



Name: \_\_\_\_\_ Date: \_\_\_\_\_

IBSL Year 1

Functions Test - Paper 1

Score: /53

CAC%:

IB:

### INSTRUCTIONS TO CANDIDATE

- Write your name in the boxes above.
- Do not open this examination paper until instructed to do so.
- You are not permitted access to any calculator for this paper.
- Section A: answer all questions in the boxes provided.
- Section B: answer all questions in the answer booklet provided. Write your name on the front of the answer booklet turn it in with your examination paper.
- Unless otherwise stated in the question, all numerical answers should be given exactly or correct to three significant figures.
- A clean copy of the *Mathematics SL formula booklet* is required for this paper
- The maximum mark for this examination paper is [53 marks].



Full marks are not necessarily awarded for a correct answer with no working. Answers must be supported by working and/or explanations. In particular, solutions found from a graphic display calculator should be supported by suitable working, for example if graphs are used to find a solution, you should sketch these as part of your answer. Where an answer is incorrect, some marks may be given for a correct method, provided this is shown by written working. You are therefore advised to show all working.

## Section A

Answer **all** questions in the space provided. Working may be continued in the answer booklet.

1a. Let  $f(x) = \sqrt{x - 5}$ , for  $x \geq 5$ .

Find  $f^{-1}(2)$ .

[3 marks]

1b. Let  $g$  be a function such that  $g^{-1}$  exists for all real numbers. Given that  $g(30) = 3$ , find  $(f \circ g^{-1})(3)$ .

[3 marks]

2. Let  $f(x) = x^2$  and  $g(x) = 2(x - 1)^2$ .

The graph of  $g$  can be obtained from the graph of  $f$  using two transformations.

Give a full geometric description of each of the two transformations.

[2 marks]

3a. Let  $f(x) = 4x - 2$  and  $g(x) = -2x^2 + 8$ .

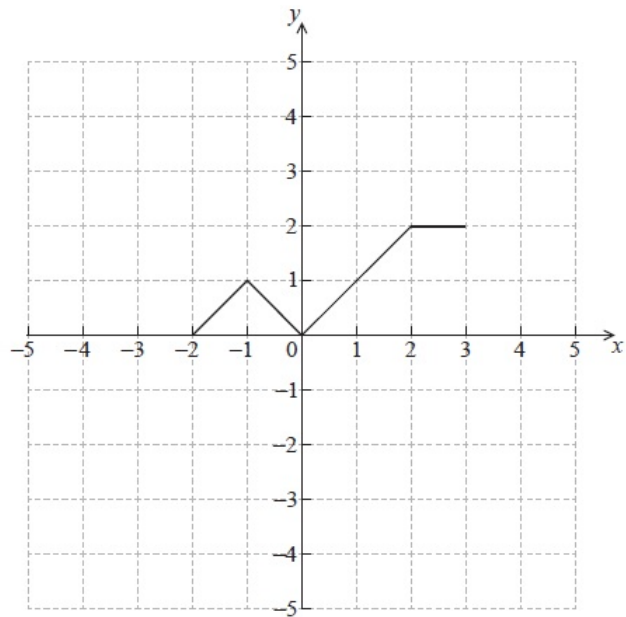
Find  $f^{-1}(x)$ .

[3 marks]

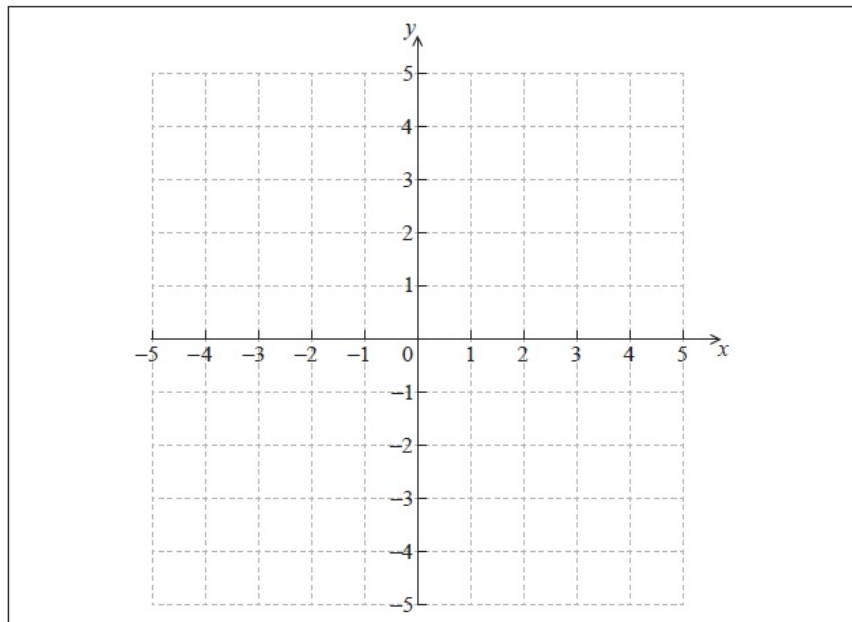
3b. Find  $(f \circ g)(1)$ .

