DAY 12

MCA CET 2025

MATHS

ALGEBRAIC POLYNOMIALS

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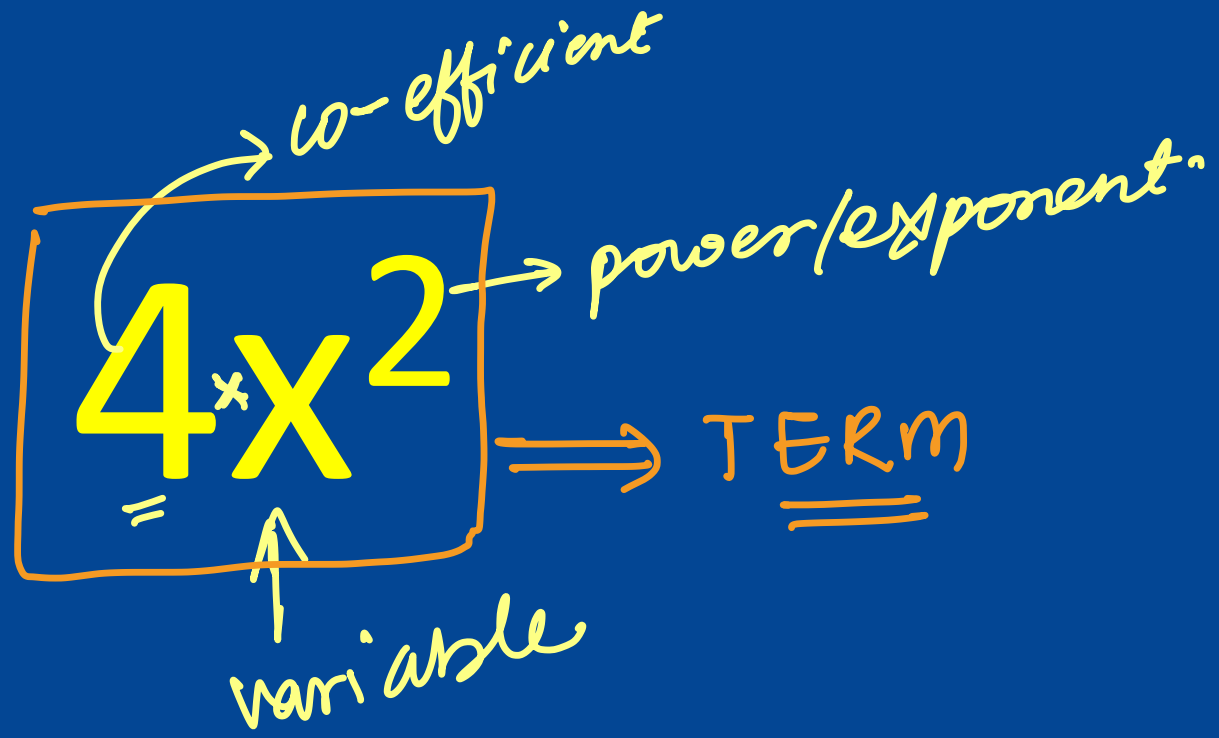
Variable, Co-efficient & Term

value varies
changable.



Expressions

$x + y$

$\sqrt{x} + y$

- Expression is combination of terms

$2x^2$

$2x^2 + x + 1$

Every term is also an expression

Difference b/n Expression & Equation

Difference b/n Expression & Equation

- Expression is combination of terms

- Equations is formed when two expressions are equated together using equal to (=) sign

$$\underbrace{2x^2}_{\text{exp.}} = \underbrace{4x}_{\text{exp.}}$$

Polynomials

$x^0 = 1$

$2x^0$

- Expressions having positive integral powers are known as polynomials.

