2.3 Linear inequalities

1 **a** $x \leqslant 2$ **b** $x > -4$ **c** $x \geqslant -2$ **d** $x \geqslant \frac{3}{5}$

2 **a** $0 \leqslant 3$ so $x = 0$ satisfies Jane's solution.

$x = 0$: $9 - 4x = 9 - 4(0)$

$= 9$, which is **not** less than -3.

So Jane's solution is incorrect.

b When Jane cancelled off the minus signs she was actually multiplying both sides by -1, and so she should have reversed the inequality symbol.

c $x \geqslant 3$

3 **a** $x \geqslant 2$ **b** $x > \frac{1}{2}$ **c** $x > 8$

d $x \geqslant -\frac{1}{2}$ **e** $x \leqslant -2$ **f** $x > 1$

4 **a** $1 \leqslant x \leqslant 4$ **b** $-3 < x \leqslant -1$

c $-3 < x < -2$

5 **a** $\frac{4}{3} \leqslant x \leqslant \frac{11}{3}$ **b** $x = 2, x = 3$

6 **a** $0 \leqslant x < \frac{2}{3}$

b Unsolvable, as 12 is not less than 6

c $x = -\frac{3}{4}$

7 **a** $2 < x \leqslant 4$

b $2x + 3 > 16$ has solution $x > \frac{13}{2} = 6.5$

$4 - 3x \geqslant x - 20$ has solution $x \leqslant 6$

8 $3 < x \leqslant 4$

9 **a** Since $-7 < -4$, any number less than -7 must also be less than -4. But Tom's expression says $x > -4$.

b $-7 < x < -4$

10 **a** $x \geqslant 2$ **b** $14x - 10$ **c** 5

11 **a** $x \geqslant \frac{3}{2}$ **b** $x = \frac{3}{2}$

c The solution to $2x - 3 \geqslant 0$ corresponds to the values of x for which the line lies on or above the x-axis, i.e. $x \geqslant \frac{3}{2}$.

12 **a** $x \leqslant \frac{3}{4}$ **b** $x > -\frac{2}{3}$ **c** $x \leqslant \frac{5}{4}$

2.4 Forming expressions

1 **a** $6x + 8$

b Hint: Length $BE = \frac{1}{2}(2x + 4) = x + 2$.

Area of trapezium $= \frac{1}{2}(a + b)h$, where a, b are parallel sides and h is the height.

2 **a** **i** $10(x + 1)$ **ii** $5x(x + 3)$ **b** 350 cm^2

3 **a** $2\pi(x + 3)$

b Hint: The area of larger circle is $\pi(x + 3)^2$.

4 **a** Hint: The quarter-circle has circumference $\frac{1}{2}\pi r$.

b $\frac{1}{4}r^2(\pi - 2)$

5 **a** $P = 4x$ **b** $x = \sqrt{2}y, k = \sqrt{2}$

6 **a** $2x + y = 24$

b Hint: Start by rearranging $2x + y = 24$ to make y the subject.

c 64 m^2

7 **a** $V = 6x^3$

b Hint: The cuboid has 6 faces. The base has area $2x^2$ etc.

c $\frac{3}{11}$ **d** 88 cm^2

8 **a** $48 - 4x^2$

b Hint: Label the sides of the tray with its dimensions. e.g. The height of the tray is x cm.

c 1.5 cm **d** 22.5 cm^3

9 **a** $S = 2xy + 8x + 8y$

b Hint: Use Volume = base × width × height.

c $S = 8\left(x + \frac{4}{x} + 1\right)$

10 **a** $V = \pi r^2 h$ **b** $r = \frac{3}{\sqrt{h}}$

c Use Pythagoras' theorem where L is the hypotenuse.

11 **a** $4L$

b By construction, the circular lid has length L and so L = circumference of circle, radius r.
So $L = 2\pi r$ (that is, $r = \frac{L}{2\pi}$).

c Hint: Use $V = \pi r^2 h$ where $h = 4$ and $r = \frac{L}{2\pi}$.

d Hint: Add on the two circular parts, each with area πr^2.