

Mathematics

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(Chapter - 14) (Factorisation)
(Class - VIII)

Exercise 14.2

Question 1:

Factorize the following expressions:

(i) $a^2 + 8a + 16$

(ii) $p^2 - 10p + 25$

(iii) $25m^2 + 30m + 9$

(iv) $49y^2 + 84yz + 36z^2$

(v) $4x^2 - 8x + 4$

(vi) $121b^2 - 88bc + 16c^2$

(vii) $(l+m)^2 - 4lm$ [Hint: Expand $(l+m)^2$ first]

(viii) $a^4 + 2a^2b^2 + b^4$

Answer 1:

(i) $a^2 + 8a + 16 = a^2 + (4+4)a + 4 \times 4$

Using identity $x^2 + (a+b)x + ab = (x+a)(x+b)$,

Here $x = a, a = 4$ and $b = 4$

$$a^2 + 8a + 16 = (a+4)(a+4) = (a+4)^2$$

(ii) $p^2 - 10p + 25 = p^2 + (-5-5)p + (-5)(-5)$

Using identity $x^2 + (a+b)x + ab = (x+a)(x+b)$,

Here $x = p, a = -5$ and $b = -5$

$$p^2 - 10p + 25 = (p-5)(p-5) = (p-5)^2$$

(iii) $25m^2 + 30m + 9 = (5m)^2 + 2 \times 5m \times 3 + (3)^2$

Using identity $a^2 + 2ab + b^2 = (a+b)^2$, here $a = 5m, b = 3$

$$25m^2 + 30m + 9 = (5m+3)^2$$

(iv) $49y^2 + 84yz + 36z^2 = (7y)^2 + 2 \times 7y \times 6z + (6z)^2$

Using identity $a^2 + 2ab + b^2 = (a+b)^2$, here $a = 7y, b = 6z$

$$49y^2 + 84yz + 36z^2 = (7y+6z)^2$$

(v) $4x^2 - 8x + 4 = (2x)^2 - 2 \times 2x \times 2 + (2)^2$

Using identity $a^2 - 2ab + b^2 = (a-b)^2$, here $a = 2x, b = 2$

$$4x^2 - 8x + 4 = (2x-2)^2 = (2)^2(x-1)^2 = 4(x-1)^2$$

(vi) $121b^2 - 88bc + 16c^2 = (11b)^2 - 2 \times 11b \times 4c + (4c)^2$

Using identity $a^2 - 2ab + b^2 = (a-b)^2$, here $a = 11b, b = 4c$

$$121b^2 - 88bc + 16c^2 = (11b-4c)^2$$

(vii) $(l+m)^2 - 4lm = l^2 + 2 \times l \times m + m^2 - 4lm$ $\left[\because (a+b)^2 = a^2 + 2ab + b^2 \right]$

$$= l^2 + 2lm + m^2 - 4lm$$

$$= l^2 - 2lm + m^2$$

$$= (l-m)^2 \quad \left[\because (a-b)^2 = a^2 - 2ab + b^2 \right]$$

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$$\begin{aligned} \text{(viii)} \quad a^4 + 2a^2b^2 + b^4 &= (a^2)^2 + 2 \times a^2 \times b^2 + (b^2)^2 \\ &= (a^2 + b^2)^2 \quad \left[\because (a+b)^2 = a^2 + 2ab + b^2 \right] \end{aligned}$$

Question 2:

Factorize:

- | | |
|---------------------------------|--------------------------------------|
| (i) $4p^2 - 9q^2$ | (ii) $63a^2 - 112b^2$ |
| (iii) $49x^2 - 36$ | (iv) $16x^5 - 144x^2$ |
| (v) $(l+m)^2 - (l-m)^2$ | (vi) $9x^2y^2 - 16$ |
| (vii) $(x^2 - 2xy + y^2) - z^2$ | (viii) $25a^2 - 4b^2 + 28bc - 49c^2$ |

Answer 2:

