

Chapter 5 Exercise 5.1

- Q. 1.**
- (i) $a^3 = (1)^3$
 $= 1$
- (ii) $2b^2 = 2(2)^2$
 $= 2(4)$
 $= 8$
- (iii) $-6a^2 = -6(1)^2$
 $= -6(1)$
 $= -6$
- (iv) $4ab = 4(1)(2)$
 $= 8$
- (v) $a^2 b = (1)^2(2)$
 $= (1)(2)$
 $= 2$
- (vi) $(ab)^2 = (1 \times 2)^2$
 $= 2^2$
 $= 4$
- Q. 2.**
- (i) $ab + bc = (3)(-1) + (-1)(4)$
 $= -3 - 4$
 $= -7$
- (ii) $b(a - c) = (-1)(3 - 4)$
 $= (-1)(-1)$
 $= 1$
- (iii) $a^2 + ba + c = (3)^2 + (-1)(3) + (4)$
 $= 9 - 3 + 4$
 $= 10$
- (iv) $\frac{a + b}{b - c} = \frac{3 + (-1)}{(-1) - (4)}$
 $= \frac{2}{-5}$
 $= -\frac{2}{5}$
- (v) $abc = (3)(-1)(4)$
 $= -12$
- (vi) $\frac{ac - b}{ac + bc} = \frac{(3)(4) - (-1)}{(3)(4) + (-1)(4)}$
 $= \frac{12 + 1}{12 - 4} = \frac{13}{8} = 1\frac{5}{8}$

- Q. 3.**
- (i) $ax^2 - b = (1)(2)^2 - (4)$
 $= 4 - 4$
 $= 0$
- (ii) $ax^2 + bx + c$
 $= (1)(2)^2 + (4)(2) + (-5)$
 $= 4 + 8 - 5$
 $= 7$
- (iii) $bx^2 + ax - c$
 $= (4)(2)^2 + (1)(2) - (-5)$
 $= 16 + 2 + 5$
 $= 23$
- (iv) $x^3 - bx^2 + cx + a$
 $= (2)^3 - (4)(2)^2 + (-5)(2) + (1)$
 $= (8) - (4)(4) + (-10) + (1)$
 $= 8 - 16 - 10 + 1$
 $= -17$
- (v) $x^3 + ax^2 + bx - c$
 $= (2)^3 + (1)(2)^2 + (4)(2) - (-5)$
 $= 8 + 4 + 8 + 5$
 $= 25$
- (vi) $x^3 - cx^2 + cx - b$
 $= (2)^3 - (-5)(2)^2 + (-5)(2) - (4)$
 $= (8) - (-5)(4) + (-10) - (4)$
 $= (8) - (-20) + (-10) - (4)$
 $= 8 + 20 - 10 - 4$
 $= 14$
- Q. 4.**
- (i) $x + x \dots 2x$
 $3 + 3 \dots 2(3)$
 $6 = 6$
- (ii) $2x^2 \dots (2x)^2$
 $2(3)^2 \dots (2(3))^2$
 $2(9) \dots (6)^2$
 $18 < 36$

$$\begin{aligned} \text{(iii)} \quad & (x + 1)^2 \dots x^2 + 1 \\ & (3 + 1)^2 \dots 9 + 1 \\ & 16 > 10 \end{aligned}$$

$$\begin{aligned} \text{(iv)} \quad & 13x - 3x \dots 10x \\ & 13(3) - 3(3) \dots 10(3) \\ & 39 - 9 = 30 \end{aligned}$$

$$\begin{aligned} \text{(v)} \quad & x \dots x^3 - x^2 \\ & 3 \dots 27 - 9 \\ & 3 < 18 \end{aligned}$$

$$\begin{aligned} \text{(vi)} \quad & (x + 2)^2 \dots x^2 + 4x + 4 \\ & 25 \dots 9 + 12 + 4 \\ & 25 = 25 \end{aligned}$$

Q. 5. (i) $\frac{1}{x} + \frac{1}{y} = \frac{1}{1} + \frac{1}{3}$

$$\begin{aligned} &= \frac{3}{3} + \frac{1}{3} \\ &= \frac{4}{3} \\ &= 1\frac{1}{3} \end{aligned}$$

(ii) $\frac{1}{x} - \frac{3}{y} + \frac{2}{z} = \frac{1}{1} - \frac{3}{3} + \frac{2}{-4}$

$$\begin{aligned} &= \frac{1}{1} - \frac{3}{3} - \frac{2}{4} \\ &= \frac{12}{12} - \frac{12}{12} - \frac{6}{12} \\ &= \frac{-6}{12} \\ &= -\frac{1}{2} \end{aligned}$$

(iii) $\frac{x + y}{z - x} = \frac{(1) + (3)}{(-4) - (1)}$

$$\begin{aligned} &= \frac{4}{-5} \\ &= -\frac{4}{5} \end{aligned}$$

(iv) $\frac{2x - 3z}{y^2} = \frac{2(1) - 3(-4)}{3^2}$

$$\begin{aligned} &= \frac{2 + 12}{9} \\ &= \frac{14}{9} = 1\frac{5}{9} \end{aligned}$$

Q. 6. (i) $x^2 + px + q = (2)^2 + (4)(2) + (-3)$

$$\begin{aligned} &= 4 + 8 - 3 \\ &= 9 \end{aligned}$$

(ii) $x^3 + 2qx^2 + 4px - 2r$

$$\begin{aligned} &= (2)^3 + (2)(-3)(2)^2 + (4)(4)(2) \\ &\quad - (2)(-2) \\ &= (8) + (-6)(4) + (32) - (-4) \\ &= 8 - 24 + 32 + 4 \\ &= 20 \end{aligned}$$

