a polynomial

lagtaa hai !!

$P(x)=\frac{x}{x+1}$

$(x+1)P(x)=x$

$g(x)=P(x)-\frac{x}{x+1}$

Not a polynomial

let $(x+1)P(x)=h(x)$

$h(x)=x$

Ans. 5/6

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$R(x) = a(x-1)(x-2)\cdots(x-5)+x$ should have $x+1$ as a factor.

$\Downarrow$

$R(-1)=0 \longrightarrow a(-2)(-3)(-4)(-5)(-6)-1=0$

$a = -\frac{1}{720}$

$P(x) = a(x-1)(x-2)(x-3)(x-4)(x-5)+x$

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$1+x$

$P(6) = \dfrac{-\frac{1}{720}\cdot 120 + 6}{7} = \dfrac{-\frac{1}{6}+6}{7} = \dfrac{35}{7\times 6} = 5/6$ Ans

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A Golden Point

$$E = a^2 + b^2 + c^2 - ab - bc - ca \text{ (where } a, b, c \in R)$$

$$E = \frac{1}{2}\left(2a^2+2b^2+2c^2-2ab-2bc-2ca\right)$$

$$= \frac{1}{2}\left(a^2+c^2-2ac+a^2+b^2-2ab+b^2+c^2-2bc\right)$$

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$$= \frac{1}{2}\left((a-c)^2+(a-b)^2+(b-c)^2\right) \geq 0$$

≥ 0 ≥ 0 ≥ 0

① $E = a^2+b^2+c^2-ab-bc-ca \geq 0$

② $a^2+b^2+c^2-ab-bc-ca=0 \Leftrightarrow a=b=c$

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QUESTION

If a, b, c denotes the length of sides of the triangle such that $9a^2 + 16b^2 + 25c^2 - 12ab - 20bc - 15ac = 0$ then ratio a : b : c is-

A. 20 : 15 : 12

B. 3 : 4 : 5

C. 2 : 1 : 2

D. 1 : 2 : 3

$(3a)^2 + (4b)^2 + (5c)^2 - 3a \cdot 4b - 4b \cdot 5c - 5c \cdot 3a = 0$

$3a = 4b = 5c = 60\lambda$

$a = 20\lambda$

$b = 15\lambda$

$c = 12\lambda$

$a : b : c = 20\lambda : 15\lambda : 12\lambda$

$= 20 : 15 : 12$

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Ans. A

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QUESTION

★★★ KCLS ★★★

Find all real numbers x satisfying's $2^x + 3^x - 4^x + 6^x - 9^x = 1$.

$4^x + 9^x + 1 - 2^x - 3^x - 6^x = 0$

$(2^x)^2 + (3^x)^2 + (1^x)^2 - 2^x \cdot 3^x - 3^x \cdot 1^x - 2^x \cdot 1^x = 0$

