



Class Note \_ Workshop Calculation & Science



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ESTD: 2015 Siromonipur, Bishnupur, Bankura, 722122 (W.B.)



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### ADDITION AND SUBTRACTION OF ALGEBRAIC NUMBER

Algebraical quantities of similar terms may be added or subtracted. A few examples are given below.

Example 1 : Find the sum of  $2xy$ ,  $6xy$ ,  $7xy$ .

Solution : The sum of the numerical coefficients

$$= 2 + 6 + 7 = 15$$

$$2xy + 6xy + 7xy = 15xy$$

Ans.

Example 2 : Add the following

(i)  $(7x + 2)$  and  $(2x + 3)$

(ii)  $(2x^3 + x^2 + x)$  and  $(4x^3 + 2x^2)$

Solution : (i)  $(7x + 2)$  and  $(2x + 3)$

$$(7x + 2) \times (2x + 3) = 7x + 2 + 2x + 3$$

[ $\because$  Remove bracket by multiplying each bracket with '+' symbol]

$$= 7x + 2x + 2 + 3$$

[ $\because$  Similar terms brought side by side for simplification]

$$= 9x + 5$$

Ans.

(ii)  $(2x^3 + x^2 + x)$  and  $(4x^3 + 2x^2)$

$$(2x^3 + x^2 + x) + (4x^3 + 2x^2)$$

$$= 2x^3 + x^2 + x + 4x^3 + 2x^2$$

$$= 2x^3 + 4x^3 + x^2 + 2x^2 + x$$

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

Ans.

Example 3 : Subtract  $(x^2 + 3xy)$  from  $(3x^2 + 8xy^2 + y^3)$

Solution :  $(3x^2 + 8xy^2 + y^3) - (x^2 + 3xy)$

$$= 3x^2 + 8xy^2 + y^3 - x^2 - 3xy$$

$$= 3x^2 - x^2 + y^3 + 8xy^2 - 3xy$$

$$= 2x^2 + y^3 + 8xy^2 - 3xy$$

$$= 2x^2 + 8xy^2 - 3xy + y^3$$

Ans.

Example 4 : Subtract the following

(i)  $(2x^2 - 4x - 1)$  from  $(6x^2 - 3x + 5)$

(ii)  $(2a^3 - a^2b - 2b^2a)$  from  $(a^3 + 2b^3 + 2a^2b + 3b^2a)$

Solution : (i)  $(2x^2 - 4x - 1)$  from  $(6x^2 - 3x + 5)$

$$2x^2 - 4x - 1$$

$$6x^2 - 3x + 5$$

subtract eq<sup>n</sup> (i) from (ii)

$$6x^2 - 3x + 5$$

$$2x^2 - 4x - 1$$

$$- \quad + \quad +$$

$$\hline 4x^2 + x + 6$$

(ii)  $(2a^3 - a^2b - 2b^2a)$  from  $(a^3 + 2b^3 + 2a^2b + 3b^2a)$

$$= (a^3 + 2b^3 + 2a^2b + 3b^2a) - (2a^3 - a^2b - 2b^2a)$$

$$= a^3 + 2b^3 + 2a^2b + 3b^2a - 2a^3 + a^2b + 2b^2a$$

$$= a^3 - 2a^3 + 2b^3 + 2a^2b + a^2b + 3b^2a + 2b^2a$$

$$= -a^3 + 2b^3 + 3a^2b + 5b^2a$$

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### MULTIPLICATION AND DIVISION OF ALGEBRAIC NUMBERS



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**Example 5 : Multiply  $2a^2b$  by  $4ab^2$**

**Solution :**  $(2a^2b)(4ab^2)$

$$= 4 \times 2 \times a^2 \times a \times b \times b^2$$
$$= 8a^3b^3$$

**Example 6 : Multiply  $(3x + 2y)$  by  $(5x + 3y)$**

**Solution :**  $(3x + 2y)(5x + 3y)$

$$= 3x(5x + 3y) + 2y(5x + 3y)$$
$$= 15x^2 + 9xy + 10xy + 6y^2$$
$$= 15x^2 + 19xy + 6y^2 \quad \text{Ans.}$$