(iii) $(2x + p)(rq - p)$

$$\begin{aligned} 2x + p &= 2(2) + 4 \\ &= 8 \\ rq - p &= (-2)(-3) - 4 \\ &= 2 \\ 8 \times 2 &= 16 \end{aligned}$$

(iv) $3\sqrt{x(4x^2 - 3r^2)}$

$$\begin{aligned} &= (3) \sqrt{(2)[(4)(2)^2 - (3)(-2)^2]} \\ &= (3) \sqrt{(2)[16 - 12]} \\ &= (3) \sqrt{(2)(4)} \\ &= (3)\sqrt{8} \\ &= 3(2\sqrt{2}) \\ &= 6\sqrt{2} \end{aligned}$$

$$\begin{aligned} \sqrt{8} &= \sqrt{(4)(2)} \\ &= \sqrt{4} \sqrt{2} \\ &= 2\sqrt{2} \end{aligned}$$

Alternative Method

$$\begin{aligned} (4x^2 - 3r^2) &= (4)(2)^2 - (3)(-2)^2 \\ &= 16 - 12 \\ &= 4 \end{aligned}$$

$$\begin{aligned} 3\sqrt{x(4x^2 - 3r^2)} &= 3\sqrt{(2)(4)} \\ &= 3\sqrt{8} \\ &= 3(2\sqrt{2}) \\ &= 6\sqrt{2} \end{aligned}$$

Q. 7. (i) $y^2 - 3ay - 4b$

$$\begin{aligned} &= (3)^2 - (3)\left(\frac{1}{2}\right)(3) - (4)\left(\frac{1}{5}\right) \\ &= 9 - \frac{9}{2} - \frac{4}{5} \\ &= \frac{90}{10} - \frac{45}{10} - \frac{8}{10} \\ &= \frac{37}{10} \\ &= 3\frac{7}{10} \end{aligned}$$

$$\begin{aligned}
 \text{(ii) } y^3 + aby &= (3)^3 + \left(\frac{1}{2}\right)\left(\frac{1}{5}\right)(3) \\
 &= 27 + \frac{3}{10} \\
 &= 27\frac{3}{10}
 \end{aligned}$$

$$\begin{aligned}
 \text{(iii) } by^3 + cy^2 + ay + b &= \left(\frac{1}{5}\right)(3)^3 + \left(-\frac{4}{3}\right)(3)^2 + \left(\frac{1}{2}\right)(3) + \left(\frac{1}{5}\right) \\
 &= \frac{27}{5} - \frac{36}{3} + \frac{3}{2} + \frac{1}{5} \\
 &= \frac{27}{5} - \frac{12}{1} + \frac{3}{2} + \frac{1}{5} \\
 &= \frac{54}{10} - \frac{120}{10} + \frac{15}{10} + \frac{2}{10} \\
 &= -\frac{49}{10} \\
 &= -4\frac{9}{10}
 \end{aligned}$$

$$\begin{aligned}
 \text{(iv) } ay^2 - cy + b &= \left(\frac{1}{2}\right)(3)^2 - \left(\frac{-4}{3}\right)(3) + \left(\frac{1}{5}\right) \\
 &= \frac{9}{2} + 4 + \frac{1}{5} \\
 &= \frac{45}{10} + \frac{40}{10} + \frac{2}{10} \\
 &= \frac{87}{10} \\
 &= 8\frac{7}{10}
 \end{aligned}$$

Q. 8. Cone 1:

$$\begin{aligned}
 l^2 &= r^2 + h^2 \\
 l^2 &= 14^2 + 48^2 \\
 l^2 &= 196 + 2,304 \\
 l^2 &= 2,500 \\
 l &= 50 \text{ cm}
 \end{aligned}$$

Q. 9. Triangle 1:

$$S = \frac{4 + 3 + 2}{2} = 4.5$$

$$\begin{aligned}
 \text{Area} &= \sqrt{(4.5)(4.5 - 4)(4.5 - 3)(4.5 - 2)} \\
 &= \sqrt{(4.5)(0.5)(1.5)(2.5)} \\
 &= \sqrt{8.4375} \\
 &= 2.90 \text{ cm}^2
 \end{aligned}$$

$$\begin{aligned}
 \text{Area} &= \pi rl \\
 &= (3.14)(14)(50) \\
 &= 2,198 \text{ cm}^2
 \end{aligned}$$

Cone 2:

$$\begin{aligned}
 l^2 &= 24^2 + 70^2 \\
 l^2 &= 576 + 4,900 \\
 l^2 &= 5,476 \\
 l &= 74 \text{ m}
 \end{aligned}$$

$$\begin{aligned}
 \text{Area} &= \pi rl \\
 &= \left(\frac{22}{7}\right)(24)(74) \\
 &= 5,581.7 \text{ m}^2
 \end{aligned}$$

Cone 3:

$$\begin{aligned}
 l^2 &= 63^2 + 16^2 \\
 l^2 &= 3,969 + 256 \\
 l^2 &= 4,225 \\
 l &= 65 \text{ cm}
 \end{aligned}$$

$$\begin{aligned}
 \text{Area} &= \pi rl \\
 &= (3.14)(63)(65) \\
 &= 12,858.3 \text{ cm}^2
 \end{aligned}$$

Cone 4:

$$\begin{aligned}
 l^2 &= 25^2 + 60^2 \\
 l^2 &= 625 + 3,600 \\
 l^2 &= 4,225 \\
 l &= 65 \text{ mm}
 \end{aligned}$$

$$\begin{aligned}
 \text{Area} &= \pi rl \\
 &= \left(\frac{22}{7}\right)(25)(65) \\
 &= 5,107\frac{1}{7} \text{ mm}^2
 \end{aligned}$$

