1. Simplify

(a) $\dfrac{x^2 \times x^5}{x^{-1}}$ (b) $x^{3^{-2}}$ (c) $a^3 \times a^{-4^{0}}$

2. (a) Find the value of $x^{\frac{1}{2}}(x^{\frac{1}{2}} - x^{-\frac{1}{2}})$ when $x = 3$.

(b) Find the value of $(a^{\frac{3}{2}} - a^{\frac{1}{2}})(a^{\frac{3}{2}} + a^{\frac{1}{2}})$ when $a = 2$.

3. Without using a calculator or decimal approximations, explain why $\sqrt{151} > 5\sqrt{6}$.

4. Solve each of these equations/inequalities.

(a) $3(x-1) + 2(1+x) = 17$ (b) $5(3x-1) - (1-x) < 9$

(c) $16 - 3x \le x + 5(1-2x)$ (d) $(x-3)^2 - (x-5)^2 \le 0$

5. Calculate, without a calculator:

(a) $8 \cdot 5 - 1 \cdot 2 \times 6$ (b) $8 \cdot 4^2 - 1 \cdot 6^2$ (c) $15 \cdot 3 \div 0 \cdot 9$

6. It can be shown that $1^2 + 2^2 + 3^2 + \cdots\cdots + n^2 = \dfrac{1}{6}n(n+1)(2n+1)$. Using this formula,

(a) (i) Calculate $1^2 + 2^2 + 3^2 + \cdots\cdots + 10^2$.

(ii) Calculate $11^2 + 12^2 + 13^2 + \cdots\cdots + 20^2$.

(b) Find a formula for $1^2 + 2^2 + 3^2 + \cdots\cdots + (2n)^2$.

7. The cost of hiring a taxi is as follows:

Standing charge:	*£3.*
First 3 km:	*80 pence per km.*
Remainder of journey:	*60 pence per km.*

(i) Find the cost of a hire for a journey of 10 km.

(ii) Find a formula for the cost of a hire for a journey of t km. $(t > 3)$.

8. Simplify each of the following.

(a) $a^4 \times a^{-3} \times a^{-1}$ (b) $\left(x^{\frac{1}{2}}\right)^6$ (c) $\dfrac{y^3 \times y^{-2}}{y^{-3}}$ (d) $\left(g^{-2}\right)^{-4}$

(e) $\left(p^2 q^4\right)^{\frac{1}{2}}$ (f) $2c^2 \times 3c^{-3}$ (g) $10^{\frac{1}{2}} \times 10^{-\frac{2}{3}} \times 10^{\frac{1}{6}}$

9. (a) Solve $\dfrac{x}{3} = \dfrac{(1-x)}{5}$ (b) Express $\dfrac{4(2a-3)}{4a^2 - 9}$ in its simplest form.

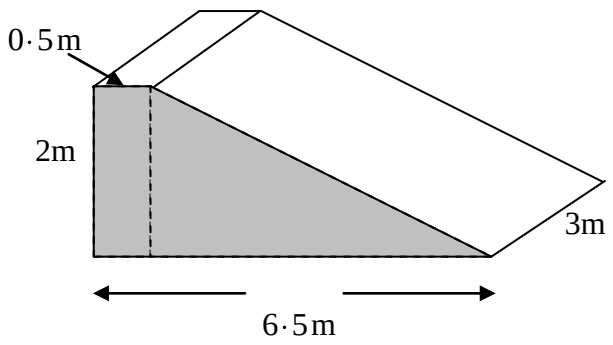
10. (a) By "completing the square", show that $x^2 - 4x + 9 \geq 5$ for all real x.

(b) At what value of x does the minimum occur?

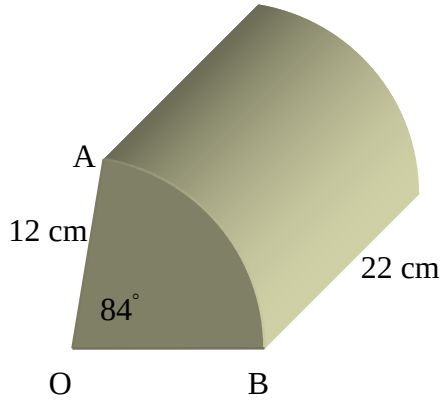
11. Factorise:

(a)	$d^2 - 2d + 1$	(b)	$2x^2 + 4x + 2$	(c)	$9m^2 - 16n^2$
(d)	$2a^2 - 7a + 3$	(e)	$a^2 - 5ab + 6b^2$	(f)	$8x^2 - 2x - 3$

12. Find the volume of the solid sketched below. Give your answer in litres.



13. The cross-section of the prism sketched below is a sector of a circle of radius 12 cm.
The prism has length 22 cm and $\angle AOB = 84^\circ$.
Calculate the volume of the prism, correct to three significant figures.



14. A tank contains 180 litres of water.
The water flows out at a constant rate of 30 litres per minute.

(a) Draw an accurate graph of the volume V, of water in the tank against the time t, in minutes.
(b) How long does it take for the volume to fall to 135 litres?