

Exercise 5.1

Q.1 Factorize

(i) $2abc - 4abx + 2abd$

Solution: $2abc - 4abx + 2abd$
 $= 2ab(c - 2x + d)$

(ii) $9xy - 12x^2y + 18y^2$

Solution: $9xy - 12x^2y + 18y^2$
 $= 3y(3x - 4x^2 + 6y)$

(iii) $-3x^2y - 3x + 9xy^2$

Solution: $-3x^2y - 3x + 9xy^2$
 $= -3x(xy + 1 - 3y^2)$

(iv) $5ab^2c^3 - 10a^2b^3c - 20a^3bc^2$

Solution: $5ab^2c^3 - 10a^2b^3c - 20a^3bc^2$
 $= 5abc(bc^2 - 2ab^2 - 4a^2c)$

(v) $3x^3y(x - 3y) - 7x^2y^2(x - 3y)$

Solution: $3x^3y(x - 3y) - 7x^2y^2(x - 3y)$
 $= (x - 3y)(3x^3y - 7x^2y^2)$
 $= (x - 3y)x^2y(3x - 7y)$
 $= x^2y(x - 3y)(3x - 7y)$

(vi) $2xy^3(x^2 + 5) + 8xy^2(x^2 + 5)$

Solution: $2xy^3(x^2 + 5) + 8xy^2(x^2 + 5)$
 $= (x^2 + 5)(2xy^3 + 8xy^2)$
 $= (x^2 + 5)2xy^2(y + 4)$
 $= 2xy^2(x^2 + 5)(y + 4)$

Q.2 Factorize

(i) $5ax - 3ay - 5bx + 3by$

Solution: $5ax - 3ay - 5bx + 3by$
 $= 5ax - 5bx - 3ay + 3by$
 $= 5x(a - b) - 3y(a - b)$
 $= (a - b)(5x - 3y)$

(ii) $3xy + 2y - 12x - 8$

Solution: $3xy + 2y - 12x - 8$
 $= 3xy - 12x + 2y - 8$
 $= 3x(y - 4) + 2(y - 4)$
 $= (y - 4)(3x + 2)$

(iii) $x^3 + 3xy^2 - 2x^2y - 6y^3$

Solution: $x^3 + 3xy^2 - 2x^2y - 6y^3$
 By cyclic order
 $= x^3 - 2x^2y + 3xy^2 - 6y^3$
 $= x^2(x - 2y) + 3y^2(x - 2y)$
 $= (x - 2y)(x^2 + 3y^2)$

(iv) $(x^2 - y^2)z + (y^2 - z^2)x$

Solution: $(x^2 - y^2)z + (y^2 - z^2)x$
 $= x^2z - y^2z + xy^2 - xz^2$
 Arrange in cyclic order
 $x^2z + xy^2 - xz^2 - y^2z$
 $= x^2z + xy^2 - y^2z - xz^2$
 $= x(xz + y^2) - z(xz + y^2)$
 $= (xz + y^2)(x - z)$

Q.3 Factorize

(i) $144a^2 + 24a + 1$

Solution: $144a^2 + 24a + 1$
 By using formula
 $(a + b)^2 = a^2 + 2ab + b^2$
 $= (12a)^2 + 2(12a)(1) + (1)^2$
 $= (12a + 1)^2$

$$(ii) \quad \frac{a^2}{b^2} - 2 + \frac{b^2}{a^2}$$

$$\text{Solution: } \frac{a^2}{b^2} - 2 + \frac{b^2}{a^2}$$

$$\text{Formula } a^2 - 2ab + b^2 = (a - b)^2$$

$$= \left(\frac{a}{b}\right)^2 - 2\left(\frac{a}{b}\right)\left(\frac{b}{a}\right) + \left(\frac{b}{a}\right)^2$$