Triangle 2:

$$S = \frac{10 + 11.5 + 10.3}{2} = 15.9$$

$$\begin{aligned} \text{Area} &= \sqrt{(15.9)(15.9 - 10)(15.9 - 11.5)(15.9 - 10.3)} \\ &= \sqrt{(15.9)(5.9)(4.4)(5.6)} \\ &= \sqrt{2311.48} \\ &= 48.08 \text{ cm}^2 \end{aligned}$$

Triangle 3:

$$S = \frac{\frac{1}{2} + \frac{1}{3} + \frac{2}{3}}{2} = \frac{\frac{3}{6} + \frac{2}{6} + \frac{4}{6}}{2}$$

$$= \frac{\frac{9}{6} + \frac{3}{6}}{2} = \frac{\frac{12}{6}}{2} = \frac{2}{2} = 1$$

$$\begin{aligned} \text{Area} &= \sqrt{\left(\frac{3}{4}\right)\left(\frac{3}{4} - \frac{1}{2}\right)\left(\frac{3}{4} - \frac{1}{3}\right)\left(\frac{3}{4} - \frac{2}{3}\right)} \\ &= \sqrt{\left(\frac{3}{4}\right)\left(\frac{1}{4}\right)\left(\frac{5}{12}\right)\left(\frac{1}{12}\right)} \\ &= \sqrt{\frac{15}{2,304}} = \sqrt{\frac{5}{768}} = 0.08 \text{ cm}^2 \end{aligned}$$

Exercise 5.2

Q. 1. (i) $(2x + 4y) + 2(x - 2y) = 2x + 4y + 2x - 4y$
 $= 2x + 2x + 4y - 4y$
 $= 4x$

(ii) $(3a - b + c) - (2b + c) = 3a - b + c - 2b - c$
 $= 3a - b - 2b + c - c$
 $= 3a - 3b$

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

(iv) $(b^2 + 2c + 4) - (b^2 - 3c + 5) = b^2 + 2c + 4 - b^2 + 3c - 5$
 $= b^2 - b^2 + 2c + 3c + 4 - 5$
 $= 5c - 1$

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

Q. 2. (i) $3(2a + b + 4) + 2(3a - 2b + 5)$
 $= 6a + 3b + 12 + 6a - 4b + 10$
 $= 6a + 6a + 3b - 4b + 12 + 10$
 $= 12a - b + 22$

$$\begin{aligned}
 \text{(ii)} \quad & 12(p + q - 5) - 8(p - 2q + 1) \\
 & = 12p + 12q - 60 - 8p + 16q - 8 \\
 & = 12p - 8p + 12q + 16q - 60 - 8 \\
 & = 4p + 28q - 68
 \end{aligned}$$

$$\begin{aligned}
 \text{(iii)} \quad & -3(2x + y + 2) - (5x - 3y - 1) \\
 & = -6x - 3y - 6 - 5x + 3y + 1 \\
 & = -6x - 5x - 3y + 3y - 6 + 1 \\
 & = -11x - 5
 \end{aligned}$$

$$\begin{aligned}
 \text{(iv)} \quad & 4(8x^2 - 3x + 2) \\
 & = 32x^2 - 12x + 8
 \end{aligned}$$

$$\begin{aligned}
 \text{(v)} \quad & 5x(2x^2 - 4) \\
 & = 10x^3 - 20x
 \end{aligned}$$

$$\begin{aligned}
 \text{(vi)} \quad & -11a(5a^2 + 1) \\
 & = -55a^3 - 11a
 \end{aligned}$$

Q. 3.

$$\begin{aligned}
 \text{(i)} \quad & 2(a + b + 3) - 2(5a - 3b + 2) - (3a + 5b - 3) \\
 & = 2a + 2b + 6 - 10a + 6b - 4 - 3a - 5b + 3 \\
 & = 2a - 10a - 3a + 2b + 6b - 5b + 6 - 4 + 3 \\
 & = -11a + 3b + 5
 \end{aligned}$$

$$\begin{aligned}
 \text{(ii)} \quad & 3x(2x + 2) + 2x(x + 3) \\
 & = 6x^2 + 6x + 2x^2 + 6x \\
 & = 6x^2 + 2x^2 + 6x + 6x \\
 & = 8x^2 + 12x
 \end{aligned}$$

$$\begin{aligned}
 \text{(iii)} \quad & p(1 - 2p) + 2p(p - 1) \\
 & = p - 2p^2 + 2p^2 - 2p \\
 & = p - 2p - 2p^2 + 2p^2 \\
 & = -p
 \end{aligned}$$

$$\begin{aligned}
 \text{(iv)} \quad & -5(x + 4y - 8) + 3(x + y + 1) - 2(4 - y - 2x) \\
 & = -5x - 20y + 40 + 3x + 3y + 3 - 8 + 2y + 4x \\
 & = -5x + 3x + 4x - 20y + 3y + 2y + 40 + 3 - 8 \\
 & = 2x - 15y + 35
 \end{aligned}$$

