GRADE 8

MATHEMATICS

TOPIC: ALGEBRAIC EXPRESSIONS

Introduction

Algebra involves the use letters of the alphabet to stand for numbers.

$4 + 7$ is called a numeric expression.

$x + 7$ is called an algebraic expression.

Terms of an algebraic expression.

A term in algebra is a combination of numbers and letters involving multiplication and division. Terms are separated by addition and subtraction signs.

Types of algebraic expressions

Word	Description
Polynomial	an algebraic expression consisting of one or more terms for which the exponents are whole numbers
Monomial	a polynomial consisting of one term
Binomial	a polynomial consisting of two terms
Trinomial	a polynomial consisting of three terms

Parts of an algebraic expression:

Word	Description
Variable	A letter in the expression which can vary in value
Coefficient	A number or variable multiplied by the factor
Constant term	A number that does not change

Activity 1

1.1 Study the given algebraic expression and answer the questions that follow:

$5m^2 - 4x - 9$

a) Write down the coefficient of x

b) Write down the constant term

c) Is the given expression a monomial, binomial or trinomial?

d) Write down all the variables in the given expression

1.2 Study the given algebraic expression and answer the questions that follow:

$\frac{2}{7}p^5 + 4q + (r - w)^3 + 18$

a) Write down the coefficient of p

b) Write down the constant term

c) Write down all the variables in the given expression

Conventions for writing algebraic expressions

- $1k^1 = k$
- $y \times 3 = 3y$
- $4 \times c \times 2 \times a \times b = 8abc$

Simplification of algebraic expressions.

Like terms are terms that consist of the same variable with the same exponent.

Activity 2

Simplify the following expressions

a) $3x - 2x^2 + 6x + 10x^2$

b) $-4ab^2 + 2a^2b - 7ab^2 + 5a^2b$

c) $4p^2 - q + 5 - 2q + 8 - 3p^2 - 6r$

d) $7xy - 2x - 8y + 3yx - 10x + 6y$

Multiplication of algebraic expressions

Multiplying polynomials by a monomial

Distributive law:

Example

$2(5 + 3)$

$= (2 \times 5) + (2 \times 3)$

$= 10 + 6$

$= 16$

∴Generalisation

$a(b + c)$

$= a \times b + a \times c$

$= ab + ac$

Activity 3

Simplify the following expressions

a) $6y \times 3$

b) $5x^3 \times -2x^7$

c) $4(3a + 2b)$

d) $pq(7p^3 - 4q^2 + 2pq)$

e) $6k(3k^2 + 2m) - 3k(k^2 - 2m)$

Division of algebraic expressions

Dividing polynomials by a monomial

$$\frac{10+15}{5}$$
$$= \frac{10}{5} + \frac{15}{5}$$
$$= 2 + 3$$
$$= 5$$

∴Generalisation

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

Activity 4

Simplify the following expressions

a) $\frac{18x^9}{12x^7}$

b) $\frac{5b^6}{10b^8}$

c) $\frac{4x^6 + \left(2x^3\right)^2}{3x^4 \times 4x^5}$

d) $\frac{6m^7 - 8m^5}{2m^4}$

e) $\frac{7p^2q - 21pq^2 + 14p}{7pq}$

Squares, cubes, square roots and cube roots of monomials.

Squares and cubes.

To determine the square or cube of a monomial, apply the third law of exponents.
I.E. $\left(a^m\right)^n = a^{m\times n}$ and $\left(ab\right)^m = a^m b^m$

To determine the square root of a monomial, apply the rule: $\sqrt{a^m b^n} = a^{\frac{m}{2}} b^{\frac{m}{2}}$

To determine the cube root of a monomial, apply the rule: $\sqrt[3]{a^m b^n} = a^{\frac{m}{3}} b^{\frac{m}{3}}$

Activity 5

Determine:

a) The square of $-5k^3$

b) The cube of $2x^5y^4$

c) The square root of $36a^{12}$

d) The cube root of $\left(12x^9 + 15x^9\right)$

Answers

Activity 1

1.1 Study the given algebraic expression and answer the questions that follow:

$5m^2 - 4x - 9$

a) Write down the coefficient of x

4

b) Write down the constant term

-9

c) Is the given expression a monomial, binomial or trinomial?

Trinomial

d) Write down all the variables in the given expression

m and x

1.2 Study the given algebraic expression and answer the questions that follow:

$\frac{2}{7}p^5 + 4q + (r - w)^3 + 18$

a) Write down the coefficient of p^5

$\frac{2}{7}$

b) Write down the constant term

18

c) Write down all the variables in the given expression

p; q; r and w

Activity 2

Simplify the following expressions

a) $3x-2x^2+6x+10x^2$

$=-2x^2+10x^2+3x+6x$

$=8x^2+9x$

b) $-4ab^2+2a^2b-7ab^2+5a^2b$

$=-4ab^2-7ab^2+2a^2b+5a^2b$

$=-11ab^2+7a^2b$

c) $4p^2-q+5-2q+8-3p^2-6r$

$=4p^2-3p^2-q-2q-6r+5+8$

$=p^2-3q-6r+13$

d) $7xy-2x-8y+3yx-10x+6y$

$=7xy-2x-8y+3xy-10x+6y$

$=7xy+3xy-2x-10x-8y+6y$

$=10xy-12x-2y$

Activity 3

Simplify the following expressions

a) $6y \times 3$

$= 18y$

b) $5x^3 \times -2x^7$

$= -10x^{10}$

c) $4(3a + 2b)$

$= 12a + 8b$

d) $pq(7p^3 - 4q^2 + 2pq)$

$= 7p^4q - 4pq^3 + 2p^2q^2$

e) $6k(3k^2 + 2m) - 3k(k^2 - 2m)$

$= 18k^3 + 12km - 3k^3 + 6km$

$= 15k^3 + 18km$

Activity 4

Simplify the following expressions

a) $\dfrac{18x^9}{12x^7}$

$= \dfrac{3x^{9-7}}{2}$

$= \dfrac{3x^2}{2}$

b) $\dfrac{5b^6}{10b^8}$

$= \dfrac{1}{2b^{8-6}}$

$= \dfrac{1}{2b^2}$

c) $\dfrac{4x^6 + \left(2x^3\right)^2}{3x^4 \times 4x^5}$

$= \dfrac{4x^6 + 4x^6}{12x^9}$

$= \dfrac{8x^6}{12x^9}$

$= \dfrac{2}{3x^3}$

d) $\dfrac{6m^7 - 8m^5}{2m^4}$

$= \dfrac{6m^7}{2m^4} - \dfrac{8m^5}{2m^4}$

$= 3m^3 - 4m$

e) $\dfrac{7p^2q - 21pq^2 + 14p}{7pq}$

$= \dfrac{7p^2q}{7pq} - \dfrac{21pq^2}{7pq} + \dfrac{14p}{7pq}$

$= p - 3q + \dfrac{2}{q}$

Activity 5

Determine:

a) The square of $-5k^3$

$= \left(-5k^3\right)^2$

$= (-5)^2 k^6$

$= 25k^6$

b) The cube of $2x^5y^4$

$= \left(2x^5y^4\right)^3$

$= (2)^3 x^{15} y^{12}$

$= 8x^{15}y^{12}$

c) The square root of $36a^{12}$

$= \sqrt{36a^{12}}$

$= 6a^6$

d) The cube root of $\left(12x^9 + 15x^9\right)$

$= \sqrt[3]{\left(12x^9 + 15x^9\right)}$

$= \sqrt[3]{27x^9}$

$= 3x^3$