

22147305



**MATHEMATICS**  
**STANDARD LEVEL**  
**PAPER 1**

Candidate session number

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Tuesday 13 May 2014 (afternoon)

Examination code

1 hour 30 minutes

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INSTRUCTIONS TO CANDIDATES

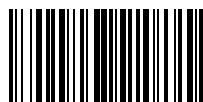
- Write your session number in the boxes above.
- Do not open this examination paper until instructed to do so.
- You are not permitted access to any calculator for this paper.
- Section A: answer all questions in the boxes provided.
- Section B: answer all questions in the answer booklet provided. Fill in your session number on the front of the answer booklet, and attach it to this examination paper and your cover sheet using the tag provided.
- 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 [90 marks].



16EP01

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Answers written on this page  
will not be marked.



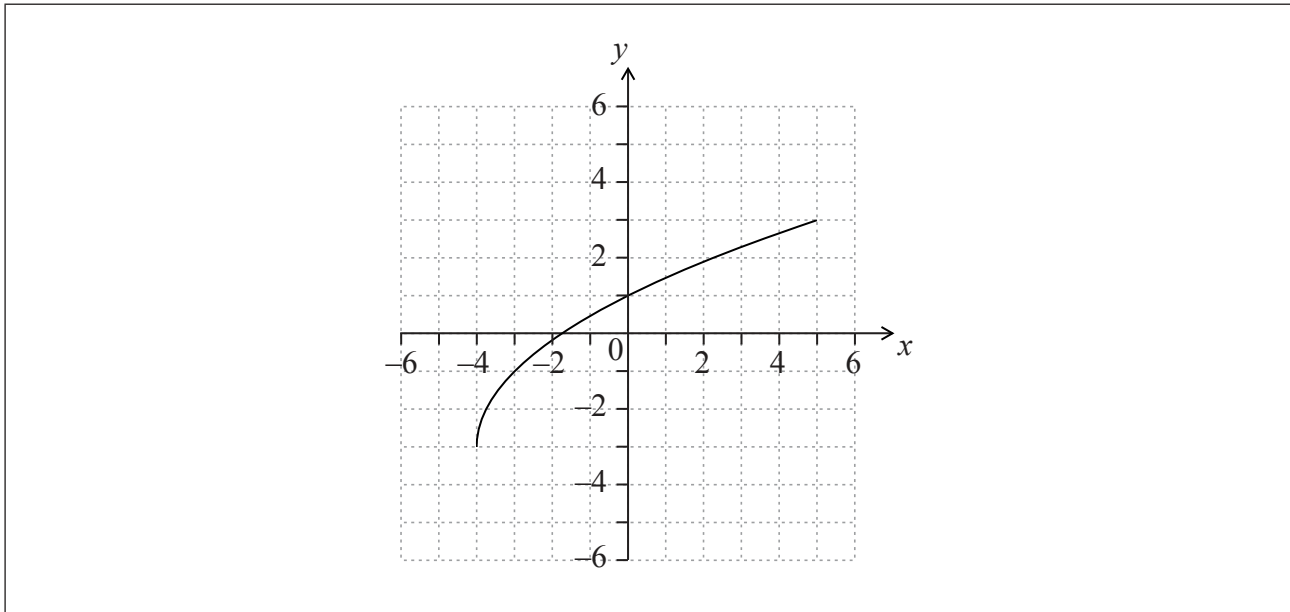
16EP02





3. [Maximum mark: 6]

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



- (a) Write down the value of
  - (i)  $f(-3)$ ;
  - (ii)  $f^{-1}(1)$ . [2]
- (b) Find the domain of  $f^{-1}$ . [2]
- (c) On the grid above, sketch the graph of  $f^{-1}$ . [2]

