1 The function f is defined by

$$f: x \to 3 + \ln(x+2), x \in \mathbb{R}, x \ge k$$

where k is a constant.

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

a find the value of
$$k$$
, (3)

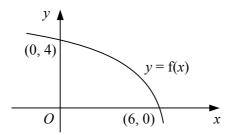
b find
$$f^{-1}(x)$$
, stating its domain clearly. (4)

The function g is defined by

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

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

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

$$\mathbf{a} \quad y = \mathbf{f}(\mid x \mid), \tag{2}$$

b
$$y = 4 - f(x)$$
, (2)

c
$$y = 2f(3x)$$
. (3)

3 The functions f and g are given by

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

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

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

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

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

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

a Find the value of ff(1). (2)

b Find
$$f^{-1}(x)$$
 and state its domain. (4)

The function g is defined by

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

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

6 The function f is defined by

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

a Evaluate f(ln 9). (2)

c Find
$$f^{-1}(x)$$
 and state its domain. (4)

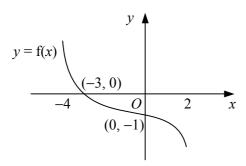
The function g is defined by

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

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 $-4 \le x \le 2$ 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

$$\mathbf{i} \quad y = |\mathbf{f}(x)|,$$

ii
$$y = f^{-1}(x)$$
. (5)

8

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

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)

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

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