Factorization

The process of writing an algebraic expression as the product of two or more algebraic expressions is called *factorization*.

Example: $30x^2y = 2 \times 3 \times 5 \times x \times x \times y$

Each 2, 3, 5, x, x, and y is a factor of $30x^2y$. Therefore $30x^2y$ is exactly divisible by 2, 3, 5, x, and y, and hence these are all factors of $30x^2y$. Also, the product of all these factors will be a factor of $30x^2y$.

Note: 1 is a factor of every algebraic term. So 1 is a factor of $30x^2y$ also.

Note: Factorisation is nothing but converting addition Expression to multiplication Expression.

Ex: Factorise $2x^2+x$.

$\therefore$ $\underline{2x^2+x}$

$= \underline{x(2x+1)}$

Ex: Factorise $6x^3+4x^2+2x$

$\rightarrow$ $\underline{6x^3+4x^2+2x}$

$= 2x(3x^2+2x+1)$

Exercise 5.4

1. Find all possible factors of the following

(a) $16x^3y^2$

$16x^3y^2 = 2\times2\times2\times2\times x\times x\times x\times y\times y$

$$\begin{array}{r|l} 2 & 16 \\ 2 & 8 \\ 2 & 4 \\ 2 & 2 \\ & 1 \end{array}$$

(b) $27p^3q^2r^3$

$27p^3q^2r^3$

$= 3\times3\times3\times p\times p\times p\times q\times q \times r\times r\times r$

$$\begin{array}{r|l} 3 & 27 \\ 3 & 9 \\ 3 & 3 \\ & 1 \end{array}$$

(c), (d) H.W

(2) Find the common factors of the following monomials.

(a) p^2, p^3

→ Common factor :- p^2

(b) $5z^3, 30z^2p$

→ common factor :- $5z^2$

(c) $ax^2, 5xa$

→ ax

(d) $39y^4z^3, 13y^4z$

→ $13y^4z$

3. Factorise the following algebraic Expression by taking common.

(a) $9m^5 - 18m^4 - 27m^3$

$= 9m^3(1m^2 - 2m - 3)$

$1 \quad 2 \quad 4$

$\cancel{4}, \cancel{8}, \cancel{16}$

4.

(b) $4x^2y^2 + 8xy - 16x^3y^3$

$= 4xy(1xy + 2 - 4x^2y^2)$

ⓒ $32x^2 + 18x - 24x^3$ $\qquad \cancel{32}^{16}, \cancel{18}^{9}, \cancel{24}^{12}$

$= 2x(16x + 9 - 12x^2)$ $\qquad$ 2

ⓓ $3ax^2y + 15axy^2 + 30a^2xy$

$= 3axy(1x + 5y + 10a)$

(4) Factorise (By taking common)

ⓐ $3(x-5) + x(x-5)$

$= (x-5)(3+x)$

ⓑ $5y(a-b) - 8(a-b)$

$= (a-b)(5y-8)$

ⓒ $-6(p-2q) + 4(p-2q)^2$ $\qquad \cancel{6}^{3}, \cancel{4}^{2}$ $\qquad$ 2

$= 2(p-2q)[-3 + 2(p-2q)]$

ⓓ $16(m+n)^3 + 16(m+n)^2$

$= 16(m+n)^2[1(m+n) + 1]$

(5) Factorize using Suitable grouping

(a) $abc - ab - c + 1$

$= ab(c-1) - 1(c-1)$

$= (c-1)(ab-1)$

(b) $p^2q - pr^2 - pq + r^2$

$= p^2q - pq - pr^2 + r^2$

$= pq(p-1) - r^2(p-1)$

$= (p-1)(pq - r^2)$

I^st^ method	II^nd^ method
(c) $4x^2 + 2y^2 + x^2y^2 + 8$	$4x^2 + 2y^2 + x^2y^2 + 8$
$= 4x^2 + x^2y^2 + 2y^2 + 8$	$= 2y^2 + x^2y^2 + 4x^2 + 8$
$= x^2(4 + y^2) + 2(y^2 + 4)$	$= y^2(2 + x^2) + 4(x^2 + 2)$
$= (y^2+4)(x^2+2)$	$= (2+x^2)(y^2+4)$