Q. 4.

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

$$\begin{aligned}
 \text{(ii)} \quad & (2x - 1)(x + 3) \\
 & = 2x^2 + 6x - x - 3 \\
 & = 2x^2 + 5x - 3
 \end{aligned}$$

$$\begin{aligned}
 \text{(iii)} \quad & (3x - 2)(2x - 1) \\
 & = 6x^2 - 3x - 4x + 2 \\
 & = 6x^2 - 7x + 2
 \end{aligned}$$

$$\begin{aligned}
 \text{(iv)} \quad & (2a - 5)(a + 2) \\
 & = 2a^2 + 4a - 5a - 10 \\
 & = 2a^2 - a - 10
 \end{aligned}$$

$$\begin{aligned} \text{(v)} \quad & (2a - 2)(3a - 2) \\ & = 6a^2 - 4a - 6a + 4 \\ & = 6a^2 - 10a + 4 \end{aligned}$$

$$\begin{aligned} \text{(vi)} \quad & (x - y)(x + y) \\ & = x^2 + xy - xy - y^2 \\ & = x^2 - y^2 \end{aligned}$$

$$\begin{aligned} \text{(vii)} \quad & (m - n)(m - n) \\ & = m^2 - mn - mn + n^2 \\ & = m^2 - 2mn + n^2 \end{aligned}$$

$$\begin{aligned} \text{(viii)} \quad & (2a - 3)(5a - 4) \\ & = 10a^2 - 8a - 15a + 12 \\ & = 10a^2 - 23a + 12 \end{aligned}$$

$$\begin{aligned} \text{(ix)} \quad & (1 - 2a)(1 + 2a) \\ & = 1 + 2a - 2a - 4a^2 \\ & = 1 - 4a^2 \end{aligned}$$

$$\begin{aligned} \text{(x)} \quad & (7 + 3a)(3a - 2) \\ & = 21a - 14 + 9a^2 - 6a \\ & = 9a^2 + 15a - 14 \end{aligned}$$

Q. 5. (i) $(x - 3)^2 = (x - 3)(x - 3)$
 $= x^2 - 3x - 3x + 9$
 $= x^2 - 6x + 9$

(ii) $(5x + 1)^2 = (5x + 1)(5x + 1)$
 $= 25x^2 + 5x + 5x + 1$
 $= 25x^2 + 10x + 1$

(iii) $(3y - 2)^2 = (3y - 2)(3y - 2)$
 $= 9y^2 - 6y - 6y + 4$
 $= 9y^2 - 12y + 4$

(iv) $(4y + 5)^2 = (4y + 5)(4y + 5)$
 $= 16y^2 + 20y + 20y + 25$
 $= 16y^2 + 40y + 25$

(v) $[2(2x - 3)]^2 = (4x - 6)^2$
 $= (4x - 6)(4x - 6)$
 $= 16x^2 - 24x - 24x + 36$
 $= 16x^2 - 48x + 36$

Q. 6. (i) $(x + 1)(x^2 + 2x + 3)$
 $= x^3 + 2x^2 + 3x + x^2 + 2x + 3$
 $= x^3 + 2x^2 + x^2 + 3x + 2x + 3$
 $= x^3 + 3x^2 + 5x + 3$

(ii) $(x + 2)(2x^2 + 3x - 1)$
 $= 2x^3 + 3x^2 - x + 4x^2 + 6x - 2$
 $= 2x^3 + 3x^2 + 4x^2 - x + 6x - 2$
 $= 2x^3 + 7x^2 + 5x - 2$

(iii) $(2x + 2)(3x^2 + 2x - 3)$
 $= 6x^3 + 4x^2 - 6x + 6x^2 + 4x - 6$
 $= 6x^3 + 4x^2 + 6x^2 - 6x + 4x - 6$
 $= 6x^3 + 10x^2 - 2x - 6$

(iv) $(a^2 + 2a - 2)(2a - 3)$
 $= 2a^3 - 3a^2 + 4a^2 - 6a - 4a + 6$
 $= 2a^3 + a^2 - 10a + 6$

(v) $(3a^2 - 4a - 1)(3a - 1)$
 $= 9a^3 - 3a^2 - 12a^2 + 4a - 3a + 1$
 $= 9a^3 - 15a^2 + a + 1$

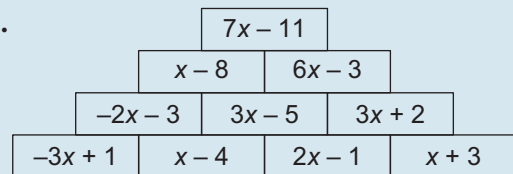
(vi) $(1 - a)(4 - 3a - a^2)$
 $= 4 - 3a - a^2 - 4a + 3a^2 + a^3$
 $= a^3 - a^2 + 3a^2 - 3a - 4a + 4$
 $= a^3 + 2a^2 - 7a + 4$

Q. 7. (i) $x(x + 1)(x + 3)$
 $= (x^2 + x)(x + 3)$
 $= x^3 + 3x^2 + x^2 + 3x$
 $= x^3 + 4x^2 + 3x$

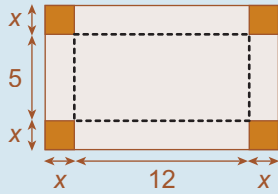
(ii) $-2a(a + 1)(2a - 3)$
 $= (-2a^2 - 2a)(2a - 3)$
 $= -4a^3 + 6a^2 - 4a^2 + 6a$
 $= -4a^3 + 2a^2 + 6a$

(iii) $-p(p - 1)(p + 1)$
 $= -p(p^2 + p - p - 1)$
 $= -p(p^2 - 1)$
 $= -p^3 + p$

Q. 8.



Q. 9.



(i) Area of garden = Total length \times Total width

$$\begin{aligned} &= (12 + 2x) \times (5 + 2x) \\ &= 60 + 24x + 10x + 4x^2 \\ &= 4x^2 + 34x + 60 \end{aligned}$$

(ii) Area of flower-bed = Area of garden – Area of lawn

$$\begin{aligned} &= (4x^2 + 34x + 60) - (5 \times 12) \\ &= 4x^2 + 34x + 60 - 60 \\ &= 4x^2 + 34x \end{aligned}$$

