



22127303



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

Candidate session number

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Thursday 3 May 2012 (afternoon)

Examination code

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1 hour 30 minutes

**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 on the answer sheets provided. Write your session number on each answer sheet, and attach them to this examination paper and your cover sheet using the tag provided.
- At the end of the examination, indicate the number of sheets used in the appropriate box on your cover sheet.
- 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 information booklet** is required for this paper.
- The maximum mark for this examination paper is [90 marks].



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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: 7]

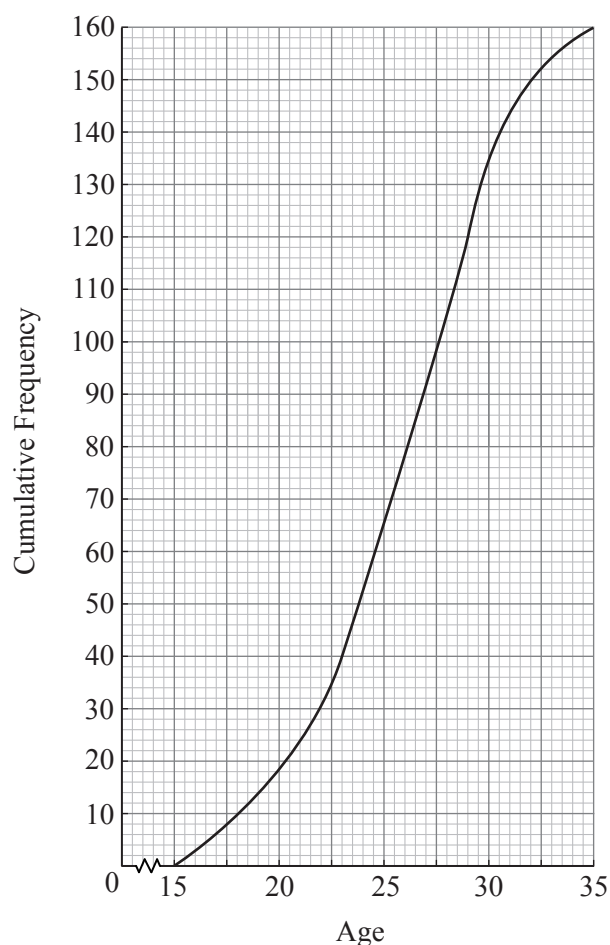
The ages of people attending a music concert are given in the table below.

Age	$15 \leq x < 19$	$19 \leq x < 23$	$23 \leq x < 27$	$27 \leq x < 31$	$31 \leq x < 35$
Frequency	14	26	52	52	16
Cumulative Frequency	14	40	92	$p$	160

(a) Find  $p$ .

[2 marks]

The cumulative frequency diagram is given below.



(This question continues on the following page)



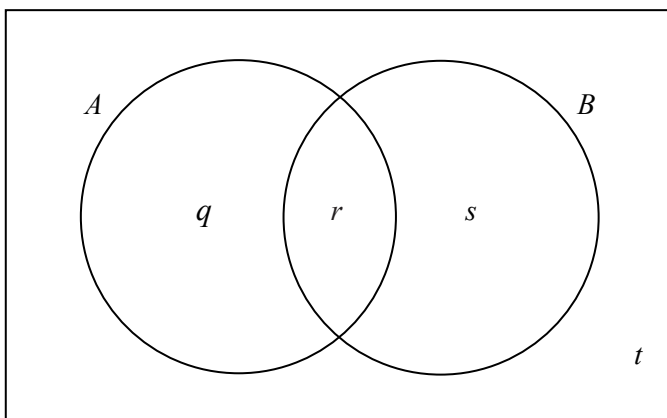






4. [Maximum mark: 7]

Events  $A$  and  $B$  are such that  $P(A) = 0.3$ ,  $P(B) = 0.6$  and  $P(A \cup B) = 0.7$ .



The values  $q$ ,  $r$ ,  $s$  and  $t$  represent probabilities.

(a) Write down the value of  $t$ . [1 mark]

(b) (i) Show that  $r = 0.2$ .  
(ii) Write down the value of  $q$  and of  $s$ . [3 marks]

