1 You are given that $\mathrm{f}(x) = (x+3)(x-2)(x-5)$.

(i) Sketch the curve $y = \mathrm{f}(x)$. **[3]**

(ii) Show that $\mathrm{f}(x)$ may be written as $x^3 - 4x^2 - 11x + 30$. **[2]**

(iii) Describe fully the transformation that maps the graph of $y = \mathrm{f}(x)$ onto the graph of $y = \mathrm{g}(x)$, where $\mathrm{g}(x) = x^3 - 4x^2 - 11x - 6$. **[2]**

(iv) Show that $\mathrm{g}(-1) = 0$. Hence factorise $\mathrm{g}(x)$ completely. **[5]**

2

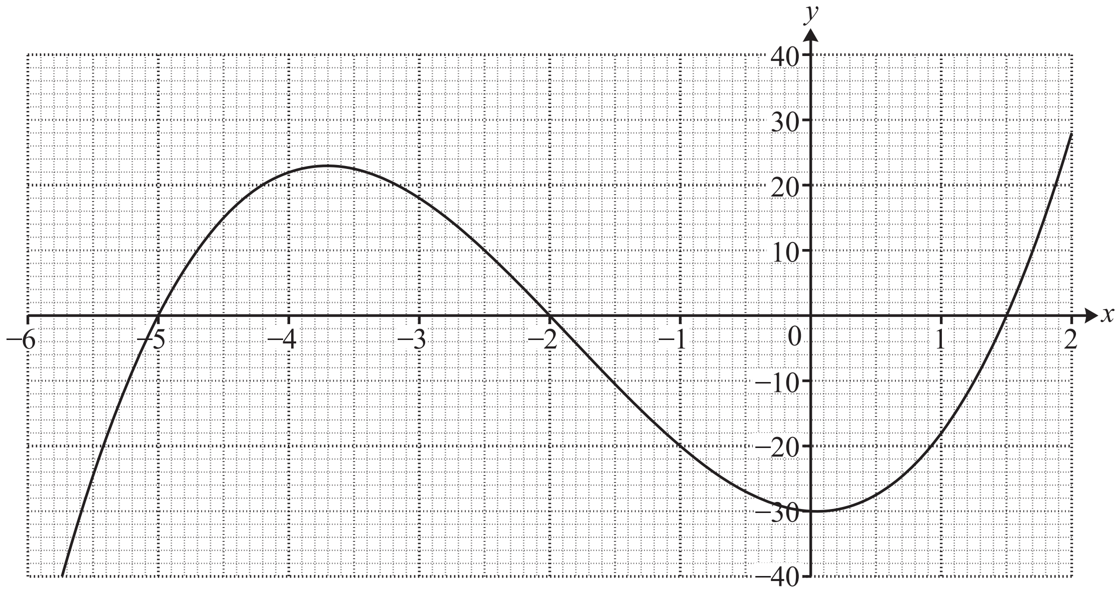

Fig. 12

Fig. 12 shows the graph of a cubic curve. It intersects the axes at (–5, 0), (–2, 0), (1.5, 0) and (0, –30).

(i) Use the intersections with both axes to express the equation of the curve in a factorised form. **[2]**

(ii) Hence show that the equation of the curve may be written as $y = 2x^3 + 11x^2 - x - 30$. **[2]**

(iii) Draw the line $y = 5x + 10$ accurately on the graph. The curve and this line intersect at (–2, 0); find graphically the x-coordinates of the other points of intersection. **[3]**

(iv) Show algebraically that the x-coordinates of the other points of intersection satisfy the equation

$$2x^2 + 7x - 20 = 0.$$

Hence find the exact values of the x-coordinates of the other points of intersection. **[5]**

3 You are given that $\mathrm{f}(x) = (2x-3)(x+2)(x+4)$.

(i) Sketch the graph of $y = \mathrm{f}(x)$. **[3]**

(ii) State the roots of $\mathrm{f}(x-2) = 0$. **[2]**

(iii) You are also given that $\mathrm{g}(x) = \mathrm{f}(x) + 15$.

(A) Show that $\mathrm{g}(x) = 2x^3 + 9x^2 - 2x - 9$. **[2]**

(B) Show that $\mathrm{g}(1) = 0$ and hence factorise $\mathrm{g}(x)$ completely. **[5]**

4 You are given that $\mathrm{f}(x) = (x+2)^2(x-3)$.

(i) Sketch the graph of $y = \mathrm{f}(x)$. **[3]**

(ii) State the values of x which satisfy $\mathrm{f}(x+3) = 0$. **[2]**

5 A cubic curve has equation $y = \mathrm{f}(x)$. The curve crosses the x-axis where $x = -\frac{1}{2}, -2$ and 5.

(i) Write down three linear factors of $\mathrm{f}(x)$. Hence find the equation of the curve in the form $y = 2x^3 + ax^2 + bx + c$. **[4]**

(ii) Sketch the graph of $y = \mathrm{f}(x)$. **[3]**

(iii) The curve $y = \mathrm{f}(x)$ is translated by $\begin{pmatrix} 0 \\ -8 \end{pmatrix}$. State the coordinates of the point where the translated curve intersects the y-axis. **[1]**

(iv) The curve $y = \mathrm{f}(x)$ is translated by $\begin{pmatrix} 3 \\ 0 \end{pmatrix}$ to give the curve $y = \mathrm{g}(x)$.

Find an expression in factorised form for $\mathrm{g}(x)$ and state the coordinates of the point where the curve $y = \mathrm{g}(x)$ intersects the y-axis. **[4]**