

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

Wednesday 2 May 2018 (afternoon)

1 hour 30 minutes

Candidate session number

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**Instructions to candidates**

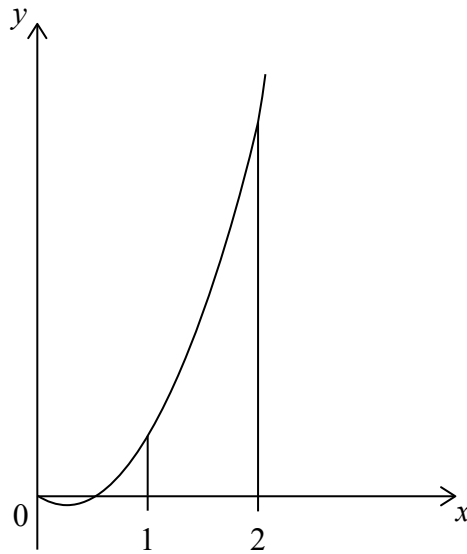
- Write your session number in the boxes above.
- Do not open this examination paper until instructed to do so.
- You are not permitted access to any calculator for this paper.
- Section A: answer all questions. Answers must be written within the answer boxes provided.
- Section B: answer all questions 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]**.





2. [Maximum mark: 6]

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



(a) Find  $\int (6x^2 - 3x) dx$ . [2]

(b) Find the area of the region enclosed by the graph of  $f$ , the  $x$ -axis and the lines  $x = 1$  and  $x = 2$ . [4]

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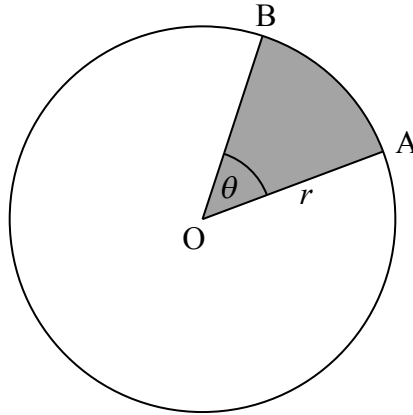




4. [Maximum mark: 7]

The following diagram shows a circle with centre  $O$  and radius  $r$  cm.

diagram not to scale



The points  $A$  and  $B$  lie on the circumference of the circle, and  $\widehat{AOB} = \theta$ . The area of the shaded sector  $AOB$  is  $12 \text{ cm}^2$  and the length of arc  $AB$  is  $6 \text{ cm}$ .

Find the value of  $r$ .

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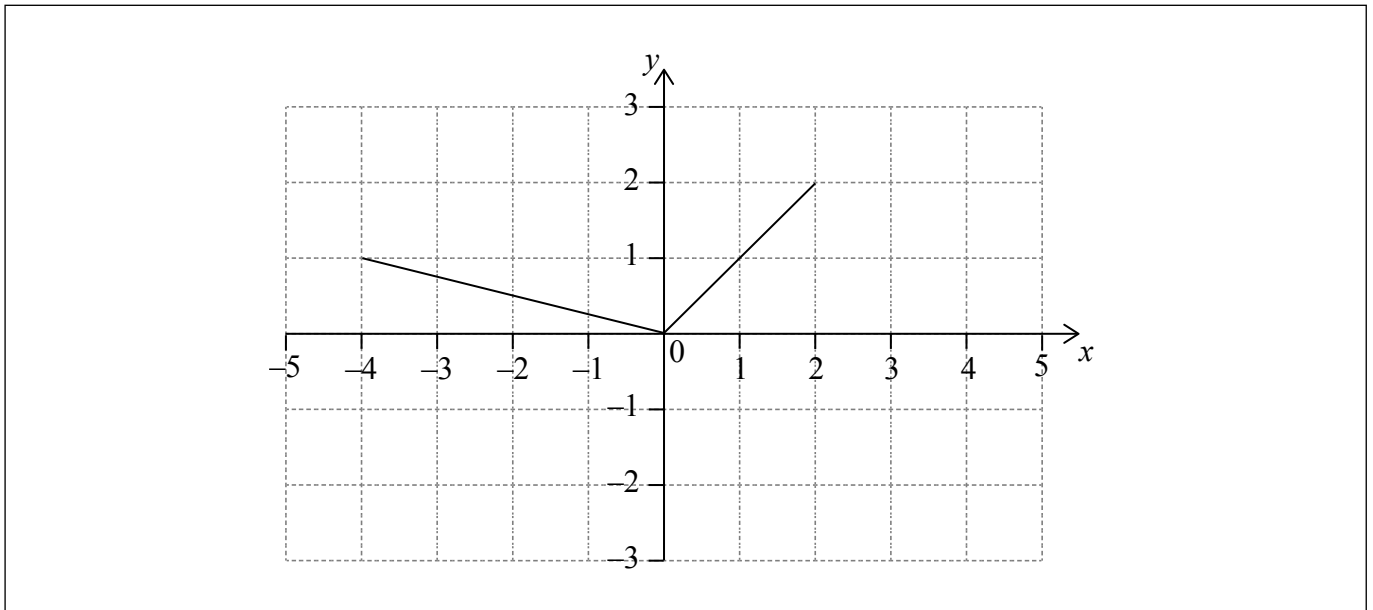
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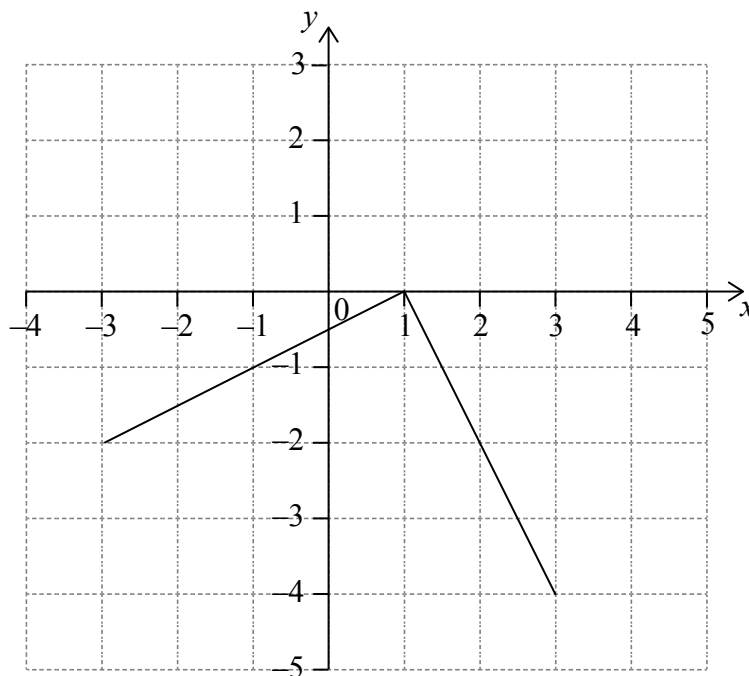
5. [Maximum mark: 6]

