11 The function f is defined by $\mathrm{f}(x) = 3 + 6x - 2x^2$ for $x \in \mathbb{R}$.

(a) Express $\mathrm{f}(x)$ in the form $a - b(x-c)^2$, where a, b and c are constants, and state the range of f. [3]

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(b) The graph of $y = \mathrm{f}(x)$ is transformed to the graph of $y = \mathrm{h}(x)$ by a reflection in one of the axes followed by a translation. It is given that the graph of $y = \mathrm{h}(x)$ has a minimum point at the origin.

Give details of the reflection and translation involved. [2]

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The function g is defined by $g(x) = 3 + 6x - 2x^2$ for $x \leqslant 0$.

(c) Sketch the graph of $y = g(x)$ and explain why g is a one-one function. You are **not** required to find the coordinates of any intersections with the axes. [2]

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(d) Sketch the graph of $y = g^{-1}(x)$ on your diagram in **(c)**, and find an expression for $g^{-1}(x)$. You should label the two graphs in your diagram appropriately and show any relevant mirror line. [4]

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