TEXT BOOK EXERCISE 12.2

Q. 1. Factorise the following expressions :

(*i*) $x^2 + 10x + 25$

(*ii*) $y^2 - 8y + 16$

(*iii*) $25p^2 + 30p + 9$

(*iv*) $49a^2 + 84ab + 36b^2$

(*v*) $100x^2 - 80xy + 16y^2$

(*vi*) $(p + q)^2 - 4pq$ (Hint expand $(p + q)^2$ first)

(*vii*) $l^4 + 2l^2m^2 + m^4$

(*viii*) $4x^2 - 8x + 4$

(Hint : First take common 4 from each term)

Solution. (*i*) Here, $x^2 + 10x + 25$

$= (x)^2 + 2\,(x)\,(5) + (5)^2$

$= (x + 5)^2$

Thus, $x^2 + 10x + 25 = (x + 5)^2$ **Ans.**

(*ii*) Here, $y^2 - 8y + 16 = (y)^2 - 2\,(4)\,(y) + (4)^2$

$= (y - 4)^2$

Thus, $y^2 - 8y + 16 = (y - 4)^2$ **Ans.**

(*iii*) Here, $25p^2 + 30p + 9$

$= (5p)^2 + 2\,(3)\,(5p) + (3)^2$

$= (5p + 3)^2$

Thus, $25p^2 + 30p + 9 = (5p + 3)^2$ **Ans.**

(*iv*) Here, $49a^2 + 84ab + 36b^2$

$= (7a)^2 + 2\,(7a)\,(6p) + (6b)^2$

$= (7a + 6b)^2$

Thus, $49a^2 + 84ab + 36b^2 = (7a + 6b)^2$ **Ans.**

(*v*) Here, $100x^2 + 80xy + 16y^2$

$= (10x)^2 + 2\,(10x \times 4) + (4y)^2$

$= (10x + 4y)^2$

Thus, $100x^2 + 80xy + 16y^2$

$= (10x + 4y)^2$

$= 4\,(5x + 2y)^2$ **Ans.**

(*vi*) Here $(p + q)^2 - 4pq = p^2 + q^2 + 2pq - 4pq$

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

$= (p - q)^2$

Thus, $(p + q)^2 - 4pq = (p - q)^2$ **Ans**

(*vii*) Here, $l^4 + 2l^2m^2 + m^4$

$= (l^2)^2 + 2\,(l^2)\,(m^2) + (m^2)^2$

$= (l^2 + m^2)^2$

Thus, $l^4 + 2l^2m^2 + m^2 = (l^2 + m^2)^2$ **Ans.**

(*viii*) Here, $4x^2 - 8x + 4$

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

$= 4\,[(x)^2 - 2 \times x \times 1 + (1)^2]$

$= 4\,(x - 1)^2$ **Ans.**

Q. 2. Factorise the following expressions :

(*i*) $25a^2 - 64b^2$

(*ii*) $49x^2 - 36$

(*iii*) $28x^2 - 63y^2$

(*iv*) $\frac{4}{25}x^2 - \frac{9}{49}y^2$

(*v*) $8x^5 - 72x^3$

(Hint : taking x common first)

(*vi*) $(p + q)^2 - (p - q)^2$

(*vii*) $16a^2b^2 - 25$

(*viii*) $(x^2 - 2xy + y^2) - z^2$

(Hint : First use identity $a^2 - 2ab + b^2 = (a - b)^2$ then another)

Solution. (*i*) Here, $25a^2 - 64b^2$

$= (5a)^2 - (8b)^2$

$= (5a - 8b)\ (5a + 8b)$ **Ans.**

(*ii*) Here, $49x^2 - 36 = (7x)^2 - (6)^2$

$= (7x - 6)\ (7x + 6)$ **Ans.**

(*iii*) Here, $28x^2 - 63y^2 = 7\ (4x^2 - 9y)^2$

$= 7\ [(2x)^2 - (3y)^2]$

$= 7\ [(2x - 3y)\ (2x + 3y)]$ **Ans.**

(*iv*) Here, $\frac{4}{25}x^2 - \frac{9}{49}y^2 = \left(\frac{2}{5}x\right)^2 - \left(\frac{3}{7}y\right)^2$

$= \left(\frac{2}{5}x + \frac{3}{7}y\right)\left(\frac{2}{5}x - \frac{3}{7}y\right)$ **Ans.**

