

- 4 (a) Express $1 - 6x - x^2$ in the form $a - (x + b)^2$, where a and b are constants. [3]

[illegible]

- (b) The graph of $y = x^2$ is transformed to the graph of $y = 1 - 6x - x^2$ by a reflection followed by a translation of $\begin{pmatrix} m \\ n \end{pmatrix}$. Give details of the reflection and determine the values of m and n . [3]

[illegible]

- 6** Functions f and g are defined by

$$f(x) = (x+3)^2 - 12 \quad \text{for } x \geq 0,$$

$$g(x) = 2x - 5 \quad \text{for } x \in \mathbb{R}.$$

- (a) State the range of f . [1]

.....

.....

.....

.....

.....

- (b) Find an expression for $f^{-1}(x)$. [2]

[illegible]

- (c) Solve the equation $gf(x) = 69$. [4]

This image shows a full page of handwriting practice paper. It features multiple sets of horizontal dashed lines spaced evenly down the page, providing a guide for letter height and placement. At the bottom center of the page, there is a small circle containing the number "2".

- 3 (a)** The graph of $y = f(x)$ is transformed to the graph of $y = f(3x) + 2$.

Describe fully the two transformations which have been combined to give the resulting graph.

[3]

[illegible]

- (b) A different graph has equation $y = g(x)$. This graph is stretched by scale factor 3 in the y -direction and then reflected in the y -axis.

Write down the equation of the transformed graph in terms of the function g . [2]

3

- 9 The function f is defined by $f(x) = \frac{4}{(3x-6)^2} + \frac{1}{(3x-6)^3}$ for $x > 2$.

- (a) Find an expression for $f'(x)$ and hence determine whether f is an increasing function, a decreasing function or neither. [4]

[illegible]

- (b) State whether f^{-1} exists. Give a reason for your answer. [1]

This image shows a full page of handwriting practice paper. It features ten identical rows of horizontal dashed lines, each row consisting of three parallel lines. At the bottom center of the page, there is a small circle containing the number "4". The rest of the page is blank white space.

The function g is defined by $g(x) = 4x - 3$ for $x > a$.

(c) Find the range of g in terms of the constant a . [1]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(d) Find the set of values of a for which the composite function fg exists. [2]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

10 The functions f and g are defined by

$f(x) = \sqrt{x}$

for $x \geq 0$,

$g(x) = 3\sqrt{x+2} - 5$

for $x \geq -2$.

(a) Describe fully a sequence of transformations which transforms the graph of $y = f(x)$ to the graph of $y = g(x)$. You should make clear the order in which the transformations are applied. [5]

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

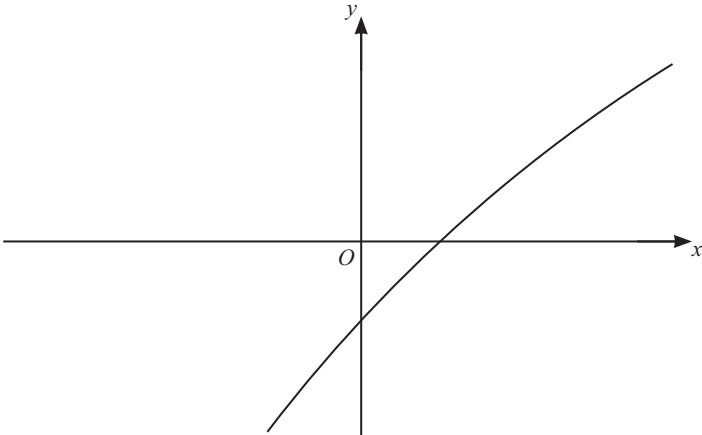
.....

.....

.....

.....

.....



The diagram shows the graph of $y = g(x)$.

(b) On the diagram sketch the graph of $y = g^{-1}(x)$ together with any relevant mirror line. [2]

(c) Find an expression for $g^{-1}(x)$. [2]

[illegible]

(d) State the range of g^{-1} . [1]

.....

The function h is defined by

$$h(x) = x - 2 \quad \text{for } x \geq 0.$$

(c) Find the value of $g^{-1}h(4)$. [1]

[illegible]

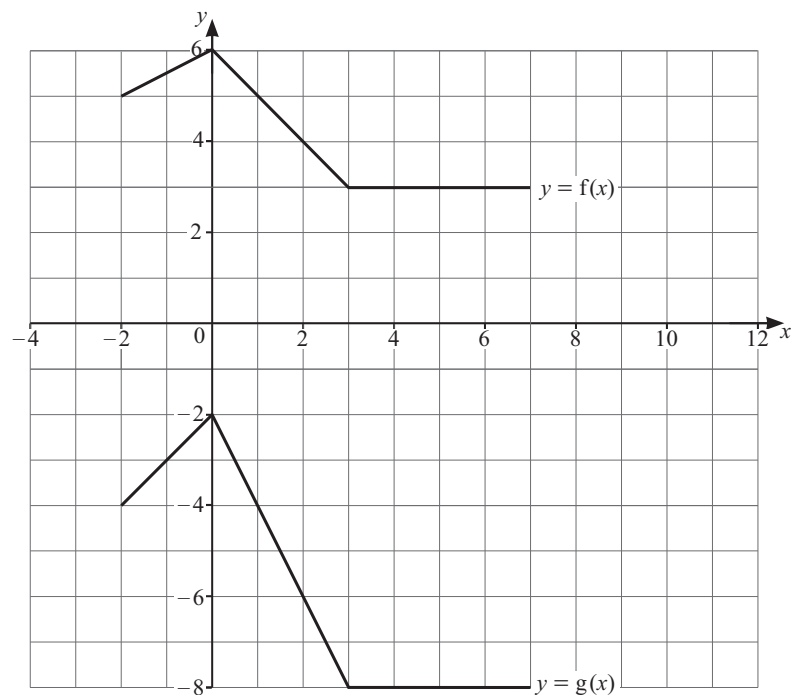
(f) Explain why the composite function hg^{-1} cannot be formed. [1]

7

Additional page

If you use the following page to complete the answer to any question, the question number must be clearly shown.

[illegible]



The diagram shows the graphs with equations $y = f(x)$ and $y = g(x)$.

Describe fully a sequence of two transformations which transforms the graph of $y = f(x)$ to the graph of $y = g(x)$. Make clear the order in which the transformations should be applied. [4]

- 11 (a)** Express $x^2 + 4x + 2$ in the form $(x + a)^2 + b$, where a and b are integers. [2]

[illegible]

The functions f and g are defined as follows.

$$f(x) = x^2 + 4x + 2 \quad \text{for } x \leq -2$$

$$g(x) = -x - 4 \quad \text{for } x \geq -2$$

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

10

[4]

If you use the following page to complete the answer to any question, the question number must be clearly shown.