$$= \left(\frac{a}{b} - \frac{b}{a}\right)^2$$

$$(iii) \quad (x + y)^2 - 14z(x + y) + 49z^2$$

$$\text{Solution: } (x + y)^2 - 14z(x + y) + 49z^2$$

$$\text{Formula } a^2 - 2ab + b^2 = (a - b)^2$$

$$= (x + y)^2 - 2(x + y)(7z) + (7z)^2$$

$$= (x + y - 7z)^2$$

$$(iv) \quad 12x^2 - 36x + 27$$

$$\text{Solution: } 12x^2 - 36x + 27$$

$$= 3(4x^2 - 12x + 9)$$

$$\text{Formula } a^2 - 2ab + b^2 = (a - b)^2$$

$$= 3[(2x)^2 - 2(2x)(3) + (3)^2]$$

$$= 3(2x - 3)^2$$

Q.4 Factorize

$$(i) \quad 3x^2 - 75y^2$$

$$\text{Solution: } 3x^2 - 75y^2$$

$$= 3(x^2 - 25y^2)$$

$$\text{Formula } a^2 - b^2 = (a + b)(a - b)$$

$$= 3[(x)^2 - (5y)^2]$$

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

$$(ii) \quad x(x - 1) - y(y - 1)$$

$$\text{Solution: } x(x - 1) - y(y - 1)$$

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

Arranging in cyclic order

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

Taking common

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

$$= [(x + y)(x - y)] - (x - y)$$

$$= (x - y)(x + y - 1)$$

$$(iii) \quad 128am^2 - 242an^2$$

$$\text{Solution: } 128am^2 - 242an^2$$

$$= 2a(64m^2 - 121n^2)$$

$$= 2a[(8m)^2 - (11n)^2]$$

$$= 2a(8m + 11n)(8m - 11n)$$

$$(iv) \quad 3x - 243x^3$$

$$\text{Solution: } 3x - 243x^3$$

$$= 3x(1 - 81x^2)$$

$$= 3x[(1)^2 - (9x)^2]$$

$$= 3x(1 + 9x)(1 - 9x)$$

Q.5 Factorize

$$(i) \quad x^2 - y^2 - 6y - 9$$

$$\text{Solution: } x^2 - y^2 - 6y - 9$$

$$= x^2 - [y^2 + 6y + 9]$$

$$= x^2 - [(y)^2 + 2(y)(3) + (3)^2]$$

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

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

$$= (x + y + 3)[x - (y + 3)]$$

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

$$(ii) \quad x^2 - a^2 + 2a - 1$$

$$\text{Solution: } x^2 - a^2 + 2a - 1$$

$$= x^2 - [a^2 - 2a + 1]$$

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

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

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

(iii) $4x^2 - y^2 - 2y - 1$

Solution: $4x^2 - y^2 - 2y - 1$

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

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

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

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

$$= [2x + (y+1)][2x - (y+1)]$$

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

$$= (x+y-2z)(x-y-2z)$$

(iv) $x^2 - y^2 - 4x - 2y + 3$

Solution: $x^2 - y^2 - 4x - 2y + 3$

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

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

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

$$- [(y)^2 + 2(y)(1) + (1)^2]$$

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

$$= (x-2+y+1)[x-2-(y+1)]$$

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

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

$$= (x+y-1)(x-y-3)$$

(v) $25x^2 - 10x + 1 - 36z^2$

Solution: $25x^2 - 10x + 1 - 36z^2$

$$= (5x)^2 - 2(5x)(1) + (1)^2 - 36z^2$$

$$= (5x-1)^2 - (6z)^2$$

$$= [(5x-1) + 6z][(5x-1) - 6z]$$

$$= (5x-1+6z)(5x-1-6z)$$

(vi) $x^2 - y^2 - 4xz + 4z^2$

Solution: $x^2 - y^2 - 4xz + 4z^2$

$$= x^2 - 4xz + 4z^2 - y^2$$

$$= [(x)^2 - 2(x)(2z) + (2z)^2] - y^2$$

$$= (x-2z)^2 - (y)^2$$

$$= (x-2z+y)(x-2z-y)$$