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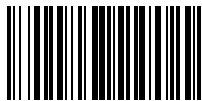
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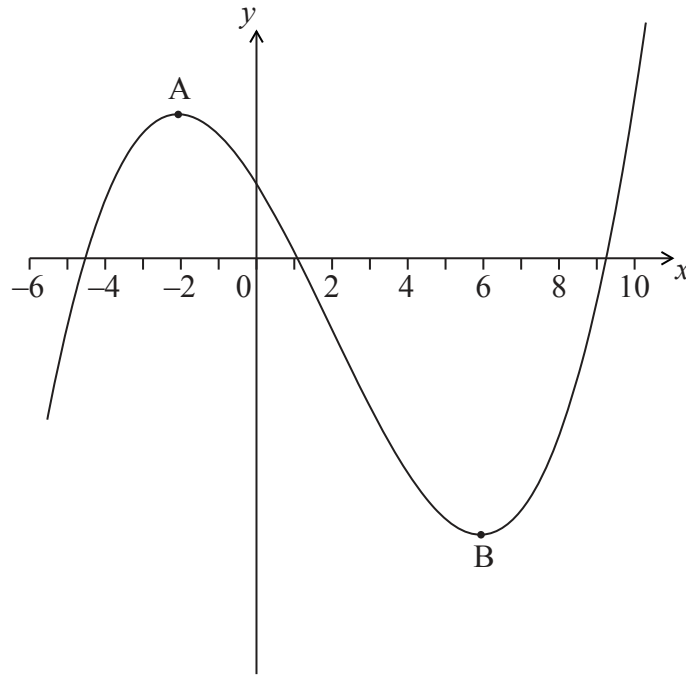






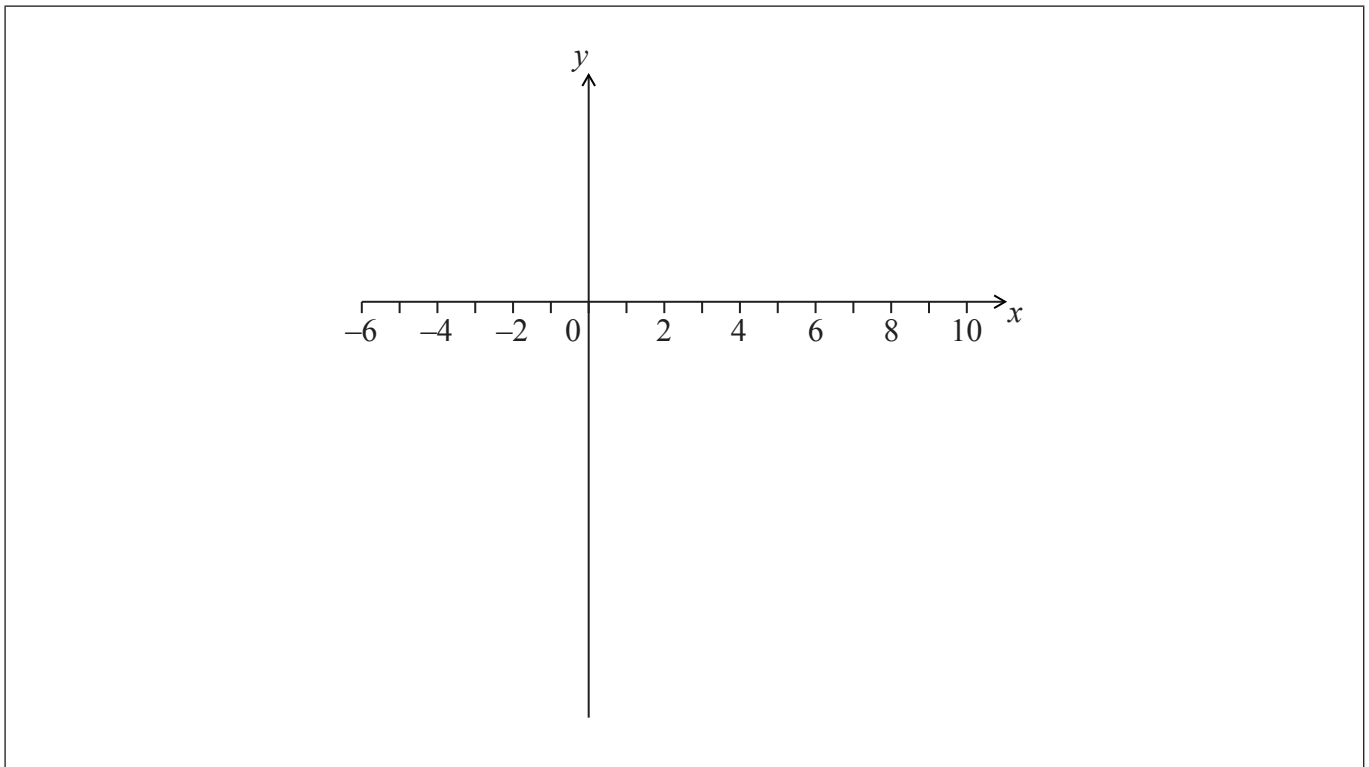
6. [Maximum mark: 6]

The following diagram shows part of the graph of  $y = f(x)$ .