$2^x = 3^x = 1^x$

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$2^x = 3^x = 1$

$x = 0$ Ans

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Retry karni Hai

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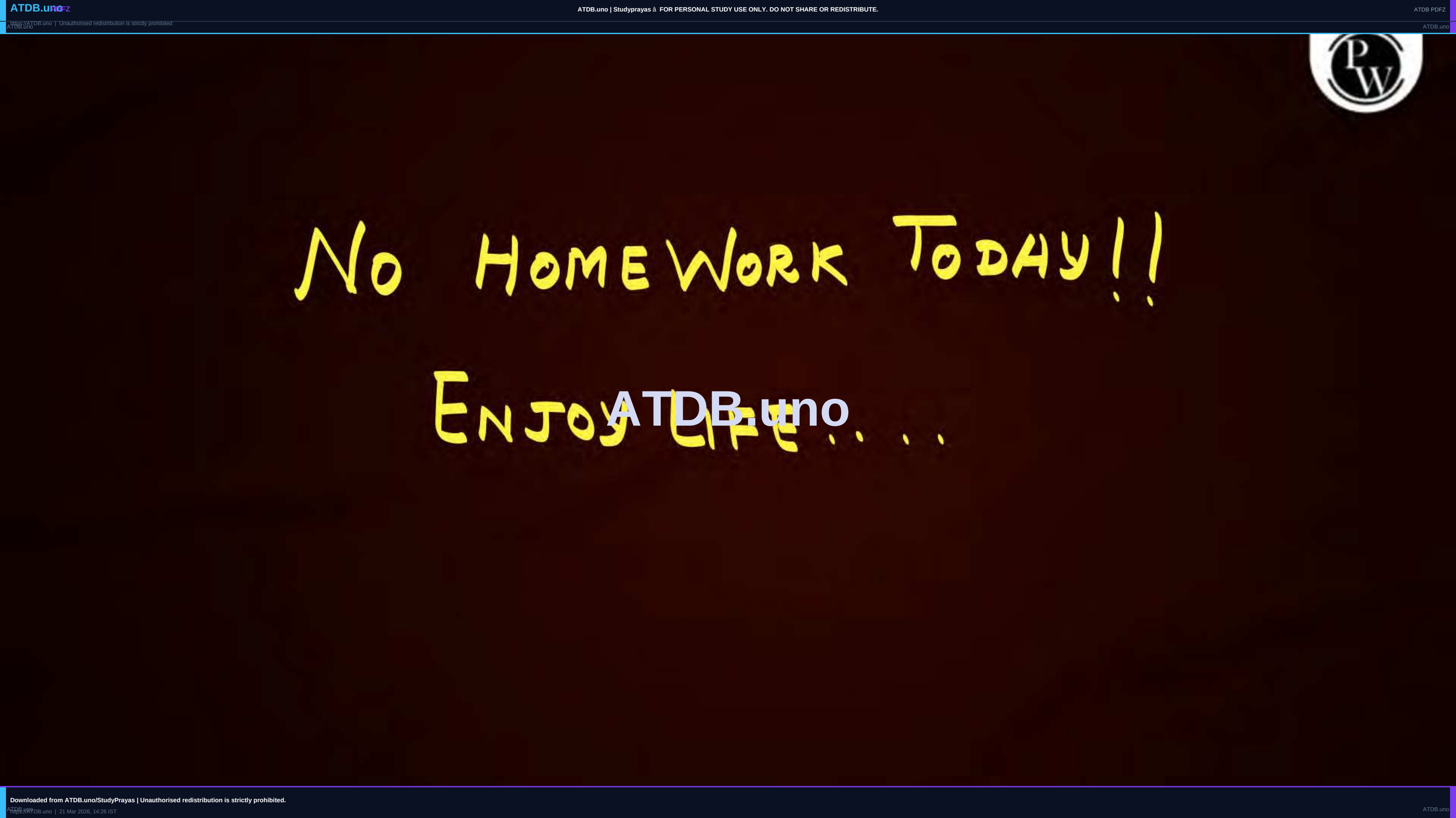

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Solution to Previous TAH

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QUESTION

TAH 01

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 $\dfrac{-7}{1 + \sqrt{2}}$

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

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Ans. C

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Q

(Jah - 01)

$x = \sqrt{33 - 20\sqrt{2}}$ $\quad y = \sqrt{54 - 20\sqrt{2}}$ then $x - y = ?$

$x = \sqrt{(5)^2 + (2\sqrt{2})^2 - 2 \times 5 \times 2\sqrt{2}}$

$x = \sqrt{(5 - 2\sqrt{2})^2}$

$x = |5 - 2\sqrt{2}|$

↳ +ve

$y = \sqrt{(5\sqrt{2})^2 + (2)^2 - 2 \cdot 5\sqrt{2} \cdot 2}$

$y = \sqrt{(5\sqrt{2} - 2)^2}$

$y = \sqrt{(2 - 5\sqrt{2})^2}$

$y = |2 - 5\sqrt{2}|$

↳ -ve

$x - y = (5 - 2\sqrt{2}) - (-(2 - 5\sqrt{2}))$

$x - y = 5 - 2\sqrt{2} + 2 - 5\sqrt{2} = 7 - 7\sqrt{2} = 7(1 - \sqrt{2})$

$x - y = -7\dfrac{(\sqrt{2} - 1) \times (\sqrt{2} + 1)}{(\sqrt{2} + 1)} = \dfrac{-7(2 - 1)}{(\sqrt{2} + 1)} = \dfrac{-7}{(\sqrt{2} + 1)}$

$\therefore x - y = -7$ Ans

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TAH-1

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

Sol: $x - y = \sqrt{33 - 20\sqrt{2}} - \sqrt{54 - 20\sqrt{2}}$

$= \sqrt{33 - 2\times10\times\sqrt{2}} - \sqrt{54 - 2\times10\times\sqrt{2}}$

$= \sqrt{33 - 2\times5\times2\sqrt{2}} - \sqrt{54 - 2\times10\sqrt{2}}$

$= \sqrt{(5)^2 + (\sqrt{8})^2 - 2\times5\times\sqrt{8}} - \sqrt{54 - 2\times10\times\sqrt{2}}$