The following diagram shows the graph of a function  $f$ , for  $-4 \leq x \leq 2$ .



(a) On the same axes, sketch the graph of  $f(-x)$ . [2]

(b) Another function,  $g$ , can be written in the form  $g(x) = a \times f(x + b)$ . The following diagram shows the graph of  $g$ .



Write down the value of  $a$  and of  $b$ . [4]

(This question continues on the following page)





6. [Maximum mark: 7]

Let  $f(x) = px^2 + qx - 4p$ , where  $p \neq 0$ . Find the number of roots for the equation  $f(x) = 0$ . Justify your answer.

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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.

8. [Maximum mark: 14]

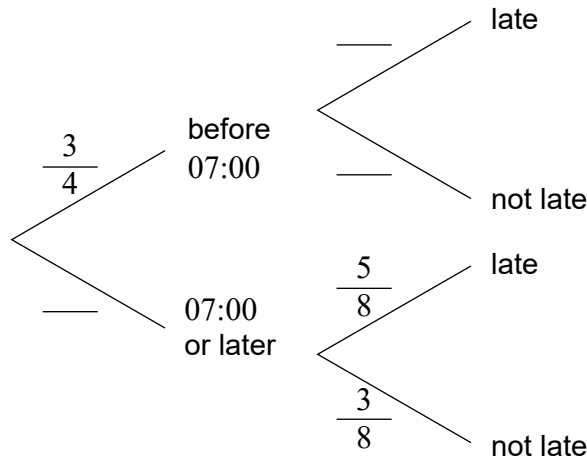
Pablo drives to work. The probability that he leaves home before 07:00 is  $\frac{3}{4}$ .

If he leaves home before 07:00 the probability he will be late for work is  $\frac{1}{8}$ .

If he leaves home at 07:00 or later the probability he will be late for work is  $\frac{5}{8}$ .

(a) **Copy** and complete the following tree diagram.

[3]



(b) Find the probability that Pablo leaves home before 07:00 and is late for work.

[2]

(c) Find the probability that Pablo is late for work.

[3]

(d) Given that Pablo is late for work, find the probability that he left home before 07:00.

[3]

(e) Two days next week Pablo will drive to work. Find the probability that he will be late at least once.

[3]

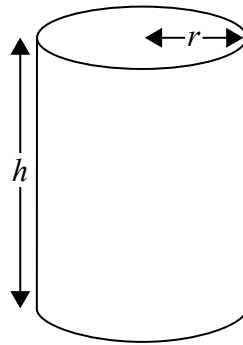


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9. [Maximum mark: 15]

A closed cylindrical can with radius  $r$  centimetres and height  $h$  centimetres has a volume of  $20\pi \text{ cm}^3$ .

diagram not to scale



(a) Express  $h$  in terms of  $r$ . [2]

The material for the base and top of the can costs 10 cents per  $\text{cm}^2$  and the material for the curved side costs 8 cents per  $\text{cm}^2$ . The total cost of the material, in cents, is  $C$ .

(b) Show that  $C = 20\pi r^2 + \frac{320\pi}{r}$ . [4]

(c) Given that there is a minimum value for  $C$ , find this minimum value in terms of  $\pi$ . [9]



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

10. [Maximum mark: 16]

Consider a function  $f$ . The line  $L_1$  with equation  $y = 3x + 1$  is a tangent to the graph of  $f$  when  $x = 2$ .

(a) (i) Write down  $f'(2)$ .

(ii) Find  $f(2)$ .

[4]

Let  $g(x) = f(x^2 + 1)$  and P be the point on the graph of  $g$  where  $x = 1$ .

(b) Show that the graph of  $g$  has a gradient of 6 at P.

[5]

(c) Let  $L_2$  be the tangent to the graph of  $g$  at P.  $L_1$  intersects  $L_2$  at the point Q. Find the  $y$ -coordinate of Q.

[7]

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