The graph has a local maximum at A, where  $x = -2$ , and a local minimum at B, where  $x = 6$ .

(a) On the following axes, sketch the graph of  $y = f'(x)$ . [4]



(This question continues on the following page)



16EP08







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### SECTION B

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

8. [Maximum mark: 15]

Let  $f(x) = 3x^2 - 6x + p$ . The equation  $f(x) = 0$  has two equal roots.

(a) (i) Write down the **value** of the discriminant.

(ii) Hence, show that  $p = 3$ . [3]

The graph of  $f$  has its vertex on the  $x$ -axis.

(b) Find the coordinates of the vertex of the graph of  $f$ . [4]

(c) Write down the solution of  $f(x) = 0$ . [1]

(d) The function can be written in the form  $f(x) = a(x-h)^2 + k$ . Write down the value of

(i)  $a$ ;

(ii)  $h$ ;

(iii)  $k$ . [3]

(e) The graph of a function  $g$  is obtained from the graph of  $f$  by a reflection of  $f$  in the  $x$ -axis, followed by a translation by the vector  $\begin{pmatrix} 0 \\ 6 \end{pmatrix}$ . Find  $g$ , giving your answer in the form  $g(x) = Ax^2 + Bx + C$ . [4]



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9. [Maximum mark: 15]

Distances in this question are in metres.

Ryan and Jack have model airplanes, which take off from level ground. Jack’s airplane takes off after Ryan’s.

The position of Ryan’s airplane  $t$  seconds after it takes off is given by  $\mathbf{r} = \begin{pmatrix} 5 \\ 6 \\ 0 \end{pmatrix} + t \begin{pmatrix} -4 \\ 2 \\ 4 \end{pmatrix}$ .

- (a) Find the speed of Ryan’s airplane. [3]
- (b) Find the height of Ryan’s airplane after two seconds. [2]

The position of Jack’s airplane  $s$  seconds after it takes off is given by  $\mathbf{r} = \begin{pmatrix} -39 \\ 44 \\ 0 \end{pmatrix} + s \begin{pmatrix} 4 \\ -6 \\ 7 \end{pmatrix}$ .

- (c) Show that the paths of the airplanes are perpendicular. [5]

The two airplanes collide at the point  $(-23, 20, 28)$ .

- (d) How long after Ryan’s airplane takes off does Jack’s airplane take off? [5]



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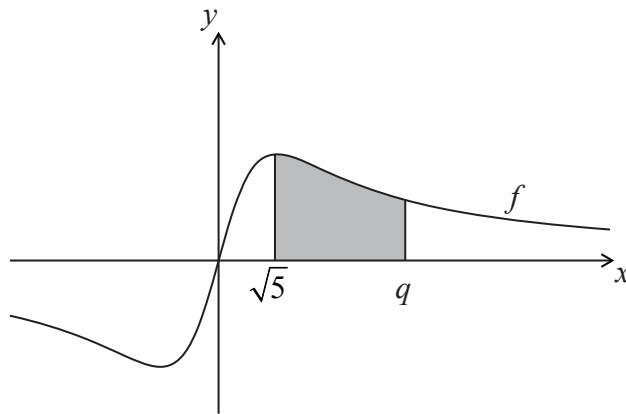
10. [Maximum mark: 15]

Let  $f(x) = \frac{2x}{x^2 + 5}$ .

(a) Use the quotient rule to show that  $f'(x) = \frac{10 - 2x^2}{(x^2 + 5)^2}$ . [4]

(b) Find  $\int \frac{2x}{x^2 + 5} dx$ . [4]

The following diagram shows part of the graph of  $f$ .



(c) The shaded region is enclosed by the graph of  $f$ , the  $x$ -axis, and the lines  $x = \sqrt{5}$  and  $x = q$ . This region has an area of  $\ln 7$ . Find the value of  $q$ . [7]



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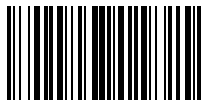
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16EP16