$= \sqrt{(5-\sqrt{8})^2} - \sqrt{54 - 2\times2\times5\sqrt{2}}$

$= |5 - \sqrt{8}| - \sqrt{(2)^2 + (\sqrt{50})^2 - 2\times2\times\sqrt{50}}$

$= 5 - \sqrt{8} - \sqrt{(\sqrt{50} - 2)^2}$

$= 5 - \sqrt{8} - (|\sqrt{50} - 2|)$

$= 5 - \sqrt{8} - \sqrt{50} + 2$

$= 7 - 2\sqrt{2} - 5\sqrt{2}$

$= 7(1 - \sqrt{2}) \times \frac{(1+\sqrt{2})}{(1+\sqrt{2})} = \frac{7(1-2)}{1+\sqrt{2}} = \frac{-7}{1+\sqrt{2}}$ //Ans.

$2\times5\times\sqrt{5}$

$= 2\sqrt{5\times8}$

$(\sqrt{33})^2$

$2\times2\times\sqrt{50}$

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QUESTION

TAH 02

If $S_n = \frac{1}{\sqrt{1}+\sqrt{4}} + \frac{1}{\sqrt{4}+\sqrt{7}} + \frac{1}{\sqrt{7}+\sqrt{10}} +$ ..... 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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Ans. A, B, C, D

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Tah: ② $S_n = \frac{1}{\sqrt{1}+\sqrt{4}} + \frac{1}{\sqrt{4}+\sqrt{7}} + \frac{1}{\sqrt{7}+\sqrt{10}} + \cdots + n$ term

(A) $S_8 = 4/3$ (B) $S_{16} = 2$ (C) $S_{33} = 3$ (D) $S_{40} = 10/3$

Sol. $1, 4, 7, \ldots n \rightarrow T_n = 1+(n-1)3 = 3n-2$

$$S_n = \frac{1}{\sqrt{1}+\sqrt{4}} + \frac{1}{\sqrt{4}+\sqrt{7}} + \frac{1}{\sqrt{7}+\sqrt{10}} + \cdots + \frac{1}{\sqrt{3n-2}+\sqrt{3n+1}}$$

$$S_n = \frac{\sqrt{4}-\sqrt{1}}{4-1} + \frac{\sqrt{7}-\sqrt{4}}{7-4} + \frac{\sqrt{10}-\sqrt{7}}{10-7} + \cdots + \frac{\sqrt{3n+1}-\sqrt{3n-2}}{(3n+1)-(3n-2)}$$

$$S_n = \frac{(\cancel{\sqrt{4}}-\sqrt{1})+(\cancel{\sqrt{7}}-\cancel{\sqrt{4}})+(\cancel{\sqrt{10}}-\cancel{\sqrt{7}})+\cancel{\cdots}+(\sqrt{3n+1}-\cancel{\sqrt{3n-2}})}{3}$$

$$= \frac{\sqrt{3n+1}-1}{3}$$

24/04/2025
Himanshu Ramuka.
S.O.: Sushil Ramuka.
Rajasthan.

(A) $S_8 = \frac{\sqrt{8(3)+1}-1}{3} = 4/3$

(B) $S_{16} = \frac{\sqrt{3(16)+1}-1}{3} = 6/2 = 3$

(C) $S_{33} = \frac{\sqrt{3(33)+1}-1}{3} = 99/3 = 3$

(D) $S_{40} = \frac{\sqrt{3(40)+1}}{3} - 1 = \frac{\sqrt{121}}{3} - 1$

$= \frac{11-1}{3} = 10/3$

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QUESTION

TAH 03

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

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TAB 3 $x = \sqrt{2+\sqrt{3}} + \sqrt{4-\sqrt{15}}$ then $\sqrt{2}x = ?$

Sol^{n}

$$\sqrt{2}x = \sqrt{2}\sqrt{2+\sqrt{3}} + \sqrt{2}\sqrt{4-\sqrt{15}}$$

$$= \sqrt{4+2\sqrt{3}} + \sqrt{8-2\sqrt{15}}$$

$$= \sqrt{(\sqrt{3}+1)^2} + \sqrt{(\sqrt{5}-\sqrt{3})^2}$$

$$= |\sqrt{3}+1| + |\sqrt{5}-\sqrt{3}|$$

$$= \sqrt{3}+1+\sqrt{5}-\sqrt{3}$$

$$= 1+\sqrt{5}$$ Ans

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QUESTION

TAH 04

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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Ans. C