$\sqrt{x} = x^{1/2}$

- Example: $x^2 + 2x^1 + 1x^0$

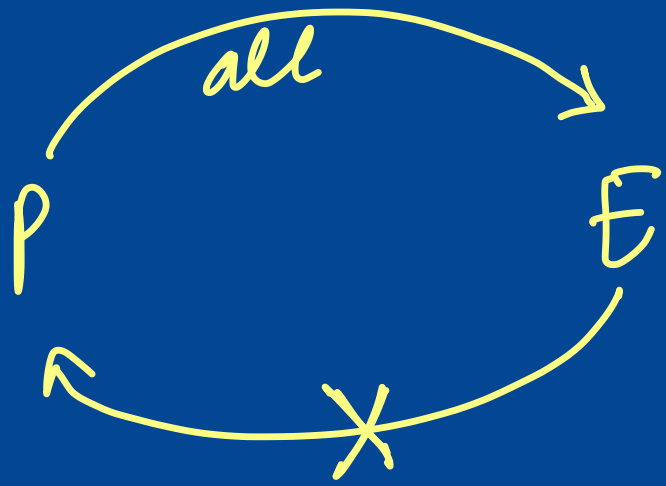
  $2x + 1$

  3, – 4, or any integer is also a polynomial

Note:

All polynomials are expressions, but not all expressions are polynomials.

$2x^2$



$\sqrt{x} = x^{1/2}$

Polynomi.

Types of Polynomials

$2x^2$

Based on Power

- 0 → constant → $2, 3, \frac{4}{3}, \ldots$
- 1 → $2x$, $x+4$ → linear
- 2 → $2x^2$, x^2+2x, x^2+7x+6 → quadratic.
- 3 → x^3, x^3+4x+1 → cubic.

Based on terms

- 1 → monomial
- 2 → binomial
- 3 → trinomial

Degree of a polynomial

Highest integral power of variable in a polynomial

Example: $5x^3 + x^7 + 2$

power/degree = 7

$x = y$

$xy^1 + 2x^1 \Rightarrow 2$

$x \times y = x \times x = x^2$

$= y \times y = y^2$

Value of a polynomial

$p(x) = x^2 + 3x + 2$

polynomial in x

Find the value of $p(x)$ for $x = 2$ $\Rightarrow$ 12

$p(2) = 2^2 + 3(2) + 2$

$= 4 + 6 + 2$

$= 12$

Zero or Factor of a polynomial

For a polynomial p(x) if any value of x makes value of p(x)=0 then it is called as zero or factor of the polynomial.

$p(x) = x^2 + 3x + 2$

Check if x = -2 or 1 is a factor for p(x)

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

$4 - 6 + 2 = 6 - 6 = 0$

$(x+2) = 0$

Remainder Theorem

$x^2 + 3x + 2 \div (x+3)$

$\Rightarrow R = 2$

$p(x) = x^2 + 3x + 2$

Find the remainder when divided by $(x+3) = 0$

$x = -3$

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

$= 9 - 9 + 2$

$= 2$

Important Formulae

1. $(a+b)^2 = a^2 + 2ab + b^2$
2. $(a-b)^2 = a^2 - 2ab + b^2$
3. $a^2 - b^2 = (a+b)(a-b)$
4. $(x+a)(x+b) = x^2 + (a+b)x + ab$
5. $(a+b)^3 = a^3 + 3a^2b + 3ab^2 + b^3 = a^3 + b^3 + 3ab(a+b)$
6. $(a-b)^3 = a^3 - 3a^2b + 3ab^2 - b^3 = a^3 - b^3 - 3ab(a-b)$

7. $a^3 + b^3 = (a+b)(a^2 - ab + b^2) = (a+b)^3 - 3ab(a+b)$

8. $a^3 - b^3 = (a-b)(a^2 + ab + b^2) = (a-b)^3 + 3ab(a-b)$

9. $(a+b+c)^2 = a^2 + b^2 + c^2 + 2ab + 2bc + 2ac$

10. $\dfrac{a^3+b^3+c^3-3abc}{a^2+b^2+c^2-ab-bc-ac} = a+b+c$

$a+b+c \to 0$

$a^3+b^3+c^3-3abc = 0$

$a^3+b^3+c^3 = 3abc$

What will happen if (a + b + c) = 0 for formula no. 10?

Methods for finding factor for polynomials

- Factorization
- Factor Theorem
- Synthetic Division

What should be subtracted from 5y - 13x - 8a to obtain 11x - 16y +7 a?