Q. 10. (i) Area = $(2x)(x - 5)$

$$= (2x^2 - 10x) \text{ m}^2$$

(ii) Perimeter = $2(2x) + 2(x - 5)$

$$= 4x + 2x - 10$$

$$= (6x - 10) \text{ m}$$

(iii) Area will be half: $\frac{1}{2}(2x^2 - 10x)$

$$= (x^2 - 5x) \text{ m}^2$$

Q. 11. (i) Surface Area = Total Area Rectangle – Area Removed

$$\begin{aligned} &= (x + 7)(x - 1) - 4(4)^2 \\ &= x^2 - x + 7x - 7 - 4(16) \\ &= x^2 + 6x - 7 - 64 \\ &= (x^2 + 6x - 71) \text{ cm}^2 \end{aligned}$$

(ii) Volume of box = length \times width \times height

$$\begin{aligned} &= (x - 1)(x - 9)(4) \\ &= (x^2 - 10x + 9)4 \\ &= (4x^2 - 40x + 36) \text{ cm}^3 \end{aligned}$$

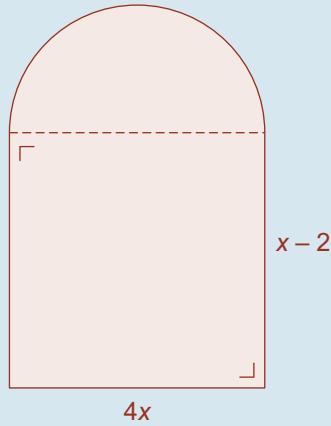
Q. 12. (i) Area = $(2x)(x + 6) - (x + 6 - (2x - 3))(2x - (x - 1))$

$$\begin{aligned} &= 2x^2 + 12x - (-x + 9)(x + 1) \\ &= 2x^2 + 12x - (-x^2 - x + 9x + 9) \\ &= 2x^2 + 12x + x^2 - 8x - 9 \\ &= 3x^2 + 4x - 9 \end{aligned}$$

Perimeter = $(2x) + (x + 6) + (x - 1) + (2x - 3) + (2x - (x - 1)) + (x + 6 - (2x - 3))$

$$\begin{aligned} &= (2x) + (x + 6) + (x - 1) + (2x - 3) + (x + 1) + (-x + 9) \\ &= 6x + 12 \end{aligned}$$

(ii)



$$\text{Radius} = 2x$$

$$\begin{aligned} \text{Area} &= 4x(x - 2) + \frac{(3.14)(2x)^2}{2} \\ &= 4x^2 - 8x + \frac{12.56x^2}{2} \\ &= 4x^2 - 8x + 6.28x^2 \end{aligned}$$

$$\text{Area} = 10.28x^2 - 8x$$

$$\begin{aligned} \text{Perimeter} &= 4x + 2(x - 2) + \frac{2(3.14)(2x)}{2} \\ &= 4x + 2x - 4 + (3.14)(2x) \\ &= 4x + 2x - 4 + 6.28x \end{aligned}$$

$$\text{Perimeter} = 12.28x - 4$$

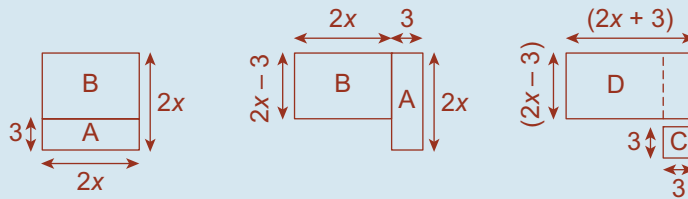
(iii) Area = (Area of square) - (Area of sector)

$$\begin{aligned} &= (x + 4)(x + 4) - \frac{1}{4}(3.14)(x + 4)^2 \\ &= (x^2 + 8x + 16) - 0.785(x^2 + 8x + 16) \\ &= x^2 - 0.785x^2 + 8x - 6.28x + 16 - 12.56 \\ &= 0.215x^2 + 1.72x + 3.44 \end{aligned}$$

$$\begin{aligned} \text{Perimeter} &= (x + 4) + (x + 4) + \frac{1}{4}(2\pi r) \\ &= (2x + 8) + \frac{3.14}{2}(x + 4) \\ &= 2x + 1.57x + 8 + 6.28 \\ &= 3.57x + 14.28 \end{aligned}$$

Q. 13. (a) $(2x)(2x) = 4x^2$ units²

(b)



$$\begin{aligned} \text{(i) Rectangle B} &= (2x)(2x - 3) \\ &= 4x^2 - 6x \text{ units}^2 \end{aligned}$$

$$\text{(ii) Square C} = 3 \times 3 = 9 \text{ units}^2$$

(c) As diagrams above show, the area of

$$\begin{aligned} D &= (2x - 3)(2x + 3) \\ &= 4x^2 + 6x - 6x - 9 \\ &= 4x^2 - 9 \end{aligned}$$

Q. 14. (a) (i) $B + 2C = 2x - 7 + 2(4 - 3x)$

$$\begin{aligned} &= 2x - 7 + 8 - 6x \\ &= -4x + 1 \end{aligned}$$

$$\begin{aligned} \text{(ii) } AC + BD &= (5x + 1)(4 - 3x) + (2x - 7)(x + 3) \\ &= (20x - 15x^2 + 4 - 3x) + (2x^2 + 6x - 7x - 21) \\ &= (-15x^2 + 17x + 4) + (2x^2 - x - 21) \\ &= -13x^2 + 16x - 17 \end{aligned}$$

$$\begin{aligned}
 \text{(iii) } ABC &= (5x + 1)(2x - 7)(4 - 3x) \\
 &= (10x^2 - 35x + 2x - 7)(4 - 3x) \\
 &= (10x^2 - 33x - 7)(4 - 3x) \\
 &= 40x^2 - 30x^3 - 132x + 99x^2 - 28 + 21x \\
 &= -30x^3 + 139x^2 - 111x - 28
 \end{aligned}$$