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Q If $a=\sqrt{6+2\sqrt{5}}-\sqrt{6-2\sqrt{5}}$; $b=\sqrt[3]{6\sqrt{3}+10}+\sqrt[3]{10-6\sqrt{3}}$,

Sol then the value of (ab) is equal to — Toh - 04

$$a=\sqrt{(\sqrt{5})^2+(1)^2+2\sqrt{5}}-\sqrt{(\sqrt{5})^2+(1)^2-2\sqrt{5}}$$

$$a=\sqrt{(\sqrt{5}+1)^2}-\sqrt{(\sqrt{5}-1)^2}$$

$$a=|\sqrt{5}+1|-|\sqrt{5}-1|=\sqrt{5}+1-(\sqrt{5}-1)$$

$$a=\sqrt{5}+1-\sqrt{5}+1=2$$

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$$b=\sqrt[3]{6\sqrt{3}+10}+\sqrt[3]{10-6\sqrt{3}}$$

C.B.S

$$b^3=(6\sqrt{3}+10)+(10-6\sqrt{3})+3\sqrt[3]{6\sqrt{3}+10}\sqrt[3]{10-6\sqrt{3}}$$

$$\left(\sqrt[3]{6\sqrt{3}+10}+\sqrt[3]{10-6\sqrt{3}}\right)$$

b

$$b^3=6\sqrt{3}+20-6\sqrt{3}+3\sqrt[3]{100-108}\cdot b$$

$$b^3=6\sqrt{3}+20-6\sqrt{3}+3\sqrt[3]{(-2)^3}\cdot b$$

$$b^3=20-6b$$

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$b^3+6b-20=0 \rightarrow (b-2)(b^2+2b+10)=0$

$b=2$ or $b^2+2b+10=0$

$D=4-10\cdot4<0$

No real roots

$P(b)=b^3+6b-20$

$P(2)=8+12-20=0$

$(b-2)$ is a factor

$b(b^2+6)=20$

$b=20$ or $b^2+6=20$

Gadho | Gadhiyoo aisaa naa karo

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QUESTION

TAH 05

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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Ans. 5

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JAM

Q 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 .

Sol^{n}

$$\frac{1}{x} + \frac{1}{y} = \frac{1}{6}$$

$$\frac{x+y}{xy} = \frac{1}{6}$$

$$6x + 6y = xy$$

$$6x + 6y - xy = 0$$

$$6x - y(-6 + x) + 36 - 36 = 0$$

$$6x - 36 - y(x-6) + 36 = 0$$

$$6(x-6) - y(x-6) + 36 = 0$$

$$(x-6)(6-y) = -36$$

$$(x-6)(y-6) = 36$$

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36

1 x 36	36 x 1	2 x 18	18 x 2	4 x 9	9 x 4	6 x 6	3 x 12	12 x 3
(7, 42)	(42, 7)	(8, 24)	(24, 8)	(10, 15)	(15, 9)	(12, 12)	(9, 18)	(18, 9)

ATQ $x, y \in I^{+}$ & $x \geq y$

$\therefore$ final pairs : (42, 7), (24, 8), (15, 9), (18, 9)
(12, 12)

$\therefore$ n(ordered pairs) = 4 // 5 // Ans

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Solution to Previous KTKs

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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

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lecture 4 24 April 2025

KTK 1 The expression $\sqrt{12+6\sqrt{3}} + \sqrt{12-6\sqrt{3}}$ simplifies to

Soln let $X = \sqrt{12+6\sqrt{3}} + \sqrt{12-6\sqrt{3}}$

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

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

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

$$X = 6$$

= Ans

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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

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

KTK-02

Sol

$$p^2 - q^2 = 4 \quad \text{SBS}$$

$$\{(p+q)(p-q)\}^2 = (4)^2$$

$$(p+q)^2 (p-q)^2 = 16$$

$$(p^2 + q^2 + 2pq)(p^2 + q^2 - 2pq) = 16$$

$$(p^2 + q^2)^2 - (2pq)^2 = 16$$

$$(p^2 + q^2)^2 - (3)^2 = 16$$

$$(p^2 + q^2)^2 = 16 + 9$$

$$(p^2 + q^2) = \sqrt{25} = 5$$

$$\boxed{p^2 + q^2 = 5} \quad \text{Ay}$$

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SIWAN, BIHAR

KTK-03

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QUESTION

(KTK 3)

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

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KTB 3 Value of x satisfying the equation $\sqrt{x^2+2x-63} + |x^2-9x+14| = 0$ is

Sol?