- (i) $4p^2 - 9q^2 = (2p)^2 - (3q)^2$
 $= (2p - 3q)(2p + 3q) \quad \left[\because a^2 - b^2 = (a-b)(a+b) \right]$
- (ii) $63a^2 - 112b^2 = 7(9a^2 - 16b^2) = 7[(3a)^2 - (4b)^2]$
 $= 7(3a - 4b)(3a + 4b) \quad \left[\because a^2 - b^2 = (a-b)(a+b) \right]$
- (iii) $49x^2 - 36 = (7x)^2 - (6)^2 = (7x - 6)(7x + 6) \quad \left[\because a^2 - b^2 = (a-b)(a+b) \right]$
- (iv) $16x^5 - 144x^3 = 16x^3(x^2 - 9)$
 $= 16x^3[(x)^2 - (3)^2]$
 $= 16x^3(x - 3)(x + 3) \quad \left[\because a^2 - b^2 = (a-b)(a+b) \right]$
- (v) $(l+m)^2 - (l-m)^2 = [(l+m) + (l-m)][(l+m) - (l-m)]$
 $= (l+m+l-m)(l+m-l+m) = (2m)(2l) = 4lm \quad \left[\because a^2 - b^2 = (a-b)(a+b) \right]$
- (vi) $9x^2y^2 - 16 = (3xy)^2 - (4)^2$
 $= (3xy - 4)(3xy + 4) \quad \left[\because a^2 - b^2 = (a-b)(a+b) \right]$
- (vii) $(x^2 - 2xy + y^2) - z^2 = (x - y)^2 - z^2$
 $= (x - y - z)(x - y + z) \quad \left[\because (a-b)^2 = a^2 - 2ab + b^2 \right]$
 $\left[\because a^2 - b^2 = (a-b)(a+b) \right]$
- (viii) $25a^2 - 4b^2 + 28bc - 49c^2 = 25a^2 - (4b^2 - 28bc + 49c^2)$
 $= 25a^2 - [(2b)^2 - 2 \times 2b \times 7c + (7c)^2]$
 $= 25a^2 - (2b - 7c)^2 \quad \left[\because (a-b)^2 = a^2 - 2ab + b^2 \right]$
 $= (5a)^2 - (2b - 7c)^2$
 $= [5a - (2b - 7c)][5a + (2b - 7c)] \quad \left[\because a^2 - b^2 = (a-b)(a+b) \right]$
 $= (5a - 2b + 7c)(5a + 2b - 7c)$

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Question 3:

Factorize the expressions:

(i) $ax^2 + bx$

(iii) $2x^3 + 2xy^2 + 2xz^2$

(v) $(lm + l) + m + 1$

(vii) $5y^2 - 20y - 8z + 2yz$

(ix) $6xy - 4y + 6 - 9x$

(ii) $7p^2 + 21q^2$

(iv) $am^2 + bm^2 + bn^2 + an^2$

(vi) $y(y + z) + 9(y + z)$

(viii) $10ab + 4a + 5b + 2$

Answer 3:

(i) $ax^2 + bx = x(ax + b)$

(ii) $7p^2 + 21q^2 = 7(p^2 + 3q^2)$

(iii) $2x^3 + 2xy^2 + 2xz^2 = 2x(x^2 + y^2 + z^2)$

(iv) $am^2 + bm^2 + bn^2 + an^2 = m^2(a + b) + n^2(a + b) = (a + b)(m^2 + n^2)$

(v) $(lm + l) + m + 1 = l(m + 1) + 1(m + 1) = (m + 1)(l + 1)$

(vi) $y(y + z) + 9(y + z) = (y + z)(y + 9)$

(vii) $5y^2 - 20y - 8z + 2yz = 5y^2 - 20y + 2yz - 8z$
 $= 5y(y - 4) + 2z(y - 4)$
 $= (y - 4)(5y + 2z)$