(*v*) Here, $8x^5 - 72y^3 = 8x^3\ (x^2 - 9)$

$= 8x^3\ [(x)^2 - (3)^2]$

$= 8x^3\ [(x + 3)\ (x - 3)]$ **Ans.**

(*vi*) Here, $(p + q)^2 - (p - q)^2$

$= (p^2 + q^2 + 2pq)$

$- (p^2 + q^2 - 2pq)$

$= p^2 + q^2 + 2qq$

$- p^2 - q^2 + 2pq$

$= 4pq$ **Ans.**

(*vii*) Here, $16a^2b^2 - 25$

$= (4ab)^2 - (5)^2$

$= (4ab + 5)\ (4ab - 5)$ **Ans.**

(*viii*) Here, $x^2 - 2xy + y^2 - z^2$

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

$= (x - y + z)\ (x - y - z)$ **Ans.**

Q. 3. Factorise :

(*i*) $x^4 - y^4$ **(*ii*) $a^4 - 81$**

(*iii*) $m^4 - 256$ **(*iv*) $p^4 - (q + r)^4$**

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

Solution. (*i*) Here, $x^4 - y^4 = (x^2)^2 - (y^2)^2$

$= (x^2 + y^2)\ (x^2 - y^2)]$

$= (x^2 + y^2)\ (x + y)\ (x - y)$ **Ans.**

(*ii*) Here, $a^4 - 81 = (a^2)^2 - (9)^2$

$= (a^2 + 9)\ (a^2 - 9)$

$= (a^2 + 9)\ (a + 3)\ (a - 3)$ **Ans.**

(*iii*) Here, $m^4 - 256 = (m^2)^2 - (16)^2$

$= (m^2 + 16)\ (m^2 - 16)$

$= (m^2 + 16)\ (m + 4)\ (m - 4)$

Ans.

(*iv*) Here, $p^4 - (q + r)^4 = (p^2)^2 - [(q + r)^2]^2$

$= [p^2 + (q + r)^2]$

$[p^2 - (q + r)^2]$

$= [p^2 + (q + r)^2]\ [p + (q + r)]$

$[p - (q + r)]$

$= [p^2 + (q + r)^2]\ (p + q + r)$

$(p - q - r)$ **Ans.**

(*v*) Here, $a^4 - 2a^2b^2 + b^4$

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

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

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

$= (a + b)^2\ (a - b)^2$ **Ans.**

Q. 4. Factorise the following :

(*i*) $a^2 + 2ab + b^2 - c^2$

(*ii*) $1 - 9l^2 + 24lm - 16m^2$

(*iii*) $25p^2 - 40pq + 16q^2 - 49r^2$

Solution. (*i*) Here, $a^2 + 2ab + b^2 - c^2$

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

$= (a + b + c)\ (a + b - c)$ **Ans.**

(*ii*) Here, $1 - 9l^2 + 24lm - 16m^2$

$= 1 - (9l^2 - 24lm + 16m^2)$

$= 1 - [(3l)^2 - 2\ (3l)\ (4m) + (4m)^2]$

$= (1)^2 - (3l - 4m)^2$

$= [1 + (3l - 4m)]\ [1 - 13l - 4m]$

$= [1 + 3l - 4m]\ [1 - 3l + 4m)$ **Ans.**

(*iii*) Here, $25p^2 - 40pq + 16q^2 - 49r^2$

$= (5p)^2 - 2\ (5p)\ (4q) + (4q)^2 - (7r)^2$

$= (5p - 4q)^2 - (7r)^2$

$= (5p - 4q - 7r)\ (5p - 4q + 7r)$ **Ans.**

Q. 5. Factorise the following expressions :

(*i*) $x^2 + 7x + 12$

(*ii*) $y^2 - 10y + 21$

(*iii*) $a^2 + 3a - 18$

(*iv*) $3p^2 + 18p - 48$

(Hint : taking common 3 from each term)

(*v*) $q^2 - q - 6$

(*vi*) $x^2 - 11x - 42$

(vii) $5x^2 + 25x + 30$

(viii) $3y^2 - 21y + 36$

Solution. (*i*) Here, $x^2 + 7x + 12$

We find two numbers whose product is 12 and sum is 7.

We note that $12 = 3 \times 4$ and $3 + 4 = 7$

Therefore $x^2 + 7x + 12$

$= x^2 + (3 + 4)\, x + 12$

$= x^2 + 3x + 4x + 12$

$= x\,(x + 3) + 4\,(x + 3)$

$= (x + 3)\,(x + 4)$ **Ans.**

(*ii*) $y^2 - 10y + 21$

We find two numbers whose product is 21 sum is - 10.