**Example 7 : Evaluate :  $(5a^2 - 2b^3)(2a^3 + 5b^4)$**

**Solution :**  $(5a^2 - 2b^3)(2a^3 + 5b^4)$

$$= 5a^2(2a^3 + 5b^4) - 2b^3(2a^3 + 5b^4)$$
$$= 10a^5 + 25a^2b^4 - 4a^3b^3 - 10b^7$$

**Ans.**

**Example 8 : Evaluate :  $(x^2 + 7x - 30) \div (x - 3)$**

**Solution :**

$$\begin{array}{r} x+10 \\ x-3 \overline{)x^2+7x-30} \\ \underline{x^2-3x} \phantom{-30} \\ 10x-30 \\ \underline{10x-30} \\ 0 \end{array}$$

**Example 9 : Evaluate :  $(8x^3 + 18x^2 - 15x - 36) \div (4x^2 + 3x - 12)$**

**Solution :**

$$\begin{array}{r} 2x+3 \\ 4x^2+3x-12 \overline{)8x^3+18x^2-15x-36} \\ \underline{8x^3+6x^2-24x} \phantom{-36} \\ 12x^2+9x-36 \\ \underline{12x^2+9x-36} \\ 0 \end{array}$$



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## 6 FACTORS OF TRINOMIAL

A trinomial is an algebraic expression made up of three terms. When factoring trinomials that are in the form of  $ax^2 + bx + c = 0$ , the following steps are followed :

1. See if the coefficient  $a$ ,  $b$  and  $c$  all have any common factors that you can factor out.
2. Multiply  $a$  and  $c$  and list out all of the factor pairs of the product.
3. Calculate the sum of the pair of factors which are equal to  $b$ .
4. In the original equation, write  $bx$  in terms of the sums of the factors you choose.
5. Group the first two terms together in a set of paranthesis and the second two terms together in a set of separate paranthesis and factor out the greatest common factor for each set of paranthesis.
6. Add the terms that you factored out of the paranthesis and multiply by the paranthesis that has a match.
7. To solve the trinomial, set terms in each paranthesis equal to 0 and solve for  $x$ .

**Example 10 :** Factorize  $x^4 - 25$

$$\begin{aligned} \text{Solution : } (x^4 - 25) &= (x^2)^2 - (5)^2 \\ &= (x^2 + 5)(x^2 - 5) \\ &[\because (a^2 - b^2) = (a + b)(a - b)] \end{aligned}$$

**Example 11 :** Factorize  $8x^3 - 64y^3$

$$\begin{aligned} \text{Solution : } 8x^3 - 64y^3 &= (2x)^3 - (4y)^3 \\ &= (2x - 4y) [(2x)^2 + (4y)^2 \\ &\quad + (2x)(4y)] \\ &[\because a^3 - b^3 = (a - b)(a^2 + ab + b^2)] \\ &= (2x - 4y)(4x^2 + 16y^2 + 8xy) \end{aligned}$$

**Example 12 :** Factorize  $x^2 + 13x + 40$

$$\begin{aligned} \text{Solution : } x^2 + 13x + 40 &= x^2 + 8x + 5x + 40 \\ &= x(x + 8) + 5(x + 8) \\ &= (x + 5)(x + 8) \quad \text{Ans.} \end{aligned}$$

