

- 1 The function f is defined by

$$f : x \rightarrow |3x - a|, \quad x \in \mathbb{R}.$$

where a is a positive constant.

- a Find $ff(-2a)$. (2)
- b Sketch the graph $y = f(x)$, showing the coordinates of any points where the graph meets the coordinate axes. (2)
- c Solve the equation $f(x) = x$, giving your answers in terms of a . (3)

- 2 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 $f(x) \geq 3$,

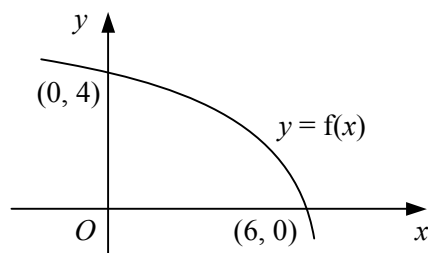
- a find the value of k , (3)
- b find $f^{-1}(x)$, stating its domain clearly. (4)

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)

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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 $y = 4 - f(x)$, (2)
- b $y = 2f(3x)$. (3)
- 4 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)

- 5 a Solve the inequality

$$|x - 60| < 5. \quad (2)$$

- b Hence find all integers
- n
- such that

$$|1.05^n - 60| < 5. \quad (4)$$

- 6 The functions
- f
- and
- g
- are defined by

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

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

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

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

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

- 7 The function
- f
- is defined by

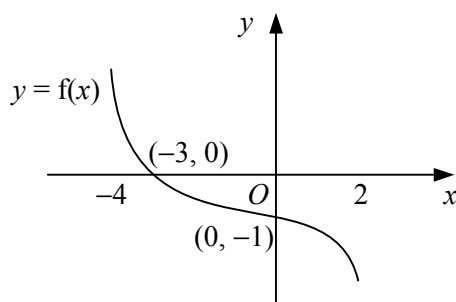
$$f(x) \equiv x^2 - 2x - 9, \quad x \in \mathbb{R}, \quad x \geq 1.$$

- a solve the equation
- $f^{-1}(x) = 4$
- ,
- (2)

- b sketch the curve
- $y = |f(x)|$
- ,
- (3)

- c find the values of
- x
- for which
- $|f(x)| = 6$
- .
- (5)

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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 $y = f^{-1}(x)$. (4)

- 9 The function
- f
- is defined by

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

- a Find the range of
- f
- .
- (2)

- b Find an expression for
- $f^{-1}(x)$
- .
- (3)

The function g is defined by

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

- c Solve the equation
- $fg(x) = \frac{2}{3}$
- .
- (5)