(a) 24x - 21y + a

(b) 6x + 21y + 15a

(c) 21y - 5x - a

(d) 21y - 24x -15a

$5y - 13x - 8a - p(x) = (11x - 16y + 7a)$

$5y - 13x - 8a - 11x + 16y - 7a = p(x)$

$21y - 24x - 15a$

If $p(x) = x^2 - 2\sqrt{2}x + 1$, then p($2\sqrt{2}$) is equal to

(a) 0

(b) 1

(c) $4\sqrt{2}$

(d) $8\sqrt{2}$ +1

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

$= 1$

$x + p = 2$

If $x = 2 - p$, then $x^3 + 6xp + p^3$ is equal to

(a) 12

(b) 6

~~(c)~~ 8

(d) 4

$x^3 + 3x^2p + 3xp^2 + p^3 = 8$

$x^3 + 3xp(x + p) + p^3$

$+ 3xp \cdot 2$

$x^3 + 6xp + p^3 = 8$

For $a = -5$ and $b = 5$, value of $a^2 - b^2$ is

(a) - 10

(b) 0

(c) - 50

(d) 100

$(-5)^2 - (5)^2$

$25 - 25$

$= 0$

10

$a = 2x \quad b = y \quad c = -3$

$a^3 - 3abc + b^3 + c^3$

-27

What is the value of $8x^3 + 18xy + y^3 - 27$, when $2x + y - 3 = 0$?

$a+b+c=0$

(a) -27

(b) 27

(c) 0

(d) 1

$-3abc$

$-3 \cdot 2x \cdot y \cdot -3$

$18xy$

$a^3+b^3+c^3 = 3abc$

$a^3+b^3+c^3 - 3abc = 0$

$x^2 - 14x + 49$

$(x-7)(x-7)$

49

$-7 \quad -7$

What is the square root of the following?

$(x^2 - 14x + 49)\ (x^2 + 6x + 9)$

(a) $(x - 4)(x + 9)$

(b) $(x - 7)(x + 3)$

(c) $(x - 1)(x + 17)$

(d) $(x - 3)(x + 8)$

$(x+3)(x+3)$

$\sqrt{(x-7)(x-7)(x+3)(x+3)}$

What is the simplified value of

$$\frac{1}{8}\left\{\left(x+\frac{1}{y}\right)^2-\left(x-\frac{1}{y}\right)^2\right\}$$

(a) $\frac{x}{2y}$ (b) $\frac{x}{y}$ (c) $\frac{4x}{y}$ (d) $\frac{2x}{y}$

$$\frac{1}{8}\left\{x^2+\frac{1}{y^2}+\frac{2x}{y}-x^2-\frac{1}{y^2}+\frac{2x}{y}\right\}$$

$$=\frac{1}{8}\times\frac{4x}{y}=\frac{x}{2y}$$

If $x^2 + (4-\sqrt{3})x - 1 = 0$, then what is the value of $x^2 + \frac{1}{x^2}$?

(a) $9 - 8\sqrt{3}$
(b) $21 - 12\sqrt{3}$
(c) $21 - 8\sqrt{3}$
(d) $17 - 8\sqrt{3}$

$(a-b)^2 = a^2 + b^2 - 2ab$.

$x^2 + \frac{1}{x^2} - 2x \cdot \frac{1}{x} = 3 + 16 - 8\sqrt{3}$

$x^2 + \frac{1}{x^2} = 21 - 8\sqrt{3}$

$x^2 + (4-\sqrt{3})x - 1 = 0$

$x^2 - 1 = -(4-\sqrt{3})x$

$\frac{x^2 - 1}{x} = \sqrt{3} - 4$

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

What is the value of

$$a(a+b^2+c)+b^2(a^2+b^2+c^2)-c(a+b^2),$$

when $a=1$, $b=-3$ and $c=-2$?

(a) 176
(b) 138
(c) 154
(d) 162

$1\cdot(1+9-2)+9(1+9+4)-(-2)(1+9)$

$8+126+20$

$134+20 = 154$

HCF

If highest common factor of $x^2 - px - q$ and $5x^2 - 3px - 15q$ is $(x-3)$, then value of p and q will be

(a) $\frac{5}{3}, 4$ (b) $-\frac{5}{3}, -4$ (c) $\frac{5}{2}, \frac{3}{2}$ (d) $4, -\frac{3}{5}$

$p(x) = x^2 - px - q$

$q(x) = 5x^2 - 3px - 15q$

$(x-3) = 0$

$x = 3$

$p(3) = 9 - 3p - q = 0$

$q = 3p + q$

$q(3) = 45 - 9p - 15q = 0$

$45 = 9p + 15q$

$15 = 3p + 5q$

$q = 3p + q$

$6 = 4q$

$q = \frac{6}{4}$

$q = \frac{3}{2}$

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