

Algebraic Expressions

Algebraic Expression:

⇒ • Combination of constants and variables connected by operators ($\oplus, \ominus, \otimes, \div$).

eg. (i) $\underline{2x + 3y}$ is an algebraic expression with terms $(2x)$ and $(3y)$

(ii) $\underline{5a + 3b - 7c}$ is an algebraic expression with terms $(5a)$, $(3b)$ and $(-7c)$
3 terms

Term: Various parts of expression separated by \oplus or \ominus sign.

Q. Find no. of terms in the given algebraic exp.

(i) $3x - 5y + 3a$

\Rightarrow (ii) $\frac{3a + 5y - 2a + 6x}{\quad}$ \Rightarrow 3 terms

\Rightarrow $a + 5y + 6x$

(iii) $\frac{2xy + 3yz + 5zx + 4xyz}{\quad}$
4 terms

Types of algebraic expression

① Monomial: only.
• expression with one term.

eg: $4x^2$, $3a$, $\sqrt{16}$, $\sqrt{8}$, 0

② Binomial: expressions with only two terms.

eg: $x+3$, $5-2x$, $3a+4y$

$\frac{2}{3}x^2 + xyz^2$, $2xy - 5xy$ not a binomial.

③ Trinomial: only 3 terms.

eg: $x+3+y$

$\sqrt{121} + 7x - 4y$, $5xy - 3ab + 7xb$.
 $3x - 2x + y$ not a trinomial.

Polynomial :

↓
general name to represent algebraic expressions
with 4 or more terms.

eg. $\underbrace{a^2 + b^2 + c^2 + d^2 + e^2}_{\substack{5 \text{ terms} \\ \text{polynomial.}}}$

Factors and Coefficient:

eg $(7x^2) + (2x) - (3y)$

3 terms:

7 is coefficient of x^2 $\leftarrow [7x^2] \rightarrow \begin{array}{l} 7 \text{ is a factor of } 7x^2 \\ x \text{ is a factor of } 7x^2 \end{array}$

2 is coefficient of x $\leftarrow [(2)x] \rightarrow 2, \text{ and } x \text{ are the factors.}$

-3 is coefficient of y $\leftarrow [(-3)y] \rightarrow 3, \cancel{y}, -3, -y$

Constant term :

term without a literal factor.

eg: $5x + 7$ \rightarrow constant term

eg: $5y^2 - 2y + x - y + 7$

No. of terms: 4 $\boxed{5y^2 - 3y + x + 7}$

$$\boxed{5y^2 - 3y + 1x + 7}$$

coefficient of x is 1

coefficient of y is -3

Like and Unlike Terms

→ Terms not having same literal factors (variables)

$$\neq \quad \underline{7x} \quad \text{and} \quad \underline{8x^2}$$
$$\quad \quad -2ab \quad \text{and} \quad -3pq$$

→ Terms having same literal factors (or variables)

$$\underline{7x} \quad \text{and} \quad \underline{9x}$$
$$\quad \quad -2ab \quad \text{and} \quad -3ba$$

Q. If $a = 1$, $b = 2$ and $c = -1$, find the

value of (i) $a^2 + b^2 + 2ab$

$$\Rightarrow (1)^2 + (2)^2 + 2(1)(2)$$

$$\Rightarrow 1 + 4 + 4$$

$$\Rightarrow 9$$

$$-1 \times -1$$

(ii) $a^2 + b^2 + c^2 - ab - bc - ac$

$$\Rightarrow 7$$

$$\Rightarrow (1)^2 + (2)^2 + (-1)^2 - 2 - (-2) - (-1)$$

$$\Rightarrow 1 + 4 + 1 - 2 + 2 + 1$$

$$\Rightarrow 6 - 2 + 3$$

$$\Rightarrow 4 + 3$$

$$\Rightarrow 7$$

Q. Evaluate the following algebraic expressions for $x=2$, $y=-3$, $z=-2$, $a=4$, $b=3$;

(i) $2a^2 + x^2 - y^2$
 $\Rightarrow 3$

(ii) $x^3 - y^3 + z^3$
 $\Rightarrow 8 - (-27) + (-8)$
 $\Rightarrow 8 + 27 - 8$
 $\Rightarrow 27$

(iii) $x^3 + y^3 + 3xyz + ab$
 $\Rightarrow 23$

Operations on Algebraic Expressions

$$\boxed{\sqrt{x^2} = x}$$

Addition and Subtraction

Ex. Add $\underline{4xy}$, $\underline{12xy}$ and $\underline{3xy}$

$$\textcircled{19xy}$$

$$\begin{array}{r} 5 - 2 \\ 5 + (-2) \end{array}$$

② Add $\underline{3a^2b}$, $\underline{2a^2b}$ and $\underline{a^2b}$

$$\textcircled{6a^2b}$$

$$\textcircled{3} \quad \underline{3(x^2+y^2)} + \underline{2(x^2+y^2)} \rightarrow$$

$$\Rightarrow \underline{5(x^2+y^2)}$$

$$\underline{3x^2} + 3y^2 + \underline{2x^2} + 2y^2 \checkmark$$

$$\Rightarrow \underline{5x^2} + \underline{5y^2}$$

$$\Rightarrow 5(x^2+y^2)$$

$$3(x^2+y^2) = \underline{3x^2} + \underline{3y^2}$$

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

④ Add $4x^2y$, $8x^2y$ and $-2x^2y$

$$\boxed{10x^2y}$$

⑤ Add: $\left(\frac{xy^2 + 4x^2y - 7x^2y - 3xy^2 + 3}{} \right)$ and $\left(\frac{x^2y + xy^2}{} \right)$

