1 Find the set of values of the constant k for which the quadratic equation

$$3kx^2 + (k+8)x + 3 = 0$$

has two distinct real roots. [4]

4 **(a)** Express $1-6x-x^2$ in the form $a-(x+b)^2$, where a and b are constants. [3]

(b) The graph of $y=x^2$ is transformed to the graph of $y=1-6x-x^2$ by a reflection followed by a translation of $\begin{pmatrix} m \\ n \end{pmatrix}$. Give details of the reflection and determine the values of m and n. [3]

1 **(a)** Express $9x^2 - 36x + 8$ in the form $p(x+q)^2 + r$, where p, q and r are constants. [2]

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(b) Hence find the set of values of the constant k for which the equation $9x^2 - 36x + 8 = k$ has no real roots. [1]

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(c) Find the exact roots of the equation $9x^2 - 36x + 8 = -15$. [2]

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2 Find the coordinates of the points of intersection of the curve and the line with equations

$$2xy + 5y^2 = 24 \quad \text{and} \quad 2x + y + 4 = 0.$$ [4]

11 **(a)** Express x^2+4x+2 in the form $(x+a)^2+b$, where a and b are integers. [2]

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The functions f and g are defined as follows.

$$\text{f}(x) = x^2+4x+2 \qquad \text{for } x \leqslant -2$$

$$\text{g}(x) = -x-4 \qquad \text{for } x \geqslant -2$$

(b) **(i)** Find an expression for $\text{f}^{-1}(x)$. [3]

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(ii) Find an expression for $(\mathrm{gf})^{-1}(x)$. [4]

Additional page

If you use the following page to complete the answer to any question, the question number must be clearly shown.