1 Express $5x^2 + 15x + 12$ in the form $a(x + b)^2 + c$.

Hence state the minimum value of $y$ on the curve $y = 5x^2 + 15x + 12$. [5]

2 You are given that $f(x) = 2x^3 - 3x^2 - 23x + 12$.

(i) Show that $x = -3$ is a root of $f(x) = 0$ and hence factorise $f(x)$ fully. [6]

(ii) Sketch the curve $y = f(x)$. [3]

(iii) Find the $x$-coordinates of the points where the line $y = 4x + 12$ intersects $y = f(x)$. [4]
Fig. 12 shows the graph of $y = \frac{4}{x^2}$.

(i) On the copy of Fig. 12, draw accurately the line $y = 2x + 5$ and hence find graphically the three roots of the equation $\frac{4}{x^2} = 2x + 5$. \[3\]

(ii) Show that the equation you have solved in part (i) may be written as $2x^3 + 5x^2 - 4 = 0$. Verify that $x = -2$ is a root of this equation and hence find, in exact form, the other two roots. \[6\]

(iii) By drawing a suitable line on the copy of Fig. 12, find the number of real roots of the equation $x^3 + 2x^2 - 4 = 0$. \[3\]
4  (i) You are given that \( f(x) = (2x - 5)(x - 1)(x - 4) \).

   (A) Sketch the graph of \( y = f(x) \).  \[3\]

   (B) Show that \( f(x) = 2x^3 - 15x^2 + 33x - 20 \).  \[2\]

(ii) You are given that \( g(x) = 2x^3 - 15x^2 + 33x - 40 \).

   (A) Show that \( g(5) = 0 \).  \[1\]

   (B) Express \( g(x) \) as the product of a linear and quadratic factor.  \[3\]

   (C) Hence show that the equation \( g(x) = 0 \) has only one real root.  \[2\]

(iii) Describe fully the transformation that maps \( y = f(x) \) onto \( y = g(x) \).  \[2\]