

### Exercise 5(C)

Factorize:

1.  $25a^2 - 9b^2$

Solution:

$$\begin{aligned} \text{We have, } & 25a^2 - 9b^2 \\ &= (5a)^2 - (3b)^2 \\ &= (5a + 3b)(5a - 3b) \quad [\text{As } x^2 - y^2 = (x + y)(x - y)] \end{aligned}$$

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

Solution:

$$\begin{aligned} \text{We have, } & a^2 - (2a + 3b)^2 \\ &= [a - (2a + 3b)][a + (2a + 3b)] \quad [\text{As } x^2 - y^2 = (x + y)(x - y)] \\ &= (a - 2a - 3b)(a + 2a + 3b) \\ &= (-a - 3b)(3a + 3b) \\ &= -3(a + 3b)(a + b) \end{aligned}$$

3.  $a^2 - 81(b-c)^2$

Solution:

$$\begin{aligned} \text{We have, } & a^2 - 81(b-c)^2 \\ &= a^2 - [9(b-c)]^2 \\ &= [a - 9(b-c)][a + 9(b-c)] \quad [\text{As } x^2 - y^2 = (x + y)(x - y)] \\ &= (a - 9b + 9c)(a + 9b - 9c) \end{aligned}$$

4.  $25(2a - b)^2 - 81b^2$

Solution:

$$\begin{aligned} \text{We have, } & 25(2a - b)^2 - 81b^2 \\ &= [5(2a - b)]^2 - (9b)^2 \\ &= [5(2a - b) - 9b][5(2a - b) + 9b] \quad [\text{As } x^2 - y^2 = (x + y)(x - y)] \\ &= (10a - 5b - 9b)(10a - 5b + 9b) \\ &= (10a - 14b)(10a + 4b) \\ &= 2(5a - 7b) \cdot 2(5a + 2b) \\ &= 2(5a - 7b)(5a + 2b) \end{aligned}$$

5.  $50a^3 - 2a$

Solution:

$$\begin{aligned} \text{We have, } & 50a^3 - 2a \\ &= 2a(25a^2 - 1) \\ &= 2a[(5a)^2 - 1^2] \\ &= 2a(5a - 1)(5a + 1) \quad [\text{As } x^2 - y^2 = (x + y)(x - y)] \end{aligned}$$

**6.  $4a^2b - 9b^3$**

**Solution:**

$$\begin{aligned} \text{We have, } & 4a^2b - 9b^3 \\ & = b(4a^2 - 9b^2) \\ & = b[(2a)^2 - (3b)^2] \\ & = b[(2a + 3b)(2a - 3b)] \quad [\text{As } x^2 - y^2 = (x + y)(x - y)] \\ & = b(2a + 3b)(2a - 3b) \end{aligned}$$

**7.  $3a^5 - 108a^3$**

**Solution:**

$$\begin{aligned} \text{We have, } & 3a^5 - 108a^3 \\ & = 3a^3(a^2 - 36) \\ & = 3a^3(a^2 - 6^2) \\ & = 3a^3(a - 6)(a + 6) \quad [\text{As } x^2 - y^2 = (x + y)(x - y)] \end{aligned}$$

**8.  $9(a - 2)^2 - 16(a + 2)^2$**

**Solution:**

$$\begin{aligned} \text{We have, } & 9(a - 2)^2 - 16(a + 2)^2 \\ & = [3(a - 2)]^2 - [4(a + 2)]^2 \\ & = [3(a - 2) - 4(a + 2)][3(a - 2) + 4(a + 2)] \quad [\text{As } x^2 - y^2 = (x + y)(x - y)] \\ & = [3a - 6 - 4a - 8][3a - 6 + 4a + 8] \\ & = [-a - 14][7a + 2] \\ & = -(a + 14)(7a + 2) \end{aligned}$$