$$\begin{aligned}
 \text{(b) } B + C + D &= (2x - 7) + (4 - 3x) + (x + 3) \\
 &= 2x - 3x + x - 7 + 4 + 3 \\
 &= 0x + 0 \\
 &= 0
 \end{aligned}$$

$$\begin{aligned}
 \text{(c) } A - B + C &= (5x + 1) - (2x - 7) + (4 - 3x) \\
 &= 5x - 2x - 3x + 1 + 7 + 4 \\
 &= 0x + 12 \\
 &= 12
 \end{aligned}$$

$$\text{(Ans} = A - B + C)$$

Q. 15. Area = $12x^2 + 16x$
 $= x(12x + 16)$

Other possible expressions

- $4(3x^2 + 4x)$ • $2(6x^2 + 8x)$
- $4x(3x + 4)$ • $2x(6x + 8)$

Revision Exercises

- Q. 1.** (a) (i) $ab = (6)(4) = 24$
(ii) $ab + c = (6)(4) + (1) = 25$
(iii) $b^2 + ab + c = (4)^2 + (6)(4) + (1) = 41$
(iv) $c^2 + bc + a = (1)^2 + (4)(1) + (6) = 11$
(v) $\frac{ab}{bc + ab} = \frac{(6)(4)}{(4)(1) + (6)(4)} = \frac{24}{28} = \frac{6}{7}$
- (b) (i) $3(2a + 5b) = 6a + 15b$
(ii) $4(6b - c) = 24b - 4c$
(iii) $7(3x - 2y) = 21x - 14y$
(iv) $-2(2x + 7y) = -4x - 14y$
(v) $-3(x - y) = -3x + 3y$
- (c) (i) $(5x^2 - 2x) + (2x^2 - 3x) + (4x - 2)$
 $= 5x^2 + 2x^2 - 2x - 3x + 4x - 2$
 $= 7x^2 - x - 2$
(ii) $(8x^2 + 2x + 3) - (6x^2 + 4x - 1)$
 $= 8x^2 + 2x + 3 - 6x^2 - 4x + 1$
 $= 2x^2 - 2x + 4$

$$\begin{aligned} \text{(iii)} \quad & (6a^2 + 3a - 2) + (7a^2 - 2a + 4) - (3a^2 + 4a - 1) \\ & = 6a^2 + 7a^2 - 3a^2 + 3a - 2a - 4a - 2 + 4 + 1 \\ & = 10a^2 - 3a + 3 \end{aligned}$$

$$\begin{aligned} \text{(iv)} \quad & (11b^2 - 2b + 7) - (8b - 3) - (4 - 3b + 8b^2) - 3b \\ & = 11b^2 - 8b^2 - 2b - 8b + 3b - 3b + 7 + 3 - 4 \\ & = 3b^2 - 10b + 6 \end{aligned}$$

$$\text{(d) (i)} \quad (x + 3)(x + 4) = x^2 + 4x + 3x + 12 = x^2 + 7x + 12$$

$$\text{(ii)} \quad (x + 2)(x + 5) = x^2 + 5x + 2x + 10 = x^2 + 7x + 10$$

$$\text{(iii)} \quad (x + 10)(x + 3) = x^2 + 3x + 10x + 30 = x^2 + 13x + 30$$

$$\text{(iv)} \quad (y + 2)(y + 7) = y^2 + 7y + 2y + 14 = y^2 + 9y + 14$$

$$\text{(v)} \quad (2y + 1)(y + 3) = 2y^2 + 6y + y + 3 = 2y^2 + 7y + 3$$

$$\text{Q. 2. (a) (i)} \quad ax + bx + c = (3)(-1) + (2)(-1) + (-4)$$

$$= -3 - 2 - 4$$

$$= -9$$

$$\text{(ii)} \quad ax^2 + cx - d = (3)(-1)^2 + (-4)(-1) - \left(\frac{1}{2}\right)$$

$$= 3 + 4 - \frac{1}{2}$$

$$= 6\frac{1}{2}$$

$$\text{(iii)} \quad x^3 - bx^2 + cx + a = (-1)^3 - (2)(-1)^2 + (-4)(-1) + (3)$$

$$= -1 - 2 + 4 + 3$$

$$= 4$$

$$\text{(iv)} \quad x^3 - ax^2 - dx + d = (-1)^3 - (3)(-1)^2 - \left(\frac{1}{2}\right)(-1) + \left(\frac{1}{2}\right)$$

$$= -1 - 3 + \frac{1}{2} + \frac{1}{2}$$

$$= -3$$

$$\text{(v)} \quad xd^3 + ad^2 - cd + c = (-1)\left(\frac{1}{2}\right)^3 + (3)\left(\frac{1}{2}\right)^2 - (-4)\left(\frac{1}{2}\right) + (-4)$$

$$= -\frac{1}{8} + \frac{3}{4} + 2 - 4$$

$$= -\frac{1}{8} + \frac{6}{8} + \frac{16}{8} - \frac{32}{8}$$

$$= -\frac{11}{8}$$

$$= -1\frac{3}{8}$$

$$\text{(b) (i)} \quad -10(2x - 5y) = -20x + 50y$$

$$\text{(ii)} \quad -(x - y + z) = -x + y - z$$

$$\text{(iii)} \quad x(2x + 5) = 2x^2 + 5x$$

$$\text{(iv)} \quad a(12a - 4) = 12a^2 - 4a$$

$$\text{(v)} \quad 3a(7a - 2b) = 21a^2 - 6ab$$

$$\text{(vi)} \quad -2x(3 - x) = -6x + 2x^2$$

$$(c) \quad (i) \quad (3x - 7)(2x + 1) = 6x^2 + 3x - 14x - 7 \\ = 6x^2 - 11x - 7$$

