6 Functions f and g are both defined for $x \in \mathbb{R}$ and are given by

$$f(x) = x^2 - 2x + 5,$$
$$g(x) = x^2 + 4x + 13.$$

(a) By first expressing each of $f(x)$ and $g(x)$ in completed square form, express $g(x)$ in the form $f(x+p)+q$, where p and q are constants. [4]

(b) Describe fully the transformation which transforms the graph of $y = f(x)$ to the graph of $y = g(x)$. [2]

6 A curve passes through the point $\left(\frac{4}{5}, -3\right)$ and is such that $\frac{dy}{dx} = \frac{-20}{(5x-3)^2}$.

(a) Find the equation of the curve. [4]

(b) The curve is transformed by a stretch in the x-direction with scale factor $\frac{1}{2}$ followed by a translation of $\begin{pmatrix} 2 \\ 10 \end{pmatrix}$.

Find the equation of the new curve. [3]

9 The functions f and g are defined by

$$f(x) = x^2 - 4x + 3 \quad \text{for } x > c, \text{ where } c \text{ is a constant,}$$
$$g(x) = \frac{1}{x+1} \quad \text{for } x > -1.$$

(a) Express $f(x)$ in the form $(x-a)^2 + b$. [2]

It is given that f is a one-one function.

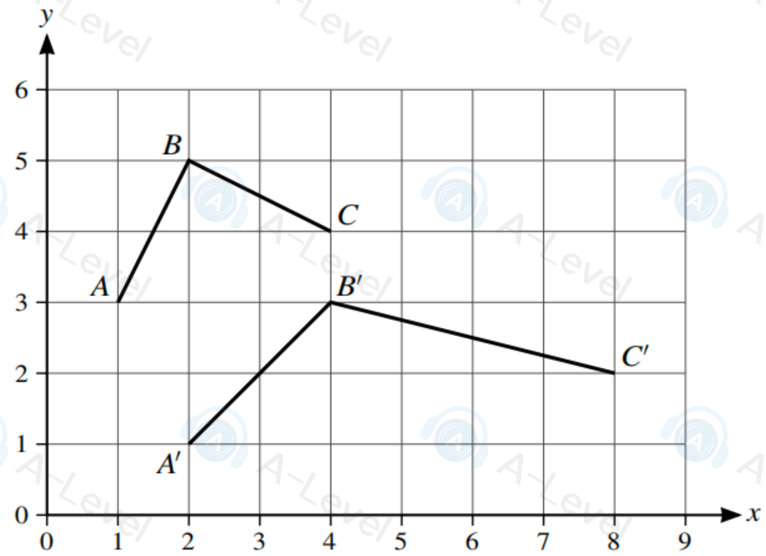
(b) State the smallest possible value of c. [1]

It is now given that $c = 5$.

(c) Find an expression for $f^{-1}(x)$ and state the domain of f^{-1}. [3]

(d) Find an expression for $gf(x)$ and state the range of gf. [3]

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]

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2. In the triangle ABC,

- $AB = 21$ cm
- $BC = 13$ cm
- angle $BAC = 25°$
- angle $ACB = x°$

(a) Use the sine rule to find the value of $\sin x°$, giving your answer to 4 decimal places.
(2)

Given also that AB is the longest side of the triangle,

(b) find the value of x, giving your answer to 2 decimal places.
(3)

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(b) State the value of q. [1]

(c) State the value of r. [1]

1 Solve the equation $8\sin^2\theta + 6\cos\theta + 1 = 0$ for $0° < \theta < 180°$. [3]

5. **In this question you must show all stages of your working. Solutions relying entirely on calculator technology are not acceptable.**

The curve C has equation $y = \mathrm{f}(x)$, $x > 0$

Given that

- $\mathrm{f}'(x) = \dfrac{12}{\sqrt{x}} + \dfrac{x}{3} - 4$
- the point $P(9, 8)$ lies on C

(a) find, in simplest form, $\mathrm{f}(x)$ **(5)**

The line l is the normal to C at P

(b) Find the coordinates of the point at which l crosses the y-axis. **(4)**

(b) State the radius of the original circle. [1]

(c) State the coordinates of the centre of the circle after the translation has been completed but before the stretch is applied. [2]

(d) State the coordinates of the centre of the original circle. [2]

blank

6. The point A has coordinates $(-4, 11)$ and the point B has coordinates $(8, 2)$.

(a) Find the gradient of the line AB, giving your answer as a fully simplified fraction. **(2)**

The point M is the midpoint of AB. The line l passes through M and is perpendicular to AB.

(b) Find an equation for l, giving your answer in the form $px + qy + r = 0$ where p, q and r are integers to be found. **(4)**

The point C lies on l such that the area of triangle ABC is 37.5 square units.

(c) Find the two possible pairs of coordinates of point C. **(5)**

(b) Show that $\dfrac{2}{3} + \dfrac{2}{3(3x-1)}$ can be expressed as $\dfrac{2x}{3x-1}$. [2]

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

2 The function f is defined for $x \in \mathbb{R}$ by $\mathrm{f}(x) = x^2 - 6x + c$, where c is a constant. It is given that $\mathrm{f}(x) > 2$ for all values of x.

Find the set of possible values of c. [4]