

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

Thursday 4 May 2017 (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]**.



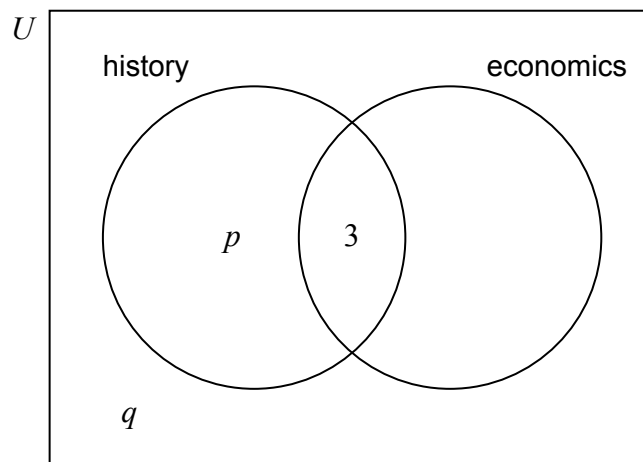
Full marks are not necessarily awarded for a correct answer with no working. Answers must be supported by working and/or explanations. Where an answer is incorrect, some marks may be given for a correct method, provided this is shown by written working. You are therefore advised to show all working.

### 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]

In a group of 20 girls, 13 take history and 8 take economics. Three girls take both history and economics, as shown in the following Venn diagram. The values  $p$  and  $q$  represent numbers of girls.



(a) Find the value of

(i)  $p$ ;

(ii)  $q$ .

[4]

(b) A girl is selected at random. Find the probability that she takes economics but not history.

[2]

(This question continues on the following page)





2. [Maximum mark: 5]

Let  $f(x) = 5x$  and  $g(x) = x^2 + 1$ , for  $x \in \mathbb{R}$ .

(a) Find  $f^{-1}(x)$ . [2]

(b) Find  $(f \circ g)(7)$ . [3]

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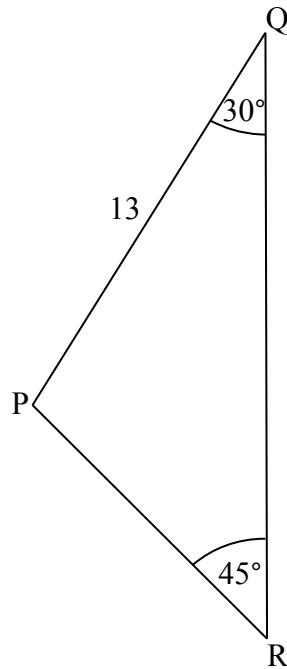


12EP04

3. [Maximum mark: 6]

The following diagram shows triangle PQR.

diagram not to scale



$\hat{PQR} = 30^\circ$ ,  $\hat{QRP} = 45^\circ$  and  $PQ = 13$  cm.

Find PR.