(viii) $10ab + 4a + 5b + 2 = 2a(5b + 2) + 1(5b + 2) = (5b + 2)(2a + 1)$

(ix) $6xy - 4y + 6 - 9x = 6xy - 9x - 4y + 6$
 $= 3x(2y - 3) - 2(2y - 3)$
 $= (2y - 3)(3x - 2)$

Question 4:

Factorize:

(i) $a^4 - b^4$

(iii) $x^4 - (y + z)^4$

(v) $a^4 - 2a^2b^2 + b^4$

(ii) $p^4 - 81$

(iv) $x^4 - (x - z)^4$

Answer 4:

(i) $a^4 - b^4 = (a^2)^2 - (b^2)^2$
 $= (a^2 - b^2)(a^2 + b^2)$
 $= (a - b)(a + b)(a^2 + b^2)$

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

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

(ii) $p^4 - 81 = (p^2)^2 - (9)^2$
 $= (p^2 - 9)(p^2 + 9)$
 $= (p^2 - 3^2)(p^2 + 9)$
 $= (p - 3)(p + 3)(p^2 + 9)$

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

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

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(iii)
$$\begin{aligned} x^4 - (y+z)^4 &= (x^2)^2 - [(y+z)^2]^2 \\ &= [x^2 - (y+z)^2][x^2 + (y+z)^2] \quad [\because a^2 - b^2 = (a-b)(a+b)] \\ &= [x - (y+z)][x + (y+z)][x^2 + (y+z)^2] \quad [\because a^2 - b^2 = (a-b)(a+b)] \\ &= (x - y + z)(x + y + z)[x^2 + (y+z)^2] \end{aligned}$$

(iv)
$$\begin{aligned} x^4 - (x-z)^4 &= (x^2)^2 - [(x-z)^2]^2 \\ &= [x^2 - (x-z)^2][x^2 + (x-z)^2] \quad [\because a^2 - b^2 = (a-b)(a+b)] \\ &= [x - (x-z)][x + (x+z)][x^2 + (x-z)^2] \quad [\because a^2 - b^2 = (a-b)(a+b)] \\ &= (x - x + z)(x + x + z)(x^2 + x^2 - 2xz + z^2) \quad [\because (a-b)^2 = a^2 - 2ab + b^2] \\ &= x(2x+z)(2x^2 - 2xz + z^2) \end{aligned}$$

(v)
$$\begin{aligned} a^4 - 2a^2b^2 + b^4 &= (a^2)^2 - 2a^2b^2 + (b^2)^2 \\ &= (a^2 - b^2)^2 \quad [\because (a-b)^2 = a^2 - 2ab + b^2] \\ &= [(a-b)(a+b)]^2 \quad [\because a^2 - b^2 = (a-b)(a+b)] \\ &= (a-b)^2(a+b)^2 \quad [\because (xy)^m = x^m \cdot y^m] \end{aligned}$$

Question 5:

Factorize the following expressions:

(i) $p^2 + 6p + 8$

(ii) $q^2 - 10q + 21$

(iii) $p^2 + 6p - 16$

Answer 5:

(i)
$$\begin{aligned} p^2 + 6p + 8 &= p^2 + (4+2)p + 4 \times 2 \\ &= p^2 + 4p + 2p + 4 \times 2 \\ &= p(p+4) + 2(p+4) \\ &= (p+4)(p+2) \end{aligned}$$

(ii)
$$\begin{aligned} q^2 - 10q + 21 &= q^2 - (7+3)q + 7 \times 3 \\ &= q^2 - 7q - 3q + 7 \times 3 \\ &= q(q-7) - 3(q-7) \\ &= (q-7)(q-3) \end{aligned}$$

(iii)
$$\begin{aligned} p^2 + 6p - 16 &= p^2 + (8-2)p - 8 \times 2 \\ &= p^2 + 8p - 2p - 8 \times 2 \\ &= p(p+8) - 2(p+8) \\ &= (p+8)(p-2) \end{aligned}$$