[3 marks]

4a. The diagram below shows the graph of a function  $f(x)$ , for  $-2 \leq x \leq 3$ .

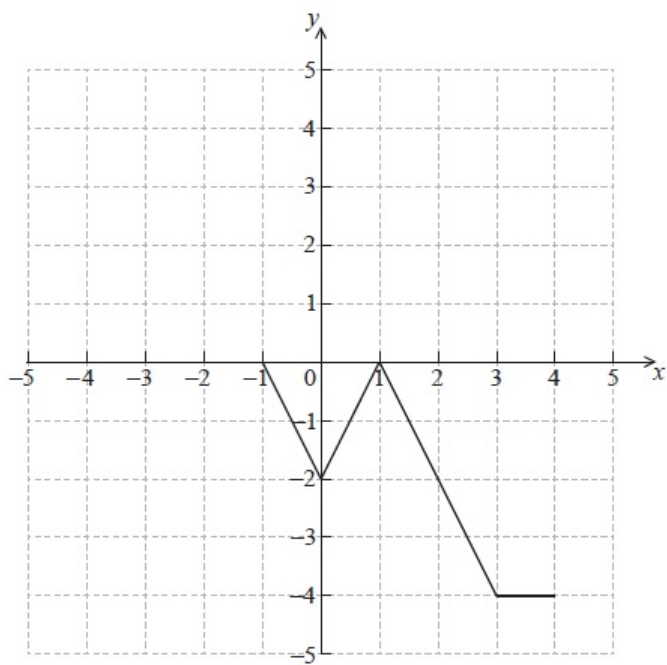


Sketch the graph of  $f(-x)$  on the grid below.



[2 marks]

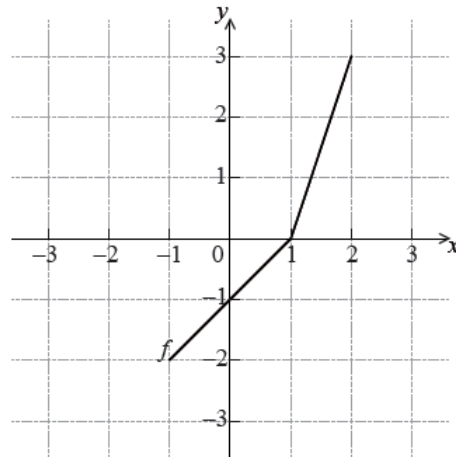
4b. The graph of  $f$  is transformed to obtain the graph of  $g$ . The graph of  $g$  is shown below.



The function  $g$  can be written in the form  $g(x) = af(x + b)$ . Write down the value of  $a$  and of  $b$ .

[4 marks]

5a. The diagram below shows the graph of a function  $f$ , for  $-1 \leq x \leq 2$ .



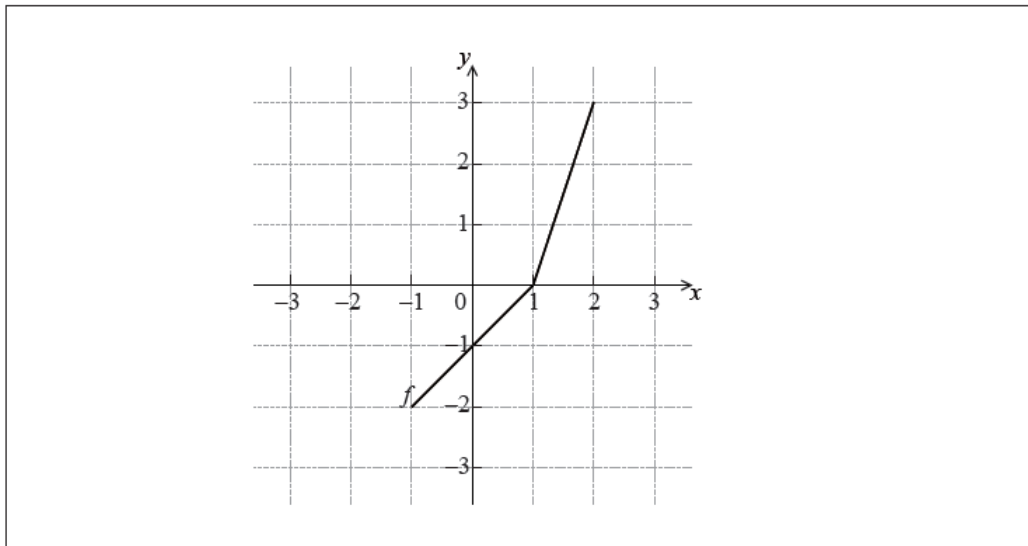
Write down the value of  $f(2)$ .