**Example 13 :** Factorize  $6x^4 - 15x^2y^2 + 9y^4$

$$\begin{aligned} \text{Solution : } 6x^4 - 15x^2y^2 + 9y^4 &= 6x^4 - 6x^2y^2 - 9x^2y^2 + 9y^4 \\ &= 6x^4 - 6x^2y^2 + 9y^4 - 9x^2y^2 \\ &= 6x^2(x^2 - y^2) - 9y^2(x^2 - y^2) \\ &= (6x^2 - 9y^2)(x^2 - y^2) \\ &= (6x^2 - 9y^2)(x + y)(x - y) \quad \text{Ans.} \end{aligned}$$

**Example 14 :** Factorize  $8x^3 - 125$

$$\begin{aligned} \text{Solution : } 8x^3 - 125 &= (2x)^3 - (5)^3 \\ &= (2x - 5) [(2x)^2 + (5)^2 + (2x)(5)] \\ &[\because a^3 - b^3 = (a - b)(a^2 + b^2 + ab)] \\ &= (2x - 5) [4x^2 + 25 + 10x] \\ &= (2x - 5)(4x^2 + 10x + 25) \quad \text{Ans.} \end{aligned}$$

**Example 15 :** Factorize  $x^8 - y^8$

$$\begin{aligned} \text{Solution : } (x^8 - y^8) &= (x^4)^2 - (y^4)^2 \\ &= (x^4 + y^4)(x^4 - y^4) \\ &[\because a^2 - b^2 = (a + b)(a - b)] \\ &= (x^4 + y^4) [(x^2)^2 - (y^2)^2] \\ &= (x^4 + y^4)(x^2 + y^2)(x^2 - y^2) \\ &= (x^4 + y^4)(x^2 + y^2) [(x)^2 - (y)^2] \\ &= (x^4 + y^4)(x^2 + y^2)(x + y)(x - y) \quad \text{Ans.} \end{aligned}$$

**Example 16 :** Factorize  $x^8 - \frac{1}{x^8}$

$$\begin{aligned} \text{Solution : } (x^4)^2 - \left(\frac{1}{x^4}\right)^2 &= \left(x^4 - \frac{1}{x^4}\right) \left(x^4 + \frac{1}{x^4}\right) \\ &= \left[(x^2)^2 - \left(\frac{1}{x^2}\right)^2\right] \left[x^4 + \frac{1}{x^4}\right] \\ &= \left(x^2 - \frac{1}{x^2}\right) \left(x^2 + \frac{1}{x^2}\right) \left(x^4 + \frac{1}{x^4}\right) \\ &= \left(x - \frac{1}{x}\right) \left(x + \frac{1}{x}\right) \left(x^2 + \frac{1}{x^2}\right) \left(x^4 + \frac{1}{x^4}\right) \quad \text{Ans.} \end{aligned}$$

**Example 17 : Factorize  $a^2 - b^2 - a - b$**

**Solution :**  $a^2 - b^2 - a - b$

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

$$= (a - b)(a + b) - (a + b)$$

$$= (a + b)[(a - b) - 1]$$

$$= (a + b)(a - b - 1)$$

**Ans.**

**Example 18 : Factorize  $x(x + z) - y(y + z)$**

**Solution :**  $x(x + z) - y(y + z)$

$$= x^2 + xz - y^2 - yz$$

$$= (x^2 - y^2) + (xz - yz)$$

$$= (x + y)(x - y) + z(x - y)$$

$$= (x - y)(x + y + z)$$

**Ans.**

**Example 19 : Factorize  $x^4 + x^2 + 1$**

**Solution :**  $x^4 + x^2 + 1$

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

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

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

**Example 20 : Factorize  $x^4 + 4$**

**Solution :**  $x^4 + 4$

Add and subtract  $4x^2$

$$= x^4 + 4x^2 + 4 - 4x^2$$

$$= (x^4 + 4x^2 + 4) - 4x^2$$

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

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

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

**Example 21 : Factorize  $(a^6 - b^6)$**

**Solution :**  $(a^6 - b^6) = (a^3)^2 - (b^3)^2$

$$= (a^3 - b^3)(a^3 + b^3)$$

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

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

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

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

