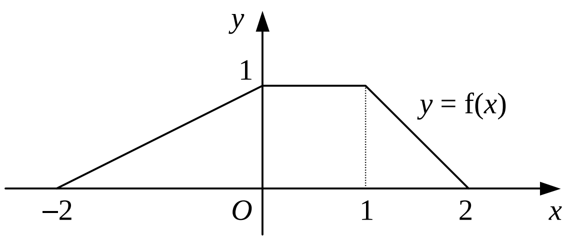
# GRAPHS OF FUNCTIONS

**1** **a** Solve the simultaneous equations

$$y = 3x - 4$$
$$y = 4x^2 - 9x + 5 \qquad \textbf{(4)}$$

**b** Hence, describe the geometrical relationship between the straight line $y = 3x - 4$ and the curve $y = 4x^2 - 9x + 5$. **(1)**

**2**




The diagram shows the graph of $y = \mathrm{f}(x)$ which is defined for $-2 \le x \le 2$.

Labelling the axes in a similar way, sketch on separate diagrams the graphs of

**a** $y = 3\mathrm{f}(x)$, **(2)**

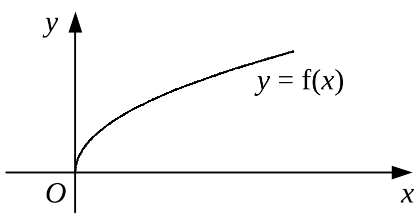
**b** $y = \mathrm{f}(x + 1)$, **(2)**

**c** $y = \mathrm{f}(-x)$. **(2)**

**3** **a** Show that the line $y = 4x + 1$ does not intersect the curve $y = x^2 + 5x + 2$. **(4)**

**b** Find the values of $m$ such that the line $y = mx + 1$ meets the curve $y = x^2 + 5x + 2$ at exactly one point. **(4)**

**4**




The diagram shows the curve with the equation $y = \mathrm{f}(x)$ where

$$\mathrm{f}(x) \equiv \sqrt{x}\,, \quad x \ge 0.$$

**a** Sketch on the same set of axes the graphs of $y = 1 + \mathrm{f}(x)$ and $y = \mathrm{f}(x + 3)$. **(4)**

**b** Find the coordinates of the point of intersection of the two graphs drawn in part **a**. **(4)**

**5** The curve $C$ has the equation $y = x^2 + kx - 3$ and the line $l$ has the equation $y = k - x$, where $k$ is a constant.

Prove that for all real values of $k$, the line $l$ will intersect the curve $C$ at exactly two points. **(7)**

**6**
$$\mathrm{f}(x) \equiv 2x^2 - 4x + 5.$$

**a** Express $\mathrm{f}(x)$ in the form $a(x + b)^2 + c$. **(3)**

**b** Showing the coordinates of the turning point in each case, sketch on the same set of axes the curves

**i** $y = \mathrm{f}(x)$,

**ii** $y = \mathrm{f}(x + 3)$. **(4)**

© Solomon Press

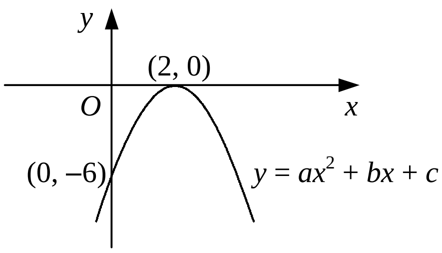
**7** **a** Sketch on the same diagram the straight line $y = 2x - 5$ and the curve $y = x^3 - 3x^2$, showing the coordinates of any points where each graph meets the coordinate axes. **(4)**

**b** Hence, state the number of real roots that exist for the equation

$$x^3 - 3x^2 - 2x + 5 = 0,$$

giving a reason for your answer. **(2)**

**8**




The diagram shows the curve with the equation $y = ax^2 + bx + c$.

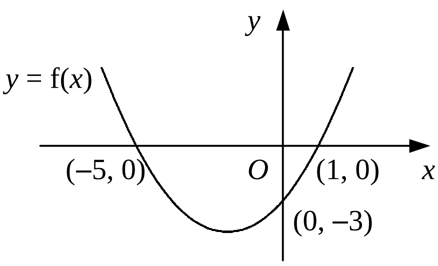
Given that the curve crosses the $y$-axis at the point (0, –6) and touches the $x$-axis at the point (2, 0), find the values of the constants $a$, $b$ and $c$. **(6)**

**9** **a** Show that

$$(1 - x)(2 + x)^2 \equiv 4 - 3x^2 - x^3.$$ **(3)**

**b** Hence, sketch the curve $y = 4 - 3x^2 - x^3$, showing the coordinates of any points of intersection with the coordinate axes. **(3)**

**10**




The diagram shows the curve with equation $y = \text{f}(x)$ which crosses the coordinate axes at the points (–5, 0), (1, 0) and (0, –3).

Showing the coordinates of any points of intersection with the axes, sketch on separate diagrams the curves

**a** $y = -\text{f}(x)$, **(2)**

**b** $y = \text{f}(x - 5)$, **(2)**

**c** $y = \text{f}(2x)$. **(2)**

**11** **a** Describe fully the transformation that maps the graph of $y = \text{f}(x)$ onto the graph of $y = \text{f}(x + 1)$. **(2)**

**b** Sketch the graph of $y = \frac{1}{x+1}$, showing the coordinates of any points of intersection with the coordinate axes and the equations of any asymptotes. **(3)**

**c** By sketching another suitable curve on your diagram in part **b**, show that the equation

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

has one positive and one negative real root. **(4)**

© *Solomon Press*