

**Mathematics**  
**Standard level**  
**Paper 1**

Monday 12 November 2018 (afternoon)

Candidate session number

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. Answers must be written within the answer 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]**.



Full marks are not necessarily awarded for a correct answer with no working. Answers must be supported by working and/or explanations. 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.

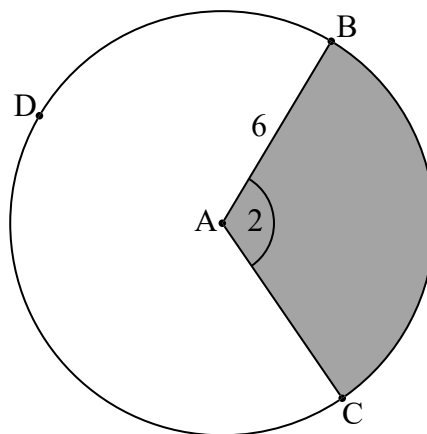
### Section A

Answer **all** questions. Answers must be written within the answer boxes provided. Working may be continued below the lines if necessary.

1. [Maximum mark: 6]

The following diagram shows a circle with centre A and radius 6 cm.

diagram not to scale



The points B, C, and D lie on the circle, and  $\widehat{BAC} = 2$  radians.

- (a) Find the area of the shaded sector. [2]
- (b) Find the perimeter of the non-shaded sector ABDC. [4]

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2. [Maximum mark: 5]

Two functions,  $f$  and  $g$ , are defined in the following table.

$x$	-2	1	3	6
$f(x)$	6	3	1	-2
$g(x)$	-7	-2	5	9

- (a) Write down the value of  $f(1)$ . [1]
- (b) Find the value of  $(g \circ f)(1)$ . [2]
- (c) Find the value of  $g^{-1}(-2)$ . [2]

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3. [Maximum mark: 6]

In an arithmetic sequence,  $u_1 = -5$  and  $d = 3$ .

(a) Find  $u_8$ . [2]

(b) Find the value of  $n$  for which  $u_n = 67$ . [4]

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4. [Maximum mark: 6]

Let  $b = \log_2 a$ , where  $a > 0$ . Write down each of the following expressions in terms of  $b$ .

(a)  $\log_2 a^3$  [2]

(b)  $\log_2 8a$  [2]

(c)  $\log_8 a$  [2]

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5. [Maximum mark: 6]

Consider the vectors  $\mathbf{a} = \begin{pmatrix} 3 \\ 2p \end{pmatrix}$  and  $\mathbf{b} = \begin{pmatrix} p+1 \\ 8 \end{pmatrix}$ .

Find the possible values of  $p$  for which  $\mathbf{a}$  and  $\mathbf{b}$  are parallel.

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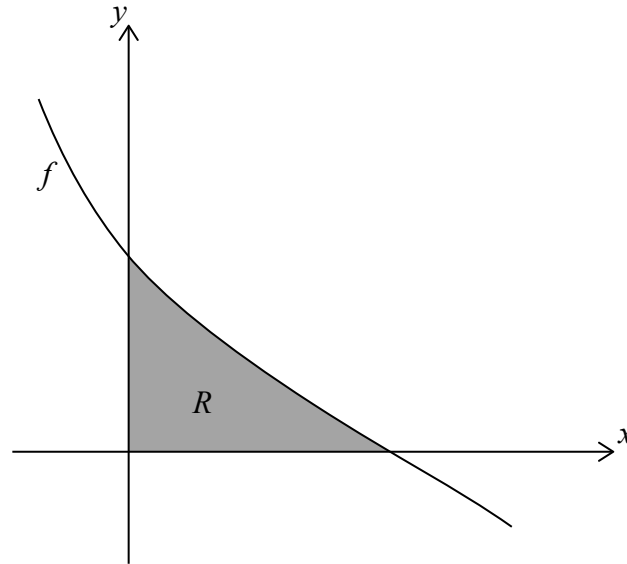
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6. [Maximum mark: 8]

Let  $f(x) = \frac{6-2x}{\sqrt{16+6x-x^2}}$ . The following diagram shows part of the graph of  $f$ .



The region  $R$  is enclosed by the graph of  $f$ , the  $x$ -axis, and the  $y$ -axis. Find the area of  $R$ .

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7. [Maximum mark: 6]

Given that  $\sin x = \frac{1}{3}$ , where  $0 < x < \frac{\pi}{2}$ , find the value of  $\cos 4x$ .

