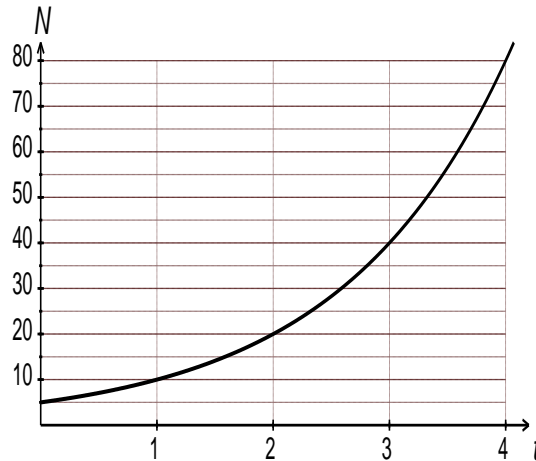1.   The graph below shows the function $N\ t\ =a\times b^t$, where a and b are constants.
      Find the values of a and b.

2.   The value of an antique has grown by 15% per annum for the last two years.
      If the present value is £10580, find the value two years ago.

3.   A cylinder has radius $2x$ units and height h units.
      A cone has radius x units and height $4x$ units.
      Given that they have equal volumes, express h in terms of x.
      Use exact values; no decimals.
      [Volume of cone $V = \dfrac{1}{3}\pi r^2 h$.]

4.   Express $\dfrac{x^2 - 9}{3x^2 - 7x - 6}$ in its simplest form.

5.   (a)   Sketch the graph of $f\ x\ = 35 + 2x - x^2$.

      (b)   Hence solve the inequality $35 + 2x - x^2 > 0$.

6.   The diagram below shows a rectangular fence built against a straight wall.
      The fencing consists of two lengths of fencing each of length y metres and one length of x metres, as shown in the diagram.
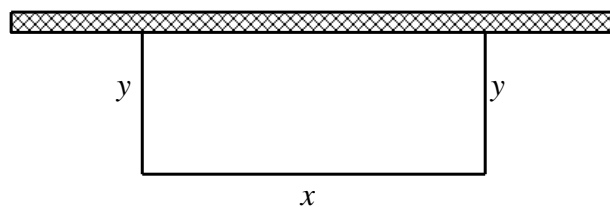

7.   (a)   Express $x^{\frac{3}{4}} - 2^{-\frac{1}{2}}\ \ x^{\frac{3}{4}} + 2^{-\frac{1}{2}}$ without brackets in its simplest form.

      (b)   Hence solve $x^{\frac{3}{4}} - 2^{-\frac{1}{2}}\ \ x^{\frac{3}{4}} + 2^{-\frac{1}{2}} = 7\dfrac{1}{2}$.

8.   The total mass of argon in a flask is $4 \cdot 15 \times 10^{-2}$ grams.
The mass of an atom of argon is $6 \cdot 63 \times 10^{-23}$ grams.
How many argon atoms are in the flask? Answer correct to 3 significant figures.

9.   (a)   Solve $3x^2 - 2x - 4 = 0$, giving the roots correct to one decimal place.

(b)   Solve $\sqrt{5}\,x = 10$, expressing your answer with a rational denominator.

(c) $f\,(x) = 2x^{\frac{1}{3}}$. Find t such that $f\,(t) = 6$.

10.
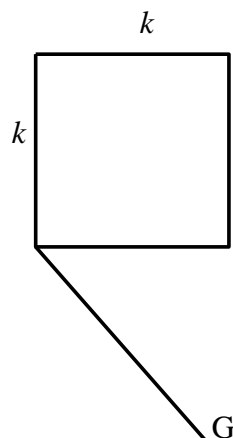
A small goat G is tethered at the corner of a shed in a field of green grass.
The shed is square with sides of length k metres, where $k > 2$.
The rope used to tether the goat is 2 metres longer than the side of the shed.

(a)   Show that the grazing area available to the goat in square metres is $\dfrac{3}{4}\pi\,(k+2)^2 + 2\pi$

(b)   Find the length of the rope needed to tie the goat to the corner so that the grazing area is 50π square metres.

11. $\mathbf{u} = \begin{pmatrix} 2 \\ -3 \end{pmatrix}$ and $\mathbf{v} = \begin{pmatrix} -4 \\ 1 \end{pmatrix}$.

(a)   Find $2\mathbf{u} - 3\mathbf{v}$
(b)   Find $|2\mathbf{u} - 3\mathbf{v}|$

12.   Simplify

(a) $\dfrac{x^2\,(x-1)^3}{x^3\,(x-1)}$, $x \neq 0,\ 1$.

(b) $\dfrac{(a-4)^2}{a^2 - 4}$, $a \neq \pm 2$