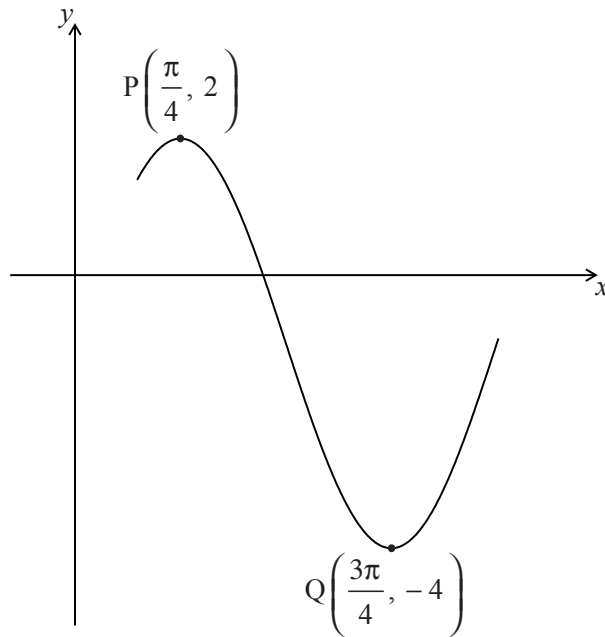
(c) (i) Write down  $P(B')$ .  
(ii) Find  $P(A|B')$ . [3 marks]

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5. [Maximum mark: 7]

The diagram below shows part of the graph of  $f(x) = a \cos(b(x-c)) - 1$ , where  $a > 0$ .



The point  $P\left(\frac{\pi}{4}, 2\right)$  is a maximum point and the point  $Q\left(\frac{3\pi}{4}, -4\right)$  is a minimum point.

- (a) Find the value of  $a$ . [2 marks]
  
- (b) (i) Show that the period of  $f$  is  $\pi$ .
  
- (ii) Hence, find the value of  $b$ . [4 marks]
  
- (c) Given that  $0 < c < \pi$ , write down the value of  $c$ . [1 mark]

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6. [Maximum mark: 6]

Given that  $\int_0^5 \frac{2}{2x+5} dx = \ln k$ , find the value of  $k$ .

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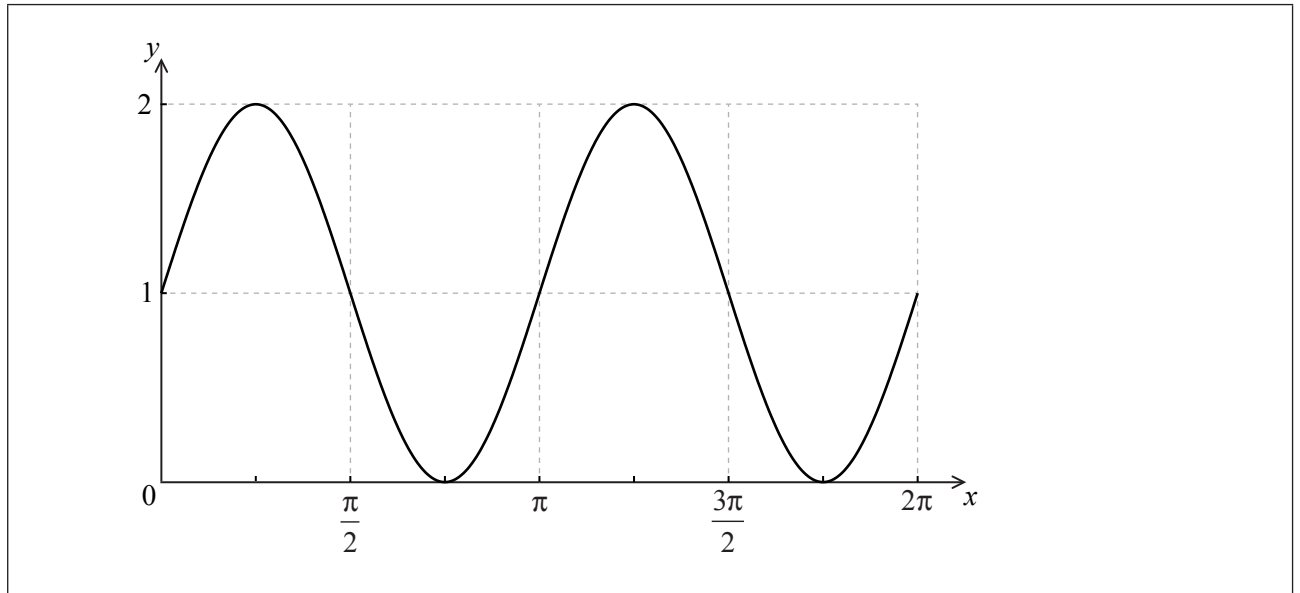
7. [Maximum mark: 6]

Let  $f(x) = (\sin x + \cos x)^2$ .

(a) Show that  $f(x)$  can be expressed as  $1 + \sin 2x$ .

[2 marks]

The graph of  $f$  is shown below for  $0 \leq x \leq 2\pi$ .



(b) Let  $g(x) = 1 + \cos x$ . On the same set of axes, sketch the graph of  $g$  for  $0 \leq x \leq 2\pi$ .

[2 marks]

The graph of  $g$  can be obtained from the graph of  $f$  under a horizontal stretch of scale factor  $p$  followed by a translation by the vector  $\begin{pmatrix} k \\ 0 \end{pmatrix}$ .

