Exercise 4.1

1. Factorize by identifying common factors.

(i) $6x + 12$

$$6x + 12$$
$$= 6(x + 2)$$

(ii) $15y^2 + 20y$

$$15y^2 + 20y$$
$$= 5y(3y + 4)$$

(iii) $-12x^2 - 3x$

$$-12x^2 - 3x$$
$$= -3x(4x + 1)$$

(iv) $4a^2b + 8ab^2$

$$4a^2b + 8ab^2$$
$$= 4ab(a + 2b)$$

(v) $xy - 3x^2 + 2x$

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

(vi) $3a^2b - 9ab^2 + 15ab$

$$3a^2b - 9ab^2 + 15ab$$
$$= 3ab(a + 3b + 5)$$

2. Factorize:

(i) $5x + 15$

$$5x + 15$$
$$= 5(x + 3)$$

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

$$x^2 + 4x + 3$$
$$= x^2 + 3x + x + 3$$
$$= x(x + 3) + 1(x + 3)$$
$$= (x + 3)(x + 1)$$

(iii) $x^2 + 6x + 8$

$$x^2 + 6x + 8$$
$$= x^2 + 4x + 2x + 8$$
$$= x(x + 4) + 2(x + 4)$$
$$= (x + 4)(x + 2)$$

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

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

3. Factorize:

(i) $x^2 + x - 12$

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

(ii) $x^2 + 7x + 10$

$$x^2 + 7x + 10$$
$$= x^2 + 5x + 2x + 10$$
$$= x(x + 5) + 2(x + 5)$$
$$= (x + 5)(x + 2)$$

(iii) $x^2 - 6x + 8$

$$x^2 - 6x + 8$$
$$= x^2 - 4x - 2x + 8$$
$$= x(x - 4) - 2(x - 4)$$
$$= (x - 4)(x - 2)$$

(iv) $x^2 - x - 56$

$$x^2 - x - 56$$
$$= x^2 - 8x + 7x - 56$$
$$= x(x - 8) + 7(x - 8)$$
$$= (x - 8)(x + 7)$$

(v) $x^2 - 10x - 24$

$$x^2 - 10x - 24$$
$$= x^2 - 12x + 2x - 24$$
$$= x(x - 12) + 2(x - 12)$$
$$= (x - 12)(x + 2)$$

(vi) $y^2 + 4y - 12$

$$y^2 + 4y - 12$$
$$= y^2 + 6y - 2y - 12$$
$$= y(y + 6) - 2(y + 6)$$
$$= (y + 6)(y - 2)$$

(vii) $y^2 + 13y + 36$

$$y^2 + 13y + 36$$
$$= y^2 + 9y + 4y + 36$$
$$= y(y + 9) + 4(y + 9)$$
$$= (y + 9)(y + 4)$$

(viii) $x^2 - x - 2$

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

4. Factorize:

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

$$2x^2 + 7x + 3$$
$$= 2x^2 + 6x + x + 3$$
$$= 2x(x + 3) + 1(x + 3)$$
$$= (x + 3)(2x + 1)$$

(ii) $2x^2 + 11x + 15$

$$\begin{aligned} & 2x^2 + 11x + 15 \\ &= 2x^2 + 6x + 5x + 15 \\ &= 2x(x + 3) + 5(x + 3) \\ &= (x + 3)(2x + 5) \end{aligned}$$

(iii) $4x^2 + 13x + 3$

$$\begin{aligned} & 4x^2 + 13x + 3 \\ &= 4x^2 + 12x + x + 3 \\ &= 4x(x + 3) + 1(x + 3) \\ &= (x + 3)(4x + 1) \end{aligned}$$

(iv) $3x^2 + 5x + 2$

$$\begin{aligned} & 3x^2 + 5x + 2 \\ &= 3x^2 + 3x + 2x + 2 \\ &= 3x(x + 1) + 2(x + 1) \\ &= (x + 1)(3x + 2) \end{aligned}$$

(v) $3y^2 - 11y + 6$

$$\begin{aligned} & 3y^2 - 11y + 6 \\ &= 3y^2 - 9y - 2y + 6 \\ &= 3y(y - 3) - 2(y - 3) \\ &= (y - 3)(3y - 2) \end{aligned}$$

(vi) $2y^2 - 5y + 2$

$$\begin{aligned} & 2y^2 - 5y + 2 \\ &= 2y^2 - 4y - y + 2 \\ &= 2y(y - 2) - 1(y - 2) \\ &= (y - 2)(2y - 1) \end{aligned}$$

(vii) $4z^2 - 11z + 6$

$$\begin{aligned} & 4z^2 - 11z + 6 \\ &= 4z^2 - 8z - 3z + 6 \\ &= 4z(z - 2) - 3(z - 2) \\ &= (z - 2)(4z - 3) \end{aligned}$$

(viii) $6 + 7x - 3x^2$

$$\begin{aligned} & 6 + 7x - 3x^2 \\ &= 6 + 9x - 2x - 3x^2 \\ &= 3(2 + 3x) - x(2 + 3x) \\ &= (2 + 3x)(3 - x) \\ &= (3x + 2)(3 - x) \end{aligned}$$