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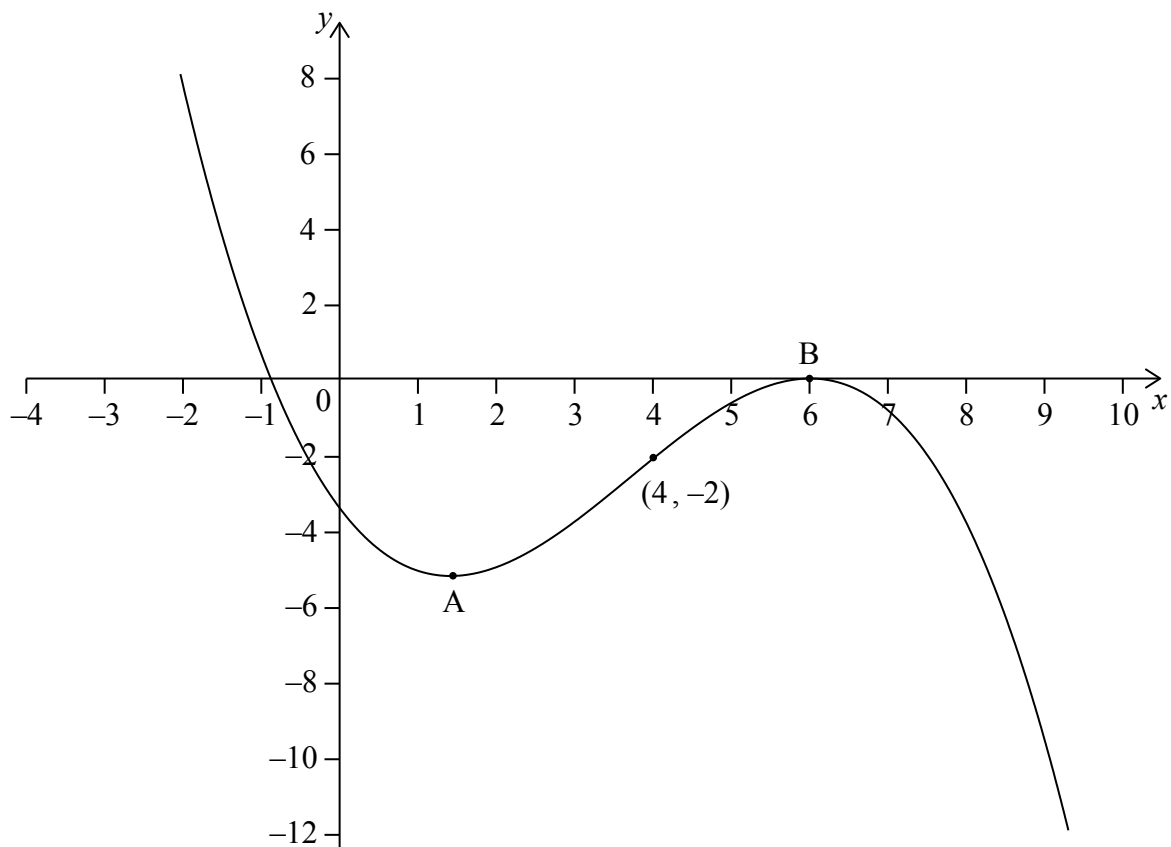
Turn over





6. [Maximum mark: 6]

The following diagram shows the graph of  $f'$ , the derivative of  $f$ .



The graph of  $f'$  has a local minimum at A, a local maximum at B and passes through  $(4, -2)$ .

- (a) The point  $P(4, 3)$  lies on the graph of the function,  $f$ .
  - (i) Write down the gradient of the curve of  $f$  at P.
  - (ii) Find the equation of the normal to the curve of  $f$  at P. [4]
- (b) Determine the concavity of the graph of  $f$  when  $4 < x < 5$  **and** justify your answer. [2]

(This question continues on the following page)









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]

A line  $L_1$  passes through the points  $A(0, 1, 8)$  and  $B(3, 5, 2)$ .

(a) (i) Find  $\vec{AB}$ .

(ii) Hence, write down a vector equation for  $L_1$ . [4]

(b) A second line  $L_2$ , has equation  $\mathbf{r} = \begin{pmatrix} 1 \\ 13 \\ -14 \end{pmatrix} + s \begin{pmatrix} p \\ 0 \\ 1 \end{pmatrix}$ .

Given that  $L_1$  and  $L_2$  are perpendicular, show that  $p = 2$ . [3]

(c) The lines  $L_1$  and  $L_2$  intersect at  $C(9, 13, z)$ . Find  $z$ . [5]

(d) (i) Find a unit vector in the direction of  $L_2$ .

(ii) Hence or otherwise, find one point on  $L_2$  which is  $\sqrt{5}$  units from  $C$ . [5]

9. [Maximum mark: 14]

A quadratic function  $f$  can be written in the form  $f(x) = a(x - p)(x - 3)$ . The graph of  $f$  has axis of symmetry  $x = 2.5$  and  $y$ -intercept at  $(0, -6)$ .

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

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

(c) The line  $y = kx - 5$  is a tangent to the curve of  $f$ . Find the values of  $k$ . [8]



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

10. [Maximum mark: 15]

The following table shows the probability distribution of a discrete random variable  $A$ , in terms of an angle  $\theta$ .

$a$	1	2
$P(A = a)$	$\cos \theta$	$2 \cos 2\theta$

(a) Show that  $\cos \theta = \frac{3}{4}$ . [6]

(b) Given that  $\tan \theta > 0$ , find  $\tan \theta$ . [3]

(c) Let  $y = \frac{1}{\cos x}$ , for  $0 < x < \frac{\pi}{2}$ . The graph of  $y$  between  $x = \theta$  and  $x = \frac{\pi}{4}$  is rotated  $360^\circ$  about the  $x$ -axis. Find the volume of the solid formed. [6]