$\sqrt{x^2+2x-63} + |x^2-9x+14| = 0$

(≥ 0) (≥ 0)

$\Rightarrow x^2+2x-63 = 0$, $x^2-9x+14 = 0$

$(x-7)(x+9) = 0$ $(x-7)(x-2) = 0$

$x = 7, -9$ $x = 2, 7$

$\cap$

$x = 7$ Ans//

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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

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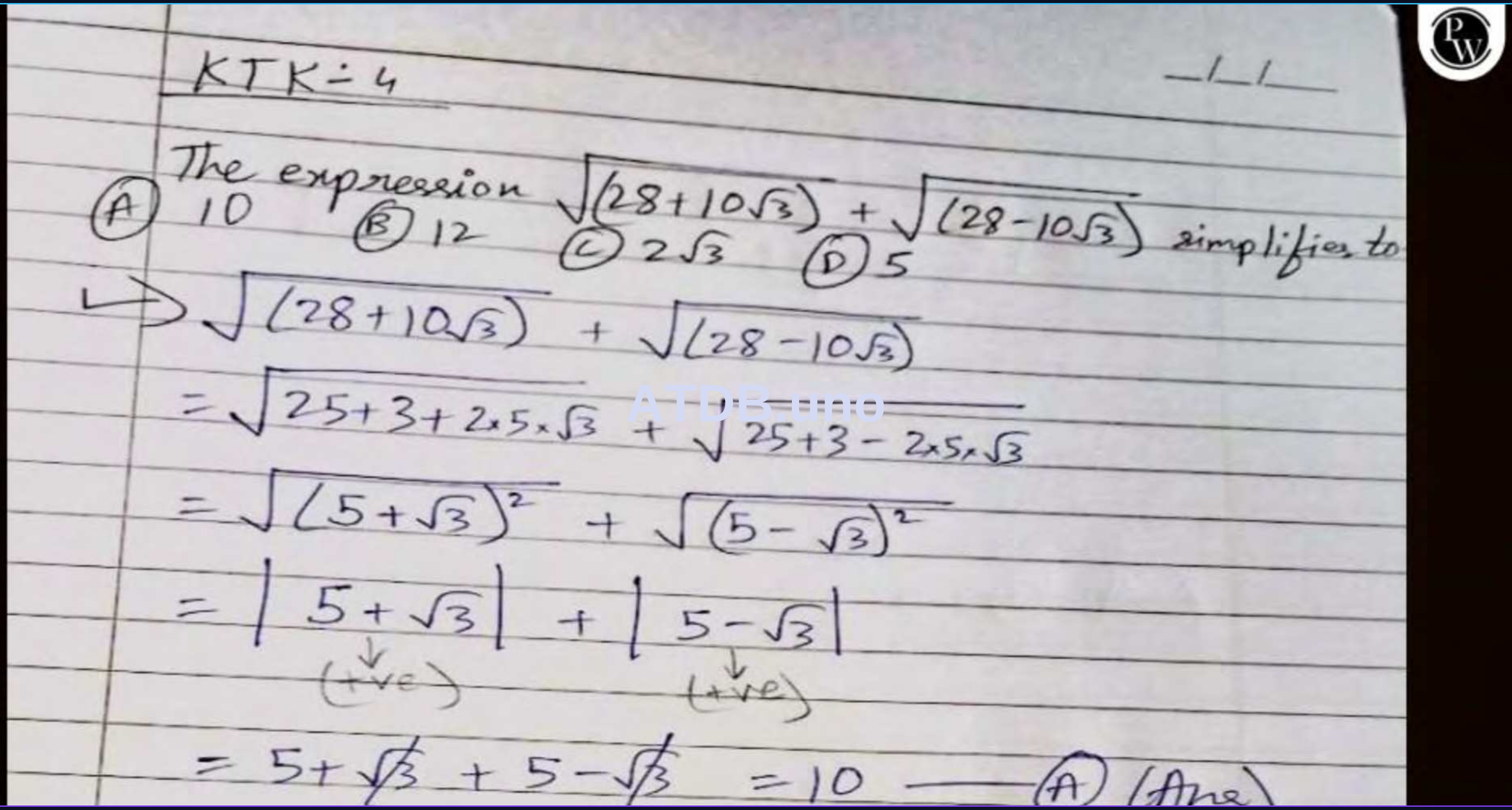