$$(ii) \quad (2a - 4)(3a - 5) = 6a^2 - 10a - 12a + 20 \\ = 6a^2 - 22a + 20$$

$$(iii) \quad (3y + 2)^2 = (3y + 2)(3y + 2) \\ = 9y^2 + 6y + 6y + 4 \\ = 9y^2 + 12y + 4$$

$$(iv) \quad (8x - 1)^2 = (8x - 1)(8x - 1) \\ = 64x^2 - 8x - 8x + 1 \\ = 64x^2 - 16x + 1$$

$$(v) \quad (x - 10)^2 = (x - 10)(x - 10) \\ = x^2 - 10x - 10x + 100 \\ = x^2 - 20x + 100$$

Q. 3. (i) $x(x + 4)(x + 5) = x(x^2 + 5x + 4x + 20)$
 $= x(x^2 + 9x + 20)$
 $= x^3 + 9x^2 + 20x$

(ii) $x(x - 3)(x + 8) = x(x^2 + 8x - 3x - 24)$
 $= x(x^2 + 5x - 24)$
 $= x^3 + 5x^2 - 24x$

(iii) $(x - 1)(x + 1)(x + 5) = (x - 1)(x^2 + 5x + x + 5)$
 $= x^3 + 6x^2 + 5x - x^2 - 6x - 5$
 $= x^3 + 5x^2 - x - 5$

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

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

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

(vii) $(2x - 1)^3 = (2x - 1)(2x - 1)(2x - 1)$
 $= (2x - 1)(4x^2 - 4x + 1)$
 $= 8x^3 - 8x^2 + 2x - 4x^2 + 4x - 1$
 $= 8x^3 - 12x^2 + 6x - 1$

Q. 4. (a) (i) $3(a + b) + 2(3a - 4b) = 3a + 3b + 6a - 8b$
 $= 9a - 5b$

(ii) $3(x + 4y + 1) - (x + y - 11) = 3x + 12y + 3 - x - y + 11$
 $= 2x + 11y + 14$

(iii) $-5x(2x^2 - 4) = -10x^3 + 20x$

$$\begin{aligned} \text{(iv)} \quad \frac{1}{3}(9x - 3y + 2) + 2(x + 2y - 1) &= 3x - y + \frac{2}{3} + 2x + 4y - 2 \\ &= 5x + 3y - 1\frac{1}{3} \end{aligned}$$

$$\begin{aligned} \text{(v)} \quad \frac{1}{2}(10x - 8y + 6) - (5x - 4y + 3) \\ &= 5x - 4y + 3 - 5x + 4y - 3 \\ &= 0 \end{aligned}$$

$$\begin{aligned} \text{(b) (i)} \quad (x - 2)(x^2 + x + 5) &= x^3 + x^2 + 5x - 2x^2 - 2x - 10 \\ &= x^3 - x^2 + 3x - 10 \end{aligned}$$

$$\begin{aligned} \text{(ii)} \quad (x + 3)(2x^2 - x - 1) &= 2x^3 - x^2 - x + 6x^2 - 3x - 3 \\ &= 2x^3 + 5x^2 - 4x - 3 \end{aligned}$$

$$\begin{aligned} \text{(iii)} \quad (x - 2)(x^2 + 2x + 4) &= x^3 + 2x^2 + 4x - 2x^2 - 4x - 8 \\ &= x^3 - 8 \end{aligned}$$

$$\begin{aligned} \text{(iv)} \quad (2x + 3)(4x^2 - 6x + 9) &= 8x^3 - 12x^2 + 18x + 12x^2 - 18x + 27 \\ &= 8x^3 + 27 \end{aligned}$$

$$\begin{aligned} \text{(v)} \quad (x + y)^4 &= (x + y)(x + y)(x + y)(x + y) \\ &= (x + y)^2 (x + y)^2 \\ &= (x^2 + 2xy + y^2)(x^2 + 2xy + y^2) \\ &= x^4 + 2x^3y + x^2y^2 + 2x^3y + 4x^2y^2 + 2xy^3 + x^2y^2 + 2xy^3 + y^4 \\ &= x^4 + 4x^3y + 6x^2y^2 + 4xy^3 + y^4 \end{aligned}$$

Q. 5. (a) (i) $x + y = (-1) + (-2) = -3$

(ii) $2x - y = 2(-1) - (-2) = 0$

(iii) $5xy = (5)(-1)(-2) = 10$

(iv) $3x + 4y = 3(-1) + 4(-2) = -11$

$$\begin{aligned} \text{(b) (i)} \quad (4a + 2)(4a^2 - 2a - 7) \\ &= 16a^3 - 8a^2 - 28a + 8a^2 - 4a - 14 \\ &= 16a^3 - 32a - 14 \end{aligned}$$

$$\begin{aligned} \text{(ii)} \quad (6y - 1)(2y^2 - 3y - 5) \\ &= 12y^3 - 18y^2 - 30y - 2y^2 + 3y + 5 \\ &= 12y^3 - 20y^2 - 27y + 5 \end{aligned}$$

$$\begin{aligned} \text{(iii)} \quad (y - 3)(-2y^2 - 4y - 2) \\ &= -2y^3 - 4y^2 - 2y + 6y^2 + 12y + 6 \\ &= -2y^3 + 2y^2 + 10y + 6 \end{aligned}$$

$$\begin{aligned} \text{(iv)} \quad (1 + 2x)(x^2 + x - 3) \\ &= x^2 + x - 3 + 2x^3 + 2x^2 - 6x \\ &= 2x^3 + 3x^2 - 5x - 3 \end{aligned}$$