$$\Rightarrow xy^2 - 3xy^2 + \cancel{xy^2} + \underline{4x^2y - 7x^2y} + x^2y + 3$$

$$\Rightarrow \underline{-xy^2 - 2x^2y + 3}$$

② $\Rightarrow \underline{5x^2 + 7y - 6z^2}, \underline{4y + 3x^2}, \underline{9x^2 + 2z^2 - 9y} \text{ and } \underline{2y - 2x^2}$

$$\Rightarrow 5x^2 + 3x^2 + 9x^2 - 2x^2 + 7y + 4y - 9y + 2y - 6z^2 + 2z^2$$

$$\Rightarrow \underline{15x^2 + 4y - 4z^2}$$

Q. From the sum of $4x^4 - 3x^3 + 6x^2$, $4x^3 + 4x - 3$ and $-3x^4 - 5x^2 + 2x$ Subtract $(5x^4 - 7x^3 - 3x + 4)$.

Sol.

$$x^4 + x^3 + x^2 + 6x - 3 - (5x^4 - 7x^3 - 3x + 4)$$

$$= \underline{x^4 - 5x^4} + x^3 + 7x^3 + x^2 + 6x + 3x - 3 - 4$$

$$= \underline{-4x^4 + 8x^3 + x^2 + 9x - 7}$$

Q. Subtract $\boxed{5x}$ from $\boxed{9x}$

$$\begin{array}{r} 9x - 5x \\ \hline 4x \end{array}$$

Subtract $-5x$ from $9x$

$$\underline{9x} - (\underline{-5x})$$

$$9x + 5x$$

$$14x$$

Subtract $\underline{\underline{(-5x + 2y)}}$ from $(9x - 4y)$

$$\begin{array}{r} (9x - 4y) - (-5x + 2y) \\ \hline 9x - 4y + 5x - 2y \end{array}$$

Q. What should be added to $a^2 + 2ab + b^2$ to obtain $4ab + b^2$? ✓

⇒ Required expression would be: $\frac{4ab + b^2}{\quad} - \frac{(a^2 + 2ab + b^2)}{\quad}$

$$\Rightarrow \frac{4ab + \cancel{b^2}}{\quad} - a^2 - \underline{2ab} - \cancel{b^2}$$

$$\Rightarrow 4ab - 2ab - a^2$$

$$\Rightarrow \boxed{2ab - a^2}$$

Q. How much is $2a^2 - 7a + 5$ less than $a^3 - 3a^2 + 2a - 3$?

$$a^3 - 5a^2 + 9a - 8$$

Simplify:

$$-m - [m + \{m + n - 2m - (m - 2n)\} - n]$$

$$-2n$$

H.W.

Simplify: $\left[3x^2z - 4yz + 3xy - \{x^2z - (x^2z - 3y) - 4yz - 7z\} \right]$

$$= 3x^2z - 4yz + 3xy - \{ \cancel{x^2z} - \cancel{x^2z} + 3y - 4yz - 7z \}$$

$$= 3x^2z - \cancel{4yz} + 3xy - \{ 3y - 4yz - 7z \}$$

$$= \cancel{3x^2z} - \cancel{4yz} + \cancel{3xy} - 3y + \cancel{4yz} + 7z$$

$$= \boxed{3x^2z + 3xy - 3y + 7z} \checkmark$$

Simplify: $15x - [8x^3 + 3x^2 - \{8x^2 - (4 - 2x - x^3) - 5x^3\} - 2x]$

$= 19x - 12x^3 + 5x^2 - 4$ ✓

Standard form: $-12x^3 + 5x^2 - 19x - 4$ ✓

$$2(4 - 3x)$$

$$\Rightarrow 8 - 6x$$

$$-2(4 - 3x)$$

$$\Rightarrow -8 + 6x$$

$$\boxed{-1(4 - 3x)}$$
$$-(4 - 3x)$$

Simplify $\checkmark 4(a^2 + b^2 + 2ab) - [4(a^2 + b^2 - 2ab) - \{-b^3 + 4(a-3)\}]$, and find the value of the expression when $a = 3$ and $b = 1$.

$$= 4a^2 + 4b^2 + 8ab - [4a^2 + 4b^2 - 8ab - \{-b^3 + 4a - 12\}]$$

$$= 4a^2 + 4b^2 + 8ab - [4a^2 + 4b^2 - 8ab + b^3 - 4a + 12]$$

$$= \cancel{4a^2} + \cancel{4b^2} + 8ab - \cancel{4a^2} - \cancel{4b^2} + 8ab - b^3 + 4a - 12$$

$$= 16ab - b^3 + 4a - 12$$

$$\checkmark = \boxed{-b^3 + 16ab + 4a - 12}$$




Standard form

$$\text{So, } -1^3 + 16 \times 3 \times 1 + \cancel{4 \times 3} - \cancel{12}$$

$$= -1 + 48$$

$$= \underline{\underline{47}} \checkmark$$

Linear Equations in One Variable


$$\boxed{\underline{9+5} = \underline{14}}$$
$$\boxed{9+5 \neq 15}$$

Statement of equality. (✓)
Statement of inequality (X)

$$9 + 5 = 14$$

$$\underline{2 \times (3 + 7) = 2 \times 3 + 2 \times 7}$$

} Statement of equality.

None of them involves a variable (literal)

- 3 added to x is 8.

$$\boxed{3 + x = 8}$$

equations

$$\Rightarrow x = 8 - 3$$

$$\boxed{x = 5}$$

End of the Chapter