

MATIMATICS Grade 8

Unit SUMMARY 2

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Further on
working with
variables

Further on Algebraic Terms and Expressions

Definition of Variables, Terms and Expressions

- ❖ A **variable** is a symbol or letter such as x , y and z used to represent an unknown number (value).
- ❖ **Algebraic expressions** are formed by using numbers, letters and the operations of addition, subtraction, multiplication, division, raising to power and taking roots.
- ❖ An algebraic expression that contains no variable at all is called **constant**.
- ✓ For example, the algebraic expression $72 - 16\pi$ is constant.

Cont.

❖ The **terms of an algebraic expression** are parts of the expression that are connected by plus or minus signs.

➤ An algebraic expression in algebra which contains one term is called a **monomial**.

Example $13a^2b^2$

➤ An algebraic expression in algebra which contains two terms is called a **binomial**.

Example $2x + 2y$, $7a - 9ab$

➤ An algebraic expression in algebra which contains three terms is called a **trinomial**.

Example $3x^2 - 5x + 2$

Cont.

- ❖ Terms which have the same variables, with the corresponding variables are raised to the same powers are called **like terms**; other wise called **unlike terms**.
- Constant terms with out variables, (or all constant terms) are like terms.
- Only like terms can be added or subtracted to form a more simplified expression.

Like Terms	Unlike Terms
$34XY$ and $-8XY$	$12XY$ and $6X$
$25P^2q^3$ and $7q^3p^2$	$10W^2$ and $20W^7$

Multiplication of Monomial by Binomial

- For any rational numbers a , b , and c
 - i. $a(b + c) = ab + ac$
 - ii. $a(b - c) = ab - ac$
- These two properties are called the **distributive properties** of multiplication over Addition and subtraction.

Examples

1, $2(a + b) + 3(a + b)$

$2a + 2b + 3a + 3b$ Distributive property

$5a + 5b$ Combining like terms

2, Multiply $4c^2$ by $(16abc - 5a^2bc)$

$4c^2(16abc - 5a^2bc)$

$4c^2(16abc) - 4c^2(5a^2bc)$

$64abc^3$ - $20a^2bc^3$

Multiplication of Binomial by Binomial

- If $(a + b)$ and $(c + d)$ are any two binomials their product

$(a + b) \times (c + d)$ is defined as:

$$a(c + d) + b(c + d)$$

$$ac + ad + bc + bd$$

Therefore $(a + b) \times (c + d) = ac + ad + bc + bd$

Examples

1, Multiply $(4x + 4)$ by $(3x + 8)$

$$(4x + 4)(3x + 8) = 4x(3x + 8) + 4(3x + 8)$$

$$= 12x^2 + 32x + 12x + 32$$

$$= \underline{12x^2 + 44x + 32}$$

2, Simplify $(x + 1)^2 + (x + 2)^2$

$$(x + 1)^2 + (x + 2)^2 = (x + 1)(x + 1) + (x + 2)(x + 2)$$

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

$$= x^2 + x + x + 1 + x^2 + 2x + 2x + 4$$

$$= \underline{\underline{2x^2 + 6x + 5}}$$

Highest Common Factors

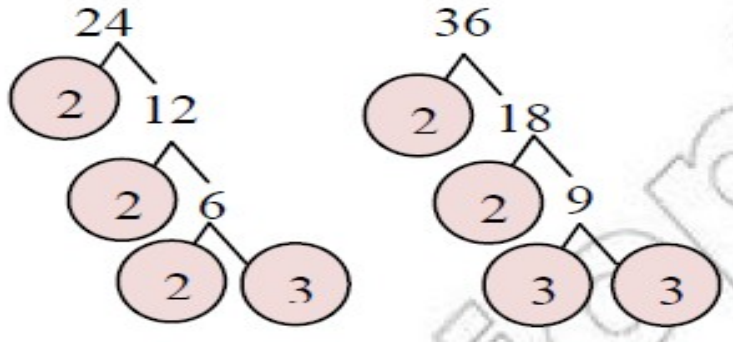
Factorizing: To factorize an integer means to write the integer as a product of two or more integers. To factorize a monomial or a Binomial means to express the monomial or Binomial as a product of two or more monomial or Binomials.

Eg. $15x^3 = (3 \times 5) \times (X \times X \times X)$
 $= (3x) \times (5x) \times (x).$

Highest common factor of two integers

- The highest common factor (denoted by HCF) of two or more integers is the highest factor common to each integer.
- To find the highest common factor of two integers, it is often helpful to express the numbers as a product of prime factors

Eg. Find the highest common factor of 24 and 36



$$24 = 2^3 \times 3 \text{ and } 36 = 2^2 \times 3^2$$

$$\begin{aligned} \text{HCF } 2^2 \times 3 &= 4 \times 3 \\ &= \underline{12} \end{aligned}$$

Highest common factor (HCF) of two or more monomials

Eg. Find the HCF among each group of terms.

1. $7x^3, 14x^2, 21x^4$

$$7x^3 = 7 \cdot x \cdot x \cdot x$$

$$14x^2 = 7 \cdot 2 \cdot x \cdot x$$

$$21x^4 = 7 \cdot 3 \cdot x \cdot x \cdot x \cdot x$$

$$\text{HCF } 7x \cdot x = \underline{\underline{7x^2}}$$

Factorizing out the highest common factor

Eg. Find the highest common factors

A, $6x^2 + 3x$

$$3x^2 \cdot X \cdot X + 3x^1 \cdot X$$

$$\underline{3X}(2X + 1)$$

Therefore HCF is $3X$

B, $15y^3 + 12y^4$

$$5x^3Y^3 + 4x^3Y^3 \cdot Y$$

$$\underline{3Y^3}(5 + 4Y)$$

Therefore HCF is $3Y^3$

Factorizing, out a binomial factor

- The distributive property may also be used to factor out a common factor that consists of more than one term such as a binomial

Eg. Factor out the highest common factor:

$$A, 2x(5x + 3) - 5(5x + 3)$$

$$\underline{(5x + 3)}(2x - 5)$$

Therefore HCF is $(5x + 3)$

$$B, 4(x + 5)^2 + 5x(x + 5) - (x + 5)$$

$$4(x + 5)(x + 5) + 5x(x + 5) - 1(x + 5)$$

$$\underline{(x + 5)}(4(x + 5) + 5x - 1)$$

Therefore HCF is $(x + 5)$



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Exercise

1. If $a=2$, $b=3$, then what is the value of $\frac{4a + 2b}{2a}$
2. Simplify the following product $(2ab^2)(2a-3b)$.
3. Simplify $(a^2-ab)(a^2+ab)$
4. The HCF of $27x^3 y^2 z$ and $9x^2y^5$ is_____.
5. The HCF of $21a$ _____ $a-3$) is _____.

