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]**

3

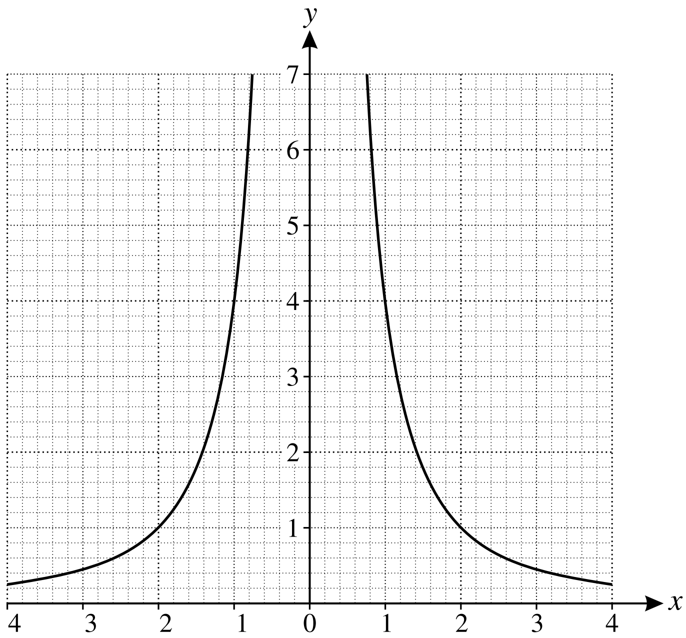

Fig. 12

Fig. 12 shows the graph of $y = \dfrac{4}{x^2}$.

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