(c) Write down the value of  $p$  and a possible value of  $k$ .

[2 marks]

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

### SECTION B

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

8. [Maximum mark: 17]

A line  $L_1$  passes through points  $P(-1, 6, -1)$  and  $Q(0, 4, 1)$ .

(a) (i) Show that  $\vec{PQ} = \begin{pmatrix} 1 \\ -2 \\ 2 \end{pmatrix}$ .

(ii) Hence, write down an equation for  $L_1$  in the form  $\mathbf{r} = \mathbf{a} + t\mathbf{b}$ . [3 marks]

A second line  $L_2$  has equation  $\mathbf{r} = \begin{pmatrix} 4 \\ 2 \\ -1 \end{pmatrix} + s \begin{pmatrix} 3 \\ 0 \\ -4 \end{pmatrix}$ .

(b) Find the cosine of the angle between  $\vec{PQ}$  and  $L_2$ . [7 marks]

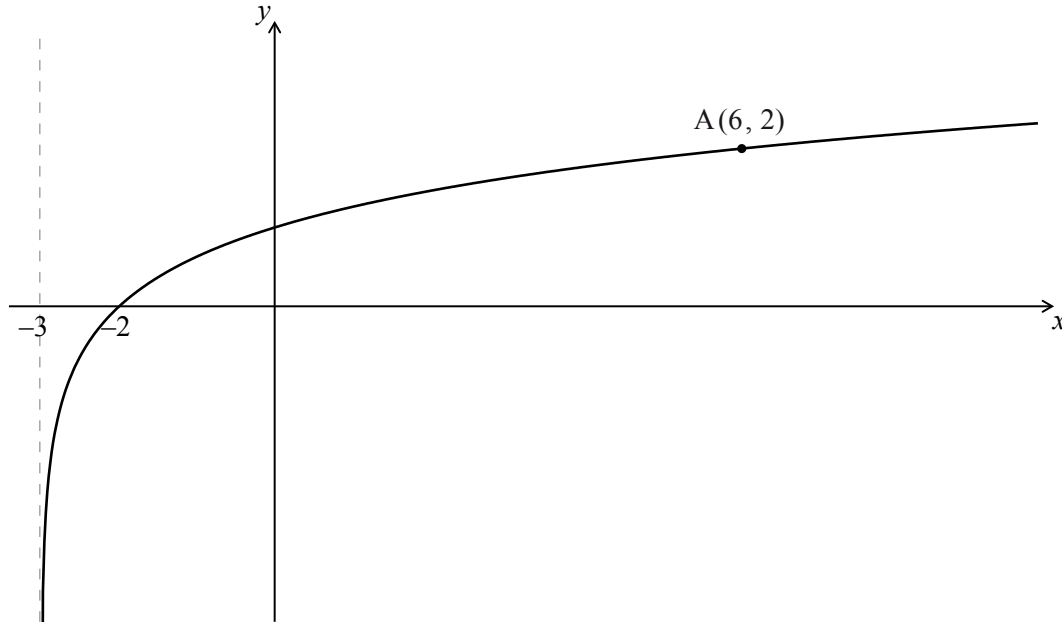
(c) The lines  $L_1$  and  $L_2$  intersect at the point R. Find the coordinates of R. [7 marks]



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9. [Maximum mark: 13]

Let  $f(x) = \log_p(x+3)$  for  $x > -3$ . Part of the graph of  $f$  is shown below.



The graph passes through  $A(6, 2)$ , has an  $x$ -intercept at  $(-2, 0)$  and has an asymptote at  $x = -3$ .

(a) Find  $p$ . [4 marks]

The graph of  $f$  is reflected in the line  $y = x$  to give the graph of  $g$ .

(b) (i) Write down the  $y$ -intercept of the graph of  $g$ .  
 (ii) Sketch the graph of  $g$ , noting clearly any asymptotes and the image of  $A$ . [5 marks]

(c) Find  $g(x)$ . [4 marks]



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

10. [Maximum mark: 15]

In this question, you are given that  $\cos \frac{\pi}{3} = \frac{1}{2}$ , and  $\sin \frac{\pi}{3} = \frac{\sqrt{3}}{2}$ .

The displacement of an object from a fixed point, O is given by  $s(t) = t - \sin 2t$  for  $0 \leq t \leq \pi$ .

(a) Find  $s'(t)$ . [3 marks]

In this interval, there are only two values of  $t$  for which the object is not moving.

One value is  $t = \frac{\pi}{6}$ .

(b) Find the other value. [4 marks]

(c) Show that  $s'(t) > 0$  between these two values of  $t$ . [3 marks]

(d) Find the distance travelled between these two values of  $t$ . [5 marks]