KTK÷4

—1—1—

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

(A) 10 (B) 12 (C) $2\sqrt{3}$ (D) 5

↳ $\sqrt{(28+10\sqrt{3})} + \sqrt{(28-10\sqrt{3})}$

$= \sqrt{25+3+2\times5\times\sqrt{3}} + \sqrt{25+3-2\times5\times\sqrt{3}}$

$= \sqrt{(5+\sqrt{3})^2} + \sqrt{(5-\sqrt{3})^2}$

$= |5+\sqrt{3}| + |5-\sqrt{3}|$

(+ve) (+ve)

$= 5+\sqrt{3}+5-\sqrt{3} = 10$ —— (A) (Ans)

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9

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

Sol^n Let $X = \sqrt{28+10\sqrt{3}} + \sqrt{28-10\sqrt{3}}$

$= \sqrt{(5+\sqrt{3})^2} + \sqrt{(5-\sqrt{3})^2}$

$= |5+\sqrt{3}| + |5-\sqrt{3}|$

$= 5+\cancel{\sqrt{3}}+5-\cancel{\sqrt{3}}$

$= 10$

= Ans

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QUESTION

(KTK 5)

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

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

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KTK5 Find all Integral Solutions of eqn $xy = 2x - y$

Soln

$$xy = 2x - y$$

$$2x - y - xy = 0$$

$$2x - y(1+x) + 2 - 2 = 0 \quad \text{[Simon Factorisation]}$$

$$2x + 2 - y(1+x) - 2 = 0$$

$$2(x+1) - y(x+1) - 2 = 0$$

$$(x+1)(2-y) - 2 = 0$$

$$(x+1)(y-2) = -2$$

1×-2 $\quad -2 \times 1$ $\quad -1 \times 2$ $\quad 2 \times -1$

$(0,0)$ $\quad (-3,3)$ $\quad (-2,4)$ $\quad (1,1)$

All soln are $(0,0)$, $(1,1)$, $(-2,4)$, $(-3,3)$ //

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KTK-5

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

↳ $2x - y = xy$

$\Rightarrow 2x - y - xy = 0$

$\Rightarrow 2x - y(1+x) = 0$

$\Rightarrow 2 - 2 + 2x - y(1+x) = 0$

$\Rightarrow -2 + 2(1+x) - y(1+x) = 0$

$\Rightarrow -2 + (2-y)(1+x) = 0$

$\Rightarrow (2-y)(1+x) = 2$

1	$\times$	2	$\longrightarrow (x, y) = (1, 11)$
2	$\times$	1	$\longrightarrow (x, y) = (0, 0)$
-1	$\times$	-2	$\longrightarrow (x, y) = (-3, 3)$
-2	$\times$	-1	$\longrightarrow (x, y) = (-2, 4)$

Ans

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Q Find the integral solutions of the equation

$xy = 2x - y$ (KTK-5)

Sol

~~x~~ $xy - 2x = -y$

$x(y-2) = -y$

$x = \frac{-y+2-2}{y-2}$

$x = -\frac{(y-2)-2}{(y-2)}$

$x = -1 - \frac{2}{y-2}$

AKASH KUMAR
SIWAN, BIHAR

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$y-2$ should be a divisor of 2

$y-2 = -2, -1, 1, 2$

$y = 0, 1, 3, 4$

$x = 0, 1, -3, -2$

$\therefore (x,y) = (0,0)\ (1,1)\ (-3,3)\ (-2,4)$

4 pairs

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K (5): Find all the integral solutions of eq.n

$$xy = 2x - y$$

Sol. $\therefore 2x - xy - y = 0$

$\Rightarrow x(2-y) - y + 2 - 2 = 0$

$\Rightarrow x(2-y) + 2 - y - 2 = 0$

$\Rightarrow (2-y)(x+1) = 2$

1	2	$\longrightarrow (x,y) \equiv (1,1)$
2	1	$\longrightarrow (x,y) \equiv (0,0)$
-1	-2	$\longrightarrow (x,y) \equiv (-3,3)$
-2	-1	$\longrightarrow (x,y) \equiv (-2,-4)$

24/04/2025
Himanshu Ramuka.
S.O.: Sushil Ramuka.
Rajasthan.

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