**9.  $a^4 - 1$**

**Solution:**

$$\begin{aligned} \text{We have, } & a^4 - 1 \\ & = (a^2)^2 - 1^2 \\ & = (a^2 - 1)(a^2 + 1) \quad [\text{As } x^2 - y^2 = (x + y)(x - y)] \\ & = [(a - 1)(a + 1)](a^2 + 1) \\ & = (a - 1)(a + 1)(a^2 + 1) \end{aligned}$$

**10.  $a^3 + 2a^2 - a - 2$**

**Solution:**

$$\begin{aligned} \text{We have, } & a^3 + 2a^2 - a - 2 \\ & = a^2(a + 2) - 1(a + 2) \\ & = (a^2 - 1)(a + 2) \\ & = (a - 1)(a + 1)(a + 2) \quad [\text{As } x^2 - y^2 = (x + y)(x - y)] \end{aligned}$$

**11.  $(a + b)^3 - a - b$**

**Solution:**

$$\begin{aligned} &\text{We have, } (a + b)^3 - a - b \\ &= (a + b)^3 - (a + b) \\ &= (a + b) [(a + b)^2 - 1] \\ &= (a + b) [(a + b - 1)(a + b + 1)] \quad [\text{As } x^2 - y^2 = (x + y)(x - y)] \\ &= (a + b)(a + b - 1)(a + b + 1) \end{aligned}$$

**12.  $a(a - 1) - b(b - 1)$**

**Solution:**

$$\begin{aligned} &\text{We have, } a(a - 1) - b(b - 1) \\ &= a^2 - a - b^2 + b \\ &= (a^2 - b^2) - (a - b) \\ &= (a + b)(a - b) - (a - b) \quad [\text{As } x^2 - y^2 = (x + y)(x - y)] \\ &= (a - b) [(a + b) - 1] \\ &= (a - b)(a + b - 1) \end{aligned}$$

**13.  $4a^2 - (4b^2 + 4bc + c^2)$**

**Solution:**

$$\begin{aligned} &\text{We know, } 4a^2 - (4b^2 + 4bc + c^2) \\ &= (2a)^2 - [(2b)^2 + 2(2b)(c) + c^2] \\ &= (2a)^2 - (2b + c)^2 \\ &= (2a - 2b - c)(2a + 2b + c) \quad [\text{As } x^2 - y^2 = (x + y)(x - y)] \end{aligned}$$

**14.  $4a^2 - 49b^2 + 2a - 7b$**

**Solution:**

$$\begin{aligned} &\text{We know, } 4a^2 - 49b^2 + 2a - 7b \\ &= (2a)^2 - (7b)^2 + (2a - 7b) \\ &= [(2a - 7b)(2a + 7b)] + (2a - 7b) \quad [\text{As } x^2 - y^2 = (x + y)(x - y)] \\ &= (2a - 7b) [(2a + 7b) + 1] \\ &= (2a - 7b)(2a + 7b + 1) \end{aligned}$$

**15.  $9a^2 + 3a - 8b - 64b^2$**

**Solution:**

$$\begin{aligned} &\text{We have, } 9a^2 + 3a - 8b - 64b^2 \\ &= 9a^2 - 64b^2 + 3a - 8b \\ &= (3a)^2 - (8b)^2 + (3a - 8b) \\ &= [(3a - 8b)(3a + 8b)] + (3a - 8b) \quad [\text{As } x^2 - y^2 = (x + y)(x - y)] \\ &= (3a - 8b) [(3a + 8b) + 1] \end{aligned}$$

$$= (3a - 8b)(3a + 8b + 1)$$

**16.  $4a^2 - 12a + 9 - 49b^2$**

**Solution:**

We have,  $4a^2 - 12a + 9 - 49b^2$   
 $= [(2a)^2 - 2(2a)(3) + 3^2] - (7b)^2$   
 $= (2a - 3)^2 - (7b)^2$   
 $= (2a - 7b - 3)(2a + 7b - 3)$  [As  $x^2 - y^2 = (x + y)(x - y)$ ]

