

- 1 The function f is defined by

$$f : x \rightarrow 3 + \ln(x + 2), \quad x \in \mathbb{R}, \quad x \geq k,$$

where k is a constant.

Given that the range of f is $f(x) \geq 3$,

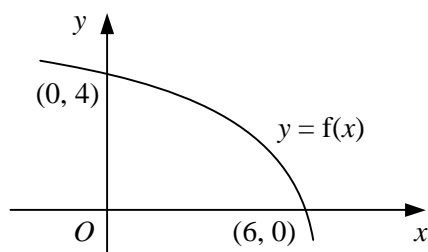
- a** find the value of k , (3)
b find $f^{-1}(x)$, stating its domain clearly. (4)

The function g is defined by

$$g : x \rightarrow 4 + \ln(x - 1), \quad x \in \mathbb{R}, \quad x > 1.$$

- c** Find, in terms of e , the value of x such that $f(x) = g(x)$. (4)

- 2



The diagram shows the curve with equation $y = f(x)$ which crosses the coordinate axes at the points $(0, 4)$ and $(6, 0)$.

Showing the coordinates of any points of intersection with the axes, sketch on separate diagrams the curves

- a** $y = f(|x|)$, (2)
b $y = 4 - f(x)$, (2)
c $y = 2f(3x)$. (3)
- 3 The functions f and g are given by

$$f(x) \equiv \frac{x}{x+2}, \quad x \in \mathbb{R}, \quad x \neq -2,$$

$$g(x) \equiv \frac{3}{x}, \quad x \in \mathbb{R}, \quad x \neq 0$$

- a** Solve the equation $fg(x) = 4$. (4)
b Find $f^{-1}(x)$, stating its domain clearly. (4)
c Solve the equation $f(x) = f^{-1}(x)$. (3)

- 4 The function f is defined by

$$f(x) \equiv x^2 - 2x - 9, \quad x \in \mathbb{R}, \quad x \geq k.$$

- a** Find the minimum value of the constant k for which $f^{-1}(x)$ exists. (3)
 Given that k takes the value found in part **a**,
- b** solve the equation $f^{-1}(x) = 4$, (2)
c sketch the curve $y = |f(x)|$, (3)
d find the values of x for which $|f(x)| = 6$. (5)

- 5 The function f is defined by

$$f : x \rightarrow 2 - \frac{3}{x}, \quad x \in \mathbb{R}, \quad x \neq 0.$$

- a Find the value of $ff(1)$. (2)
 b Find $f^{-1}(x)$ and state its domain. (4)

The function g is defined by

$$g : x \rightarrow x^2, \quad x \in \mathbb{R}.$$

- c Solve the equation $gf(x) = 1$. (4)

- 6 The function f is defined by

$$f : x \rightarrow e^{\frac{1}{2}x} - 2, \quad x \in \mathbb{R}.$$

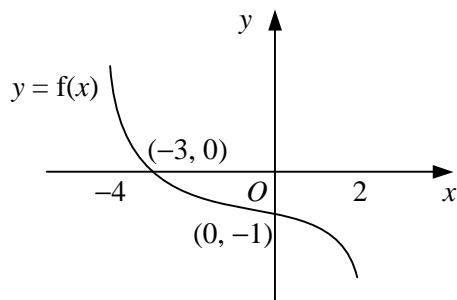
- a Evaluate $f(\ln 9)$. (2)
 b State the range of f . (1)
 c Find $f^{-1}(x)$ and state its domain. (4)

The function g is defined by

$$g : x \rightarrow x^2 + 4x, \quad x \in \mathbb{R}.$$

- d Find and simplify an expression for $gf(x)$. (3)
 e Solve the equation $gf(x) + 1 = 0$. (2)

7



The diagram shows the curve $y = f(x)$. The domain of f is $-4 \leq x \leq 2$ and the curve intersects the coordinate axes at the points $(-3, 0)$ and $(0, -1)$.

- a Explain how the graph shows that f is one-one. (1)
 b Showing the coordinates of any points of intersection with the axes, sketch on separate diagrams the graphs of
 i $y = |f(x)|$,
 ii $y = f^{-1}(x)$. (5)

8

$$f(x) \equiv \frac{5}{(x+1)(2x-3)} + \frac{1}{x+1}, \quad x \in \mathbb{R}, \quad x \geq 2.$$

- a Show that $f(x) = \frac{2}{2x-3}$. (4)
 b Find the range of f . (2)
 c Find an expression for $f^{-1}(x)$. (3)

$$g(x) \equiv \frac{1}{x-2}, \quad x \in \mathbb{R}, \quad x \neq 2.$$

- d Solve the equation $fg(x) = \frac{2}{3}$. (4)