

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.

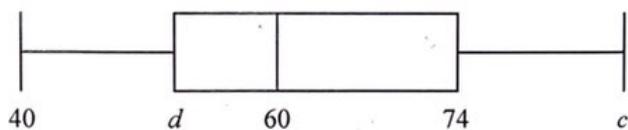
### Section A

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

1. [Maximum mark: 5]

The following box-and-whisker plot represents the examination scores of a group of students.

Examination scores



- (a) Write down the median score.

[1]

The range of the scores is 47 marks, and the interquartile range is 22 marks.

- (b) Find the value of

(i)  $c$ ;

(ii)  $d$ .

[4]

(a) ... 60 ...	(1)
(b) Range = $c - 40 = 47$	
(i) $c = 87$	(2)
(ii) IQR = $74 - d = 22$	
$d = 52$	(2)



16EP03

Turn over

7. [Maximum mark: 6]

An arithmetic sequence has the first term  $\ln a$  and a common difference  $\ln 3$ .  
The 13th term in the sequence is  $8 \ln 9$ . Find the value of  $a$ .

$$\begin{aligned} u_{13} &= \ln a + (13-1) \ln 3 = 8 \ln 9 \\ \ln a + \ln 3^{12} &= \ln 9^8 \quad 9^8 = (3^2)^8 \\ \ln (3^{12}a) &= \ln 3^{16} \\ 3^{12}a &= 3^{16} \\ a &= 3^4 \\ a &= 81 \end{aligned}$$



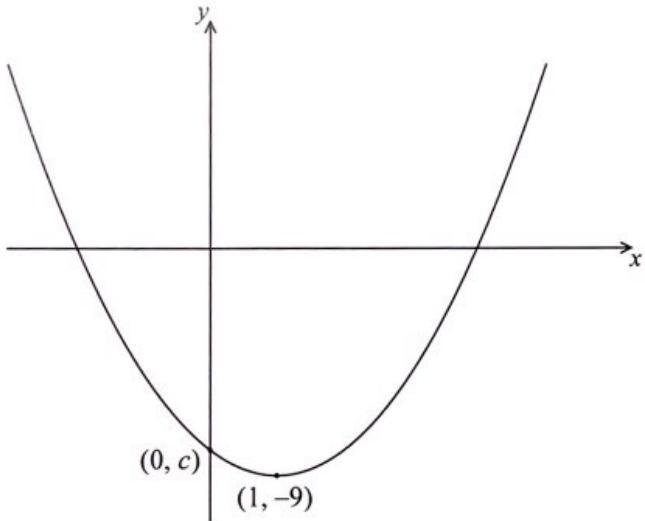
Do **not** write solutions on this page.

## Section B

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

8. [Maximum mark: 16]

The following diagram shows part of the graph of a quadratic function  $f$ .



The vertex is at  $(1, -9)$ , and the graph crosses the  $y$ -axis at the point  $(0, c)$ .

The function can be written in the form  $f(x) = (x - h)^2 + k$ .

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

Let  $g(x) = -(x - 3)^2 + 1$ . The graph of  $g$  is obtained by a reflection of the graph of  $f$  in the  $x$ -axis, followed by a translation of  $\begin{pmatrix} p \\ q \end{pmatrix}$ .

- (c) Find the value of  $p$  and of  $q$ . [5]  
(d) Find the  $x$ -coordinates of the points of intersection of the graphs of  $f$  and  $g$ . [7]



Solution

8. Quadratic function graph

(a)  $h = 1$   
 $k = -9$

(b)  $c = f(0) = (x-1)^2 - 9$   
 $c = -8$

(c)  $g$  vertex  $(3, 1)$

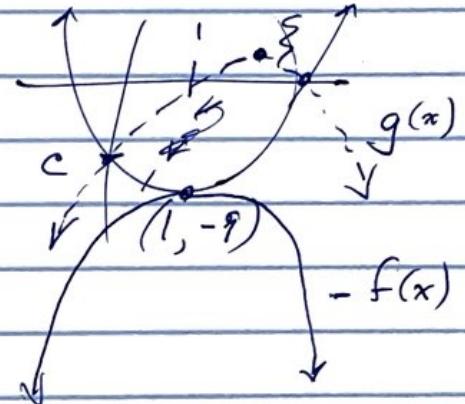
~~$(1, -9)$~~   $\xrightarrow{\text{shift}}$   $(3, 1)$   
 $\begin{pmatrix} 1 \\ -9 \end{pmatrix}$   $\begin{pmatrix} 3 \\ 1 \end{pmatrix}$   
 $p = 2$   
 $q = 10$

(d)  $f(x) = g(x)$   
 $(x-1)^2 - 9 = -(x-3)^2 + 1$   
 $x^2 - 2x + 1 - 9 = -x^2 + 6x - 9 + 1$

$2x^2 - 8x = 0$

$x(x-4) = 0$

$x = 0, 4$



check  
 $f(0) = -8$   
 $g(0) = -8$   
~~get~~  
 $f(4) = 0$   
 $g(4) = 0$

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]

(a) i) 3

ie) -1

iii) 1/2

(b)  $3 + (-1) - \frac{1}{2} = \log_4 x$

$\frac{3}{2} = \log_4 x$

$x = 4^{\left(\frac{3}{2}\right)} = 8$