8 **(a)** Express $-3x^2 + 12x + 2$ in the form $-3(x - a)^2 + b$, where a and b are constants. [2]

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The one-one function f is defined by $\text{f} : x \mapsto -3x^2 + 12x + 2$ for $x \leqslant k$.

(b) State the largest possible value of the constant k. [1]

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It is now given that $k = -1$.

(c) State the range of f. [1]

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(d) Find an expression for $\mathrm{f}^{-1}(x)$. [3]

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The result of translating the graph of $y = \mathrm{f}(x)$ by $\begin{pmatrix} -3 \\ 1 \end{pmatrix}$ is the graph of $y = \mathrm{g}(x)$.

(e) Express $\mathrm{g}(x)$ in the form $px^2 + qx + r$, where p, q and r are constants. [3]

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