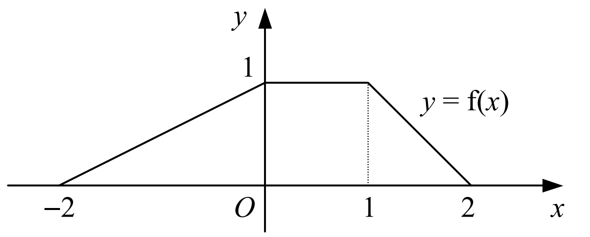
1 **a** Solve the simultaneous equations

$$y = 3x - 4$$
$$y = 4x^2 - 9x + 5$$ **(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)**

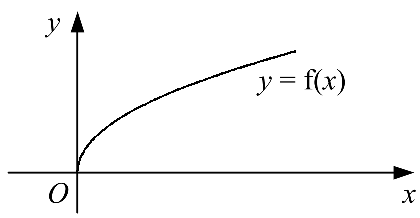
b $y = \mathrm{f}(x + 1)$, **(2)**

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 f(x) in the form $a(x + b)^2 + c$. **(3)**

b Showing the coordinates of the vertex in each case, sketch on the same set of axes the curves

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

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

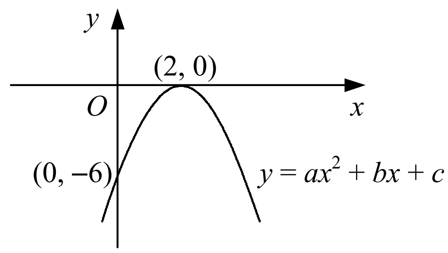
7 **a** Sketch on the same diagram the straight line $y = 2x - 5$ and the curve $y = x^3 - 3x^2$, showing the coordinates of any points where each graph meets the coordinate axes. **(4)**

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 $y = ax^2 + bx + c$.

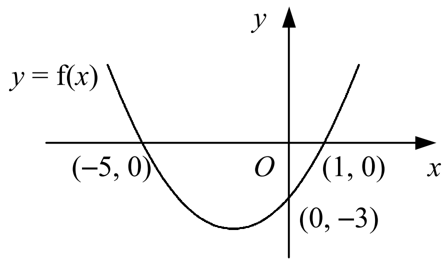
Given that the curve crosses the y-axis at the point $(0, -6)$ and touches the x-axis at the point $(2, 0)$, find the values of the constants a, b and c. **(6)**

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

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

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

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