[1 mark]

5b. Write down the value of  $f^{-1}(-1)$ .

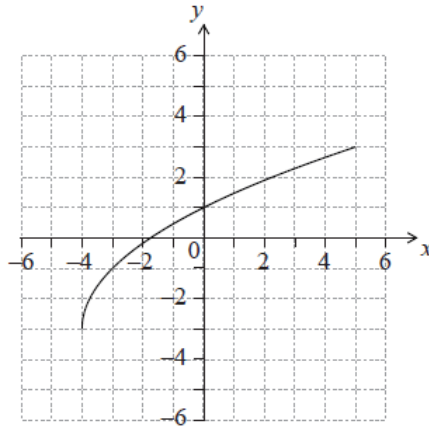
[2 marks]

5c. Sketch the graph of  $f^{-1}$  on the grid below.



[3 marks]

6a. The following diagram shows the graph of  $y = f(x)$ , for  $-4 \leq x \leq 5$ .



Write down the value of  $f(-3)$ .

[1 mark]

6b. Write down the value of  $f^{-1}(1)$ .

[1 mark]

6c. Find the domain of  $f^{-1}$ .

[2 marks]

6d. On the grid above, sketch the graph of  $f^{-1}$ .

[3 marks]

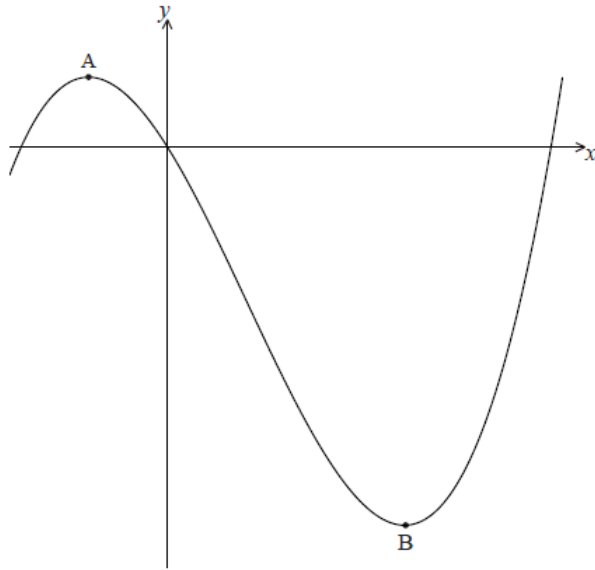


Do **not** write solutions on this page.

## Section B

Answer **all** questions in the answer booklet provided. Please start each question on a new page.

7. Let  $f(x) = \frac{1}{2}x^3 - x^2 - 3x$ . Part of the graph of  $f$  is shown below.



There is a maximum point at A and a minimum point at  $B(3, -9)$ .

Write down the coordinates of:

(i) the image of B after reflection in the  $y$ -axis;

(ii) the image of B after translation by the vector  $\begin{pmatrix} -2 \\ 5 \end{pmatrix}$ ;

(iii) the image of B after reflection in the  $x$ -axis followed by a horizontal stretch with scale factor  $\frac{1}{2}$ .

[6 marks]

**8a.** Let  $f(x) = 3x - 2$  and  $g(x) = \frac{5}{3x}$ , for  $x \neq 0$ .

Find  $f^{-1}(x)$ .

[2 marks]

**8b.** Show that  $(g \circ f^{-1})(x) = \frac{5}{x+2}$ .

[2 marks]

**8c.** Let  $h(x) = \frac{5}{x+2}$ , for  $x \geq 0$ . The graph of  $h$  has a horizontal asymptote at  $y = 0$ .

Find the y-intercept of the graph of  $h$ .

[2 marks]

**8d.** Hence, sketch the graph of  $h$ .

[3 marks]

**8e.** For the graph of  $h^{-1}$ , write down the  $x$ -intercept;

[1 mark]

**8f.** For the graph of  $h^{-1}$ , write down the equation of the vertical asymptote.

[1 mark]

**8g.** Given that  $h^{-1}(a) = 3$ , find the value of  $a$ .

[3 marks]