Q. 6. (a) (i) Left hand side: $5a = 5(6) = 30$
 Right hand side: $6a - a = 6(6) - (6) = 30$
 $30 = 30$

$$5a = 6a - a$$

Ans: =

(ii) LHS: $(a + 2)^2 = (6 + 2)^2 = 64$

RHS: $a^2 + 4 = 6^2 + 4 = 40$

$$64 > 40$$

$$(a + 2)^2 > a^2 + 4$$

Ans: >

(iii) LHS: $\frac{1}{2}a = \frac{1}{2}(6) = 3$

RHS: $\frac{a}{2} = \frac{6}{2} = 3$

$$3 = 3$$

$$\frac{1}{2}a = \frac{a}{2}$$

Ans: =

(iv) LHS: $(a + 1)^2 = (6 + 1)^2 = 49$

RHS: $(a^2 + 2a + 1) = (6)^2 + 2(6) + 1 = 49$

$$49 = 49$$

$$(a + 1)^2 = (a^2 + 2a + 1)$$

Ans: =

(v) LHS: $\left(\frac{1}{2}a\right)^2 = (3)^2 = 9$

RHS: $\frac{1}{2}(a)^2 = \frac{1}{2}(6)^2 = \frac{1}{2}(36) = 18$

$$9 < 18$$

$$\left(\frac{1}{2}a\right)^2 < \frac{1}{2}a^2$$

Ans: <

(b) (i) $p + q = (x^2 - x + 2) + (x^2 + 3x - 3)$
 $= 2x^2 + 2x - 1$

(ii) $p - q = (x^2 - x + 2) - (x^2 + 3x - 3)$
 $= x^2 - x^2 - x - 3x + 2 + 3$
 $= -4x + 5$

(iii) $3p + q = 3(x^2 - x + 2) + (x^2 + 3x - 3)$
 $= 3x^2 - 3x + 6 + x^2 + 3x - 3$
 $= 4x^2 + 3$

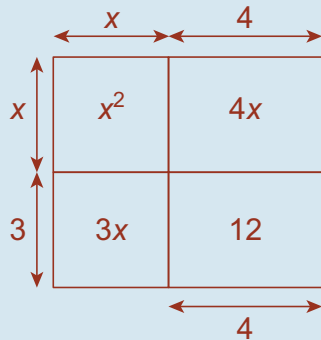
(iv) $3p - 2q = 3(x^2 - x + 2) - 2(x^2 + 3x - 3)$
 $= 3x^2 - 3x + 6 - 2x^2 - 6x + 6$
 $= x^2 - 9x + 12$

(c) (i) $p + q = (x^2 + 5) + (2x - 1)$
 $= x^2 + 2x + 4$

(ii) $pq = (x^2 + 5)(2x - 1) = 2x^3 - x^2 + 10x - 5$

(iii) $pq^2 = (x^2 + 5)(2x - 1)(2x - 1)$
 $= (x^2 + 5)(4x^2 - 2x - 2x + 1)$
 $= (x^2 + 5)(4x^2 - 4x + 1)$
 $= 4x^4 - 4x^3 + x^2 + 20x^2 - 20x + 5$
 $= 4x^4 - 4x^3 + 21x^2 - 20x + 5$

Q. 7.



(i) Length = $x + 4$

(ii) Width = $x + 3$

(iii) Perimeter
 $= 2(x + 4) + 2(x + 3)$
 $= 2x + 8 + 2x + 6$
 $= 4x + 14$

(iv) Double perimeter = $8x + 28$
 $= 2(2x + 8) + 2(2x + 6)$
 \Rightarrow Length = $(2x + 8)$
 Width = $(2x + 6)$
 Area = $(2x + 8)(2x + 6)$
 $= 4x^2 + 12x + 16x + 48$
 $= 4x^2 + 28x + 48$

Q. 8. (a)

Rectangle	Length	Width	Area
A	$x - 2$	$x - 3$	$(x - 2)(x - 3)$
B	2	$x - 3$	$(2)(x - 3)$
C	2	3	$(2)(3)$
D	$x - 2$	3	$(x - 2)(3)$

(b) Area B = $2(x - 3) = 2x - 6$
 Area C = $2(3) = 6$
 Area D = $(x - 2)(3) = 3x - 6$
 $B + C + D = (2x - 6) + (6) + (3x - 6) = 5x - 6$

(c) The full square made up of A + B + C + D has an area = x^2
 Since: $B + C + D = 5x - 6$,
 Rectangle A should be equal to $(A + B + C + D) - (B + C + D)$
 $= (x^2) - (5x - 6)$
 Area A = $x^2 - 5x + 6$
 We already know Area A = $(x - 2)(x - 3)$
 So $(x - 2)(x - 3)$ must equal $x^2 - 5x + 6$
 Verify: $(x - 2)(x - 3) = x^2 - 3x - 2x + 6 = x^2 - 5x + 6$

Q. 9. (a) Two-carriage train: no. of seats = $f + 2s$
Three-carriage train: no. of seats = $2f + 3s$
 $6(f + 2s) + 4(2f + 3s)$
 $= 6f + 12s + 8f + 12s$
 $= 14f + 24s$

(b) $\frac{1}{2}(14f)(60) = \text{€}(420f)$
 $\frac{3}{4}(24s)(40) = \text{€}(720s)$

Total = $420f + 720s$ (euros)

(c) Daily income = $420(16) + 720(90)$
 $= 6,720 + 64,800$
 $= \text{€}71,520$

Profit = $71,520 - 25,000 = \text{€}46,520$