11 The function f is defined by $f(x) = 10 + 6x - x^2$ for $x \in \mathbb{R}$.

**(a)** By completing the square, find the range of f. [3]

The function g is defined by $g(x) = 4x + k$ for $x \in \mathbb{R}$ where $k$ is a constant.

**(b)** It is given that the graph of $y = g^{-1}f(x)$ meets the graph of $y = g(x)$ at a single point $P$.

Determine the coordinates of $P$. [6]

6 A line has equation $y = 6x - c$ and a curve has equation $y = cx^2 + 2x - 3$, where $c$ is a constant. The line is a tangent to the curve at point $P$.

Find the possible values of $c$ and the corresponding coordinates of $P$. [7]

1 The graph of $y = f(x)$ is transformed to the graph of $y = 3 - f(x)$.

Describe fully, in the correct order, the two transformations that have been combined. [4]

blank

**8.** The curve $C_1$ has equation

$$y = 3x^2 + 6x + 9$$

(a) Write $3x^2 + 6x + 9$ in the form

$$a(x + b)^2 + c$$

where $a$, $b$ and $c$ are constants to be found.

**(3)**

The point $P$ is the minimum point of $C_1$

(b) Deduce the coordinates of $P$.

**(1)**

A different curve $C_2$ has equation

$$y = Ax^3 + Bx^2 + Cx + D$$

where $A$, $B$, $C$ and $D$ are constants.

Given that $C_2$

- passes through $P$
- intersects the $x$-axis at $-4$, $-2$ and 3

(c) find, making your method clear, the values of $A$, $B$, $C$ and $D$.

**(5)**

**(b)** Find an expression for $(fg)^{-1}(x)$. [3]

11 The coordinates of points $A$, $B$ and $C$ are $A(5, -2)$, $B(10, 3)$ and $C(2p, p)$, where $p$ is a constant.

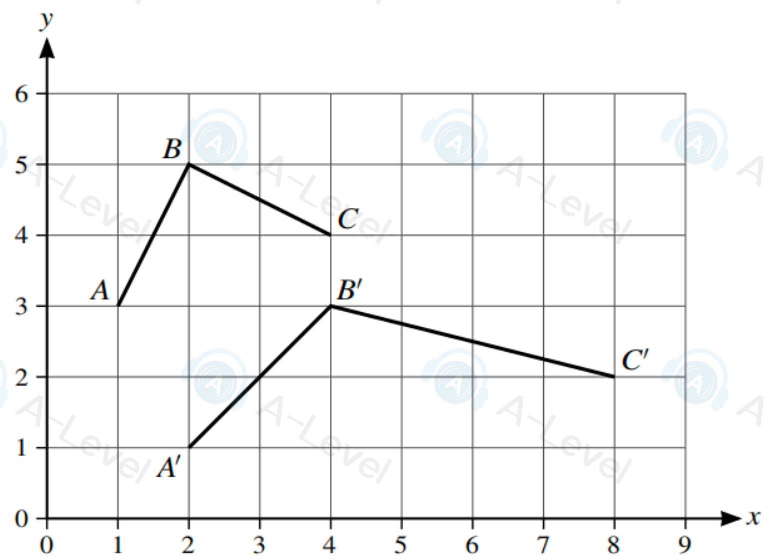
**(a)** Given that $AC$ and $BC$ are equal in length, find the value of the fraction $p$. [3]

**(b)** It is now given instead that $AC$ is perpendicular to $BC$ and that $p$ is an integer.

**(i)** Find the value of $p$. [4]

**(ii)** Find the equation of the circle which passes through $A$, $B$ and $C$, giving your answer in the form $x^2 + y^2 + ax + by + c = 0$, where $a$, $b$ and $c$ are constants. [4]

**1**




The diagram shows the graph of $y = \mathrm{f}(x)$, which consists of the two straight lines $AB$ and $BC$. The lines $A'B'$ and $B'C'$ form the graph of $y = \mathrm{g}(x)$, which is the result of applying a sequence of two transformations, in either order, to $y = \mathrm{f}(x)$.

State fully the two transformations. [4]

**1** Find the set of values of $m$ for which the line with equation $y = mx + 1$ and the curve with equation $y = 3x^2 + 2x + 4$ intersect at two distinct points. [4]