



**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].



12EP01

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 in the boxes provided. Working may be continued below the lines if necessary.

1. [Maximum mark: 5]

Let  $f(x) = a(x - h)^2 + k$ . The vertex of the graph of  $f$  is at (2, 3) and the graph passes through (1, 7).

(a) Write down the value of  $h$  and of  $k$ . [2]

(b) Find the value of  $a$ . [3]

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2. [Maximum mark: 7]

In an arithmetic sequence, the third term is 10 and the fifth term is 16.

- (a) Find the common difference. [2]
- (b) Find the first term. [2]
- (c) Find the sum of the first 20 terms of the sequence. [3]

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12EP03

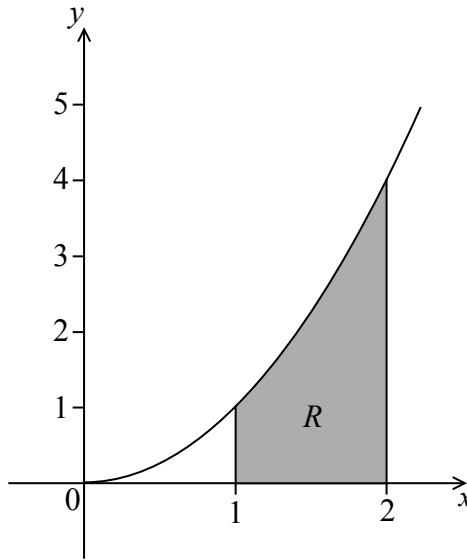
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3. [Maximum mark: 6]

Let  $f(x) = x^2$ .

(a) Find  $\int_1^2 (f(x))^2 dx$ . [4]

(b) The following diagram shows part of the graph of  $f$ .



The shaded region  $R$  is enclosed by the graph of  $f$ , the  $x$ -axis and the lines  $x = 1$  and  $x = 2$ .

Find the volume of the solid formed when  $R$  is revolved  $360^\circ$  about the  $x$ -axis. [2]

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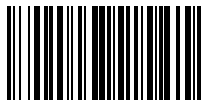
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4. [Maximum mark: 6]

(a) Write down the value of

(i)  $\log_3 27$ ;

(ii)  $\log_8 \frac{1}{8}$ ;

(iii)  $\log_{16} 4$ .

[3]

(b) Hence, solve  $\log_3 27 + \log_8 \frac{1}{8} - \log_{16} 4 = \log_4 x$ .

[3]

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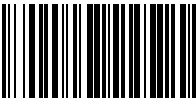
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12EP05

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5. [Maximum mark: 6]

Celeste wishes to hire a taxicab from a company which has a large number of taxicabs. The taxicabs are randomly assigned by the company.

The probability that a taxicab is yellow is 0.4.

The probability that a taxicab is a Fiat is 0.3.

The probability that a taxicab is yellow or a Fiat is 0.6.

Find the probability that the taxicab hired by Celeste is **not** a yellow Fiat.

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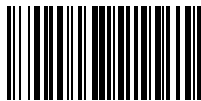
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12EP06

6. [Maximum mark: 7]

Let  $\int_{\pi}^a \cos 2x \, dx = \frac{1}{2}$ , where  $\pi < a < 2\pi$ . Find the value of  $a$ .

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7. [Maximum mark: 7]

Let  $f(x) = px^3 + px^2 + qx$ .

(a) Find  $f'(x)$ .

[2]

(b) Given that  $f'(x) \geq 0$ , show that  $p^2 \leq 3pq$ .

[5]

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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: 17]

The line  $L_1$  passes through the points A(2, 1, 4) and B(1, 1, 5).

(a) Show that  $\vec{AB} = \begin{pmatrix} -1 \\ 0 \\ 1 \end{pmatrix}$ . [1]

(b) Hence, write down

(i) a direction vector for  $L_1$ ;

(ii) a vector equation for  $L_1$ . [3]

Another line  $L_2$  has equation  $\mathbf{r} = \begin{pmatrix} 4 \\ 7 \\ -4 \end{pmatrix} + s \begin{pmatrix} 0 \\ -1 \\ 1 \end{pmatrix}$ . The lines  $L_1$  and  $L_2$  intersect at the point P.

(c) Find the coordinates of P. [6]

(d) (i) Write down a direction vector for  $L_2$ .

