1 **(i)** Find algebraically the coordinates of the points of intersection of the curve $y = 3x^2 + 6x + 10$ and the line $y = 2 - 4x$. **[5]**

(ii) Write $3x^2 + 6x + 10$ in the form $a(x + b)^2 + c$. **[4]**

(iii) Hence or otherwise, show that the graph of $y = 3x^2 + 6x + 10$ is always above the x-axis. **[2]**

2 **Answer part (i) of this question on the insert provided.**

The insert shows the graph of $y = \frac{1}{x}$.

(i) **On the insert**, on the same axes, plot the graph of $y = x^2 - 5x + 5$ for $0 \leqslant x \leqslant 5$. **[4]**

(ii) Show algebraically that the x-coordinates of the points of intersection of the curves $y = \frac{1}{x}$ and $y = x^2 - 5x + 5$ satisfy the equation $x^3 - 5x^2 + 5x - 1 = 0$. **[2]**

(iii) Given that $x = 1$ at one of the points of intersection of the curves, factorise $x^3 - 5x^2 + 5x - 1$ into a linear and a quadratic factor.

Show that only one of the three roots of $x^3 - 5x^2 + 5x - 1 = 0$ is rational. **[5]**

3 Factorise and hence simplify $\dfrac{3x^2 - 7x + 4}{x^2 - 1}$. [3]

4 **(i)** Prove that 12 is a factor of $3n^2 + 6n$ for all even positive integers n. [3]

(ii) Determine whether 12 is a factor of $3n^2 + 6n$ for all positive integers n. [2]

5 **(i)** Write $x^2 - 5x + 8$ in the form $(x - a)^2 + b$ and hence show that $x^2 - 5x + 8 > 0$ for all values of x. [4]

(ii) Sketch the graph of $y = x^2 - 5x + 8$, showing the coordinates of the turning point. [3]

(iii) Find the set of values of x for which $x^2 - 5x + 8 > 14$. [3]

(iv) If $\mathrm{f}(x) = x^2 - 5x + 8$, does the graph of $y = \mathrm{f}(x) - 10$ cross the x-axis? Show how you decide. [2]

6 **(i)** Write $4x^2 - 24x + 27$ in the form $a(x - b)^2 + c$. [4]

(ii) State the coordinates of the minimum point on the curve $y = 4x^2 - 24x + 27$. [2]

(iii) Solve the equation $4x^2 - 24x + 27 = 0$. [3]

(iv) Sketch the graph of the curve $y = 4x^2 - 24x + 27$. [3]