**17.  $4xy - x^2 - 4y^2 + z^2$**

**Solution:**

We have,  $4xy - x^2 - 4y^2 + z^2$   
On rearranging,  
 $= z^2 - x^2 - 4y^2 + 4xy$   
 $= z^2 - (x^2 + 4y^2 - 4xy)$   
 $= z^2 - (x - 2y)^2$   
 $= (z - x + 2y)(z + x - 2y)$  [As  $x^2 - y^2 = (x + y)(x - y)$ ]

**18.  $a^2 + b^2 - c^2 - d^2 + 2ab - 2cd$**

**Solution:**

We have,  $a^2 + b^2 - c^2 - d^2 + 2ab - 2cd$   
On rearranging,  
 $= a^2 + 2ab + b^2 - c^2 - d^2 - 2cd$   
 $= (a^2 + 2ab + b^2) - (c^2 + d^2 + 2cd)$   
 $= (a + b)^2 - (c + d)^2$   
 $= (a + b + c + d)(a + b - c - d)$  [As  $x^2 - y^2 = (x + y)(x - y)$ ]

**19.  $4x^2 - 12ax - y^2 - z^2 - 2yz + 9a^2$**

**Solution:**

We have,  $4x^2 - 12ax - y^2 - z^2 - 2yz + 9a^2$   
On rearranging,  
 $= 4x^2 - 12ax + 9a^2 - y^2 - z^2 - 2yz$   
 $= (4x^2 - 12ax + 9a^2) - (y^2 + z^2 + 2yz)$   
 $= (2x - 3a)^2 - (y + z)^2$   
 $= (2x - 3a + y + z)(2x - 3a - y - z)$  [As  $x^2 - y^2 = (x + y)(x - y)$ ]

**20.  $(a^2 - 1)(b^2 - 1) + 4ab$**

**Solution:**

We have,  $(a^2 - 1)(b^2 - 1) + 4ab$   
By cross multiplying and expanding, we get  
 $= (1 - a^2 - b^2 + a^2b^2) + 4ab$

On manipulating,

$$= (a^2b^2 + 1 + 2ab) - (a^2 + b^2 - 2ab)$$

Now,

$$= (ab + 1)^2 - (a - b)^2$$

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

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

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

**21.  $x^4 + x^2 + 1$**

**Solution:**

We have,  $x^4 + x^2 + 1$

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

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

$$[As a^2 - b^2 = (a + b)(a - b)]$$

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

**22.  $(a^2 + b^2 - 4c^2)^2 - 4a^2b^2$**

**Solution:**

We have,  $(a^2 + b^2 - 4c^2)^2 - 4a^2b^2$

$$= (a^2 + b^2 - 4c^2)^2 - (2ab)^2$$

$$= [(a^2 + b^2 - 4c^2) + (2ab)] [(a^2 + b^2 - 4c^2) - (2ab)]$$

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

$$= [(a^2 + b^2 + 2ab) - 4c^2] [(a^2 + b^2 - 2ab) - 4c^2]$$

$$= [(a + b)^2 - (2c)^2] [(a - b)^2 - (2c)^2]$$

$$= [(a + b - 2c) (a + b + 2c)] [(a - b - 2c) (a - b + 2c)]$$

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

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

**23.  $(x^2 + 4y^2 - 9z^2)^2 - 16x^2y^2$**

**Solution:**

We have,  $(x^2 + 4y^2 - 9z^2)^2 - 16x^2y^2$

$$= (x^2 + 4y^2 - 9z^2)^2 - (4xy)^2$$

$$= (x^2 + 4y^2 - 9z^2 - 4xy) (x^2 + 4y^2 - 9z^2 + 4xy)$$

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

$$= [(x^2 - 4xy + 4y^2) - 9z^2] [(x^2 + 4xy + 4y^2) - 9z^2]$$

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

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

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

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

**24.  $(a + b)^2 - a^2 + b^2$**

**Solution:**

We have,  $(a + b)^2 - a^2 + b^2$

On expanding,

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

$$= 2b^2 + 2ab$$

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

**25.  $a^2 - b^2 - (a + b)^2$**

**Solution:**

We have,  $a^2 - b^2 - (a + b)^2$   
On expanding,  
 $= a^2 - b^2 - (a^2 + b^2 + 2ab)$   
 $= a^2 - b^2 - a^2 - b^2 - 2ab$   
 $= -2b^2 - 2ab$   
 $= -2b(b + a)$