(ii) Hence, find the angle between  $L_1$  and  $L_2$ . [7]



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9. [Maximum mark: 14]

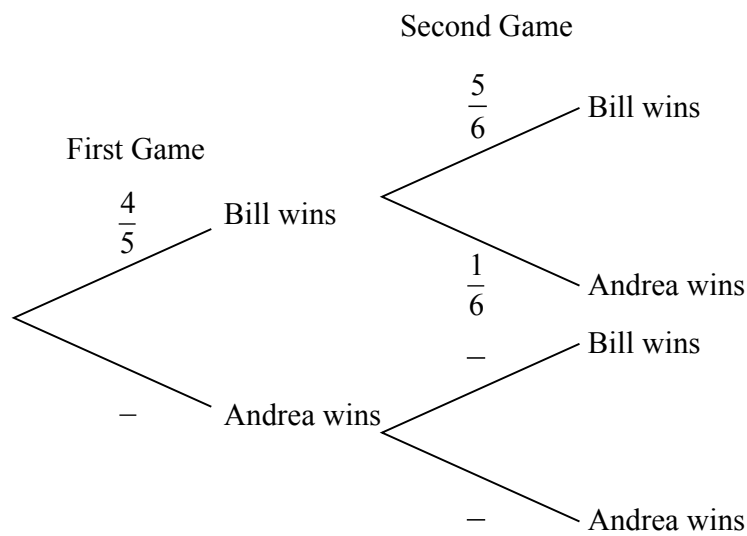
Bill and Andrea play two games of tennis. The probability that Bill wins the first game is  $\frac{4}{5}$ .

If Bill wins the first game, the probability that he wins the second game is  $\frac{5}{6}$ .

If Bill loses the first game, the probability that he wins the second game is  $\frac{2}{3}$ .

(a) **Copy** and complete the following tree diagram. (Do **not** write on this page.)

[3]



(b) Find the probability that Bill wins the first game and Andrea wins the second game.

[2]

(c) Find the probability that Bill wins at least one game.

[4]

(d) Given that Bill wins at least one game, find the probability that he wins both games.

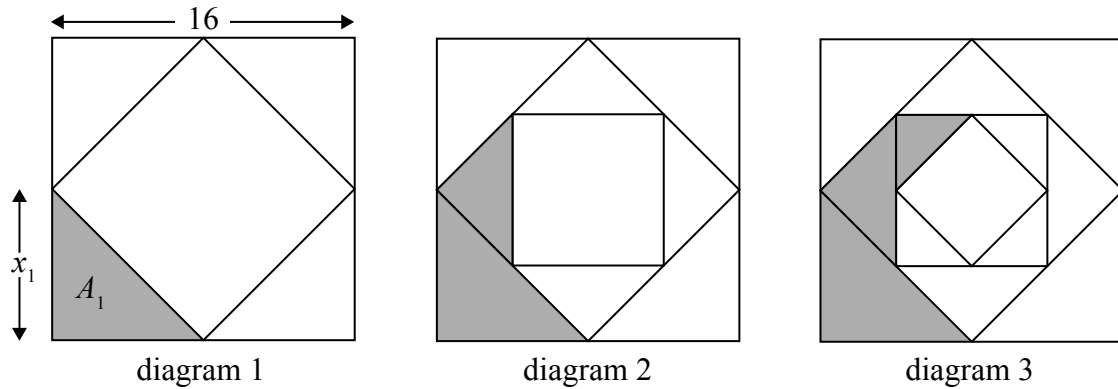
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10. [Maximum mark: 15]

The sides of a square are 16 cm in length. The midpoints of the sides of this square are joined to form a new square and four triangles (diagram 1). The process is repeated twice, as shown in diagrams 2 and 3.



Let  $x_n$  denote the length of one of the equal sides of each new triangle.  
 Let  $A_n$  denote the area of each new triangle.

- (a) The following table gives the values of  $x_n$  and  $A_n$ , for  $1 \leq n \leq 3$ . **Copy** and complete the table. (Do **not** write on this page.) [4]

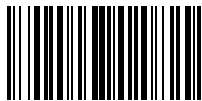
$n$	1	2	3
$x_n$	8		4
$A_n$	32	16	

- (b) The process described above is repeated. Find  $A_6$ . [4]
- (c) Consider an initial square of side length  $k$  cm. The process described above is repeated indefinitely. The total area of the shaded regions is  $k$  cm<sup>2</sup>. Find the value of  $k$ . [7]



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

Answers written on this page  
will not be marked.



12EP12