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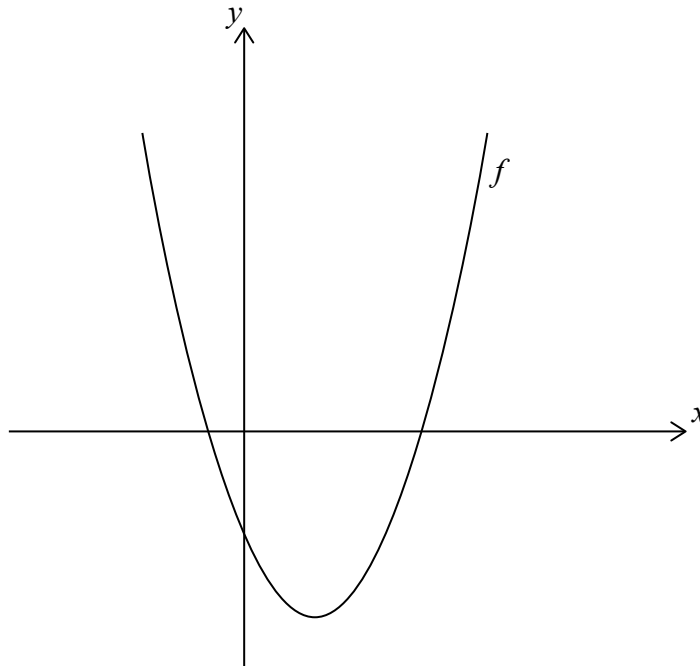
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### Section B

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

8. [Maximum mark: 16]

Let  $f(x) = x^2 - 4x - 5$ . The following diagram shows part of the graph of  $f$ .



- (a) Find the  $x$ -intercepts of the graph of  $f$ . [5]
- (b) Find the equation of the axis of symmetry of the graph of  $f$ . [2]
- (c) The function can be written in the form  $f(x) = (x - h)^2 + k$ .
- (i) Write down the value of  $h$ .
- (ii) Find the value of  $k$ . [4]

The graph of a second function,  $g$ , is obtained by a reflection of the graph of  $f$  in the  $y$ -axis, followed by a translation of  $\begin{pmatrix} -3 \\ 6 \end{pmatrix}$ .

- (d) Find the coordinates of the vertex of the graph of  $g$ . [5]



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

9. [Maximum mark: 15]

A bag contains  $n$  marbles, two of which are blue. Hayley plays a game in which she randomly draws marbles out of the bag, one after another, without replacement. The game ends when Hayley draws a blue marble.

(a) Find the probability, in terms of  $n$ , that the game will end on her

(i) first draw;

(ii) second draw. [4]

(b) Let  $n = 5$ . Find the probability that the game will end on her

(i) third draw;

(ii) fourth draw. [4]

Hayley plays the game when  $n = 5$ . She pays \$20 to play and can earn money back depending on the number of draws it takes to obtain a blue marble. She earns no money back if she obtains a blue marble on her first draw. Let  $M$  be the amount of money that she earns back playing the game. This information is shown in the following table.

Number of draws	1	2	3	4
Money earned back (\$ $M$ )	0	20	$8k$	$12k$

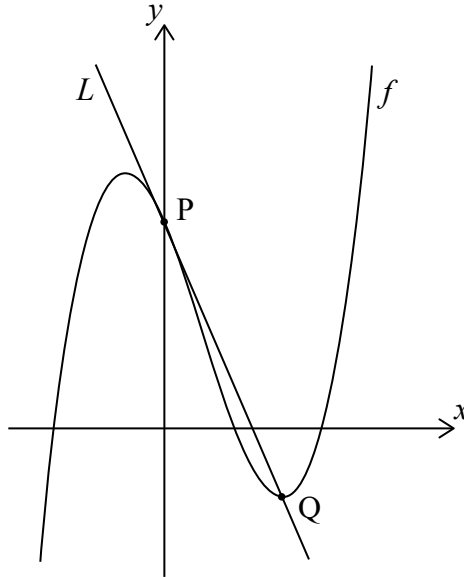
(c) Find the value of  $k$  so that this is a fair game. [7]



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10. [Maximum mark: 16]

Let  $f(x) = x^3 - 2x^2 + ax + 6$ . Part of the graph of  $f$  is shown in the following diagram.



The graph of  $f$  crosses the  $y$ -axis at the point  $P$ . The line  $L$  is tangent to the graph of  $f$  at  $P$ .

(a) Find the coordinates of  $P$ . [2]

(b) (i) Find  $f'(x)$ .

(ii) Hence, find the equation of  $L$  in terms of  $a$ . [6]

The graph of  $f$  has a local minimum at the point  $Q$ . The line  $L$  passes through  $Q$ .

(c) Find the value of  $a$ . [8]



Please **do not** write on this page.

Answers written on this page  
will not be marked.