**26.  $9a^2 - (a^2 - 4)^2$**

**Solution:**

We have,  $9a^2 - (a^2 - 4)^2$   
 $= (3a)^2 - (a^2 - 4)^2$   
 $= [3a - (a^2 - 4)] [3a + (a^2 - 4)]$  [As  $x^2 - y^2 = (x + y)(x - y)$ ]  
 $= [3a - (a^2 - 2^2)] [3a + (a^2 - 2^2)]$   
 $= (3a - a^2 + 4) (3a + a^2 - 4)$   
 $= (-a^2 + 3a + 4) (a^2 + 3a - 4)$   
 $= (-a^2 + 4a - a + 4) (a^2 + 4a - a - 4)$  [By splitting the middle term]  
 $= [a(-a + 4) + 1(-a + 4)] [a(a + 4) - 1(a + 4)]$   
 $= [(-a + 4) (a + 1)] [(a - 1) (a + 4)]$   
 $= (4 - a) (a + 1) (a - 1) (a + 4)$

**27.  $x^2 + 1/x^2 - 11$**

**Solution:**

We have,  $x^2 + 1/x^2 - 11$   
 $= x^2 + 1/x^2 - 2 - 9$   
 $= (x^2 + 1/x^2 - 2 \times x \times 1/x) - 9$   
 $= (x - 1/x)^2 - 3^2$   
 $= (x - 1/x + 3) (x - 1/x - 3)$  [As  $a^2 - b^2 = (a + b)(a - b)$ ]

**28.  $4x^2 + 1/4x^2 + 1$**

**Solution:**

We have,  $4x^2 + 1/4x^2 + 1$   
 $= 4x^2 + 1/4x^2 + 2 - 1$   
 $= [(2x)^2 + (1/2x)^2 + 2 \times 2x \times 1/2x] - 1^2$   
 $= (2x + 1/2x)^2 - 1^2$   
 $= (2x + 1/2x + 1) (2x - 1/2x - 1)$  [As  $x^2 - y^2 = (x + y)(x - y)$ ]

**29.  $4x^4 - x^2 - 12x - 36$**

**Solution:**

$$\begin{aligned} &\text{We know, } 4x^4 - x^2 - 12x - 36 \\ &= 4x^4 - (x^2 + 12x + 36) \\ &= (2x^2)^2 - [x^2 + 2(x)(6) + 6^2] \\ &= (2x^2)^2 - (x + 6)^2 \\ &= (2x^2 + x + 6) (2x^2 - x - 6) && \text{[As } x^2 - y^2 = (x + y)(x - y)\text{]} \\ &= (2x^2 + x + 6) (2x^2 - 4x + 3x - 6) && \text{[By splitting the middle term]} \\ &= (2x^2 + x + 6) [2x(x - 2) + 3(x - 2)] \\ &= (2x^2 + x + 6) [(2x + 3) (x - 2)] \\ &= (2x^2 + x + 6) (2x + 3) (x - 2) \end{aligned}$$

**30.  $a^2(b + c) - (b + c)^3$**

**Solution:**

$$\begin{aligned} &\text{We have, } a^2(b + c) - (b + c)^3 \\ &= (b + c) [a^2 - (b + c)^2] \\ &= (b + c) [(a - b - c) (a + b + c)] && \text{[As } x^2 - y^2 = (x + y)(x - y)\text{]} \\ &= (b + c) (a - b - c) (a + b + c) \end{aligned}$$



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