We note that $P = 21 = (-3) \times (-7)$

and $S = -10 = (-3) + (-7)$

$\therefore\ y^2 - 10y + 21$

$= y^2 + \{(-3) + (-7)\}\, y + 21$

$= y^2 - 3y - 7y + 21$

$= y\,(y - 3) - 7\,(y - 3)$

$= (y - 3)\,(y - 7)$ **Ans.**

(*iii*) Here, $a^2 + 3a - 18 = a^2 + [6 + (-3)]\, a - 18$

$\begin{bmatrix} P = -18 = 6 \times -3 \\ S = 3 = 6 + (-3) \end{bmatrix}$

$= a^2 + 6a - 3a - 18$

$= a\,(a + 6) - 3\,(a + 6)$

$= (a + 6)\,(a - 3)$ **Ans.**

(*iv*) Here, $3p^2 + 18p - 48 = 3\,(p^2 + 6p - 16)$

$\begin{bmatrix} P = -16 = 8 \times (-2) \\ S = 6 = 8 + (-2) \end{bmatrix}$

$= 3\,[p^2 + \{8 + (-2)\}\, p - 16]$

$= 3\,[p^2 + 8p - 2p - 16]$

$= 3\,[p\,(p + 8) - 2\,(p + 8)]$

$= 3\,(p + 8)\,(p - 2)$ **Ans.**

(*v*) Here, $q^2 - q - 6 = q^2 + \{(-3) + 2)\}\, q - 6$

$\begin{bmatrix} P = -6 = (-3) \times 2 \\ S = -1 = (-3) + 2 \end{bmatrix}$

$= q^2 - 3q + 2q - 6$

$= q\,(q - 3) + 2\,(q - 3)$

$= (q - 3)\,(q + 2)$ **Ans.**

(*vi*) Here, $x^2 - 11x - 42 = x^2 + \{(-14) + 3\}\, x - 42$

$\begin{bmatrix} S = -11 = -14 + 3 \\ P = -14 \times 3 = -42 \end{bmatrix}$

$= x^2 - 14x + 3x - 42$

$= x\,(x - 14) + 3\,(x - 14)$

$= (x - 14)\,(x + 3)$ **Ans.**

(*vii*) Here, $5x^2 + 25x + 30$

$= 5\,(x^2 + 5x + 6)$

$\begin{bmatrix} P = 6 = 3 \times 2 \\ S = 5 = 3 + 2 \end{bmatrix}$

$= 5\,(x^2 + (3 + 2)\, x + 6$

$= 5\,[x^2 + 3x + 2x + 6]$

$= 5\,[x\,(x + 3) + 2\,(x + 3)]$

$= 5\,(x + 3)\,(x + 2)$ **Ans.**

(*viii*) Here, $3y^2 - 21y + 36 = 3\,(y^2 - 7y + 12)$

$\begin{bmatrix} P = 12 = (-4) \times (-3) \\ S = -7 = (-4) + (-3) \end{bmatrix}$

$= 3\,[y^2 + \{(-4) + (-3)\, y + 12]$

$= 3\,[y^2 - 4y - 3y + 12]$

$= 3\,[y\,(y - 4) - 3\,(y - 4)]$

$= 3\,(y - 4)\,(y - 3)$ **Ans.**

Q. 6. Multiple Choice Questions :

(*i*) $4p^2 - 20pq + 25q^2$

(*a*) $(4p - 5q)^2$ (*b*) $(2p - 5q)^2$

(*c*) $(2q - 5p)^2$ (*d*) $(4q - 25p)^2$

(*ii*) $4x^3 - 9x =$

(*a*) $x^2\,(4x - 9)\,(4x + 9)$

(*b*) $x\,(2x - 3)\,(2x + 3)$

(*c*) $x^3\,(2x - 3)\,(2x + 3)$

(*d*) $x^2\,(2x - 3)\,(2x + 3)$

(*iii*) $(a + b)^2 - (a - b)^2$

(*a*) $-4ab$ (*b*) $2a + 2b$

(*c*) $2a - 2b$ (*d*) $4ab$

(*iv*) $m^2 - 14m - 32 =$

(*a*) $(m + 16)\,(m - 2)$

(*b*) $(m - 16)\,(m - 2)$

(*c*) $(m - 16)\,(m + 2)$

(*d*) $(m + 16)\,(m + 2)$.

(v) $p^3 - p$

(a) $p\,(p^2 + 1)$

(b) $(p^2 - 1)\,(p + 1)$

(c) $p^2\,(p - 1)$

(d) $p\,(p - 1)\,(p + 1)$.

Ans. (i) (b) $(2p - 5q)^2$

(ii) (b) $x\,(2x - 3)\,(2x + 3)$

(iii) (d) $4ab$

(iv) (c) $(m - 16)\,(m + 2)$

(v) (d) $p\,(p - 1)\,(p + 1)$