

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
9	
TOTAL	



General Certificate of Education
Advanced Subsidiary Examination
June 2013

Mathematics

MFP1

Unit Further Pure 1

Friday 17 May 2013 9.00 am to 10.30 am

For this paper you must have:

- the blue AQA booklet of formulae and statistical tables.
- You may use a graphics calculator.

Time allowed

- 1 hour 30 minutes

Instructions

- Use black ink or black ball-point pen. Pencil should only be used for drawing.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- Write the question part reference (eg (a), (b)(i) etc) in the left-hand margin.
- You must answer each question in the space provided for that question. If you require extra space, use an AQA supplementary answer book; do **not** use the space provided for a different question.
- Do not write outside the box around each page.
- Show all necessary working; otherwise marks for method may be lost.
- Do all rough work in this book. Cross through any work that you do not want to be marked.

Information

- The marks for questions are shown in brackets.
- The maximum mark for this paper is 75.

Advice

- Unless stated otherwise, you may quote formulae, without proof, from the booklet.
- You do not necessarily need to use all the space provided.



J U N 1 3 M F P 1 0 1

Answer **all** questions.

Answer each question in the space provided for that question.

1 The equation

$$x^3 - x^2 + 4x - 900 = 0$$

has exactly one real root, α .

Taking $x_1 = 10$ as a first approximation to α , use the Newton–Raphson method to find a second approximation, x_2 , to α . Give your answer to four significant figures.

(3 marks)

QUESTION
PART
REFERENCE

Answer space for question 1



QUESTION
PART
REFERENCE

Answer space for question 1

A large rectangular area with horizontal dotted lines for writing the answer to question 1.

Turn over ►



2 The matrices **A** and **B** are defined by

$$\mathbf{A} = \begin{bmatrix} p & 2 \\ 4 & p \end{bmatrix} \quad \mathbf{B} = \begin{bmatrix} 3 & 1 \\ 2 & 3 \end{bmatrix}$$

(a) Find, in terms of p , the matrices:

(i) $\mathbf{A} - \mathbf{B}$; (1 mark)

(ii) \mathbf{AB} . (2 marks)

(b) Show that there is a value of p for which $\mathbf{A} - \mathbf{B} + \mathbf{AB} = k\mathbf{I}$, where k is an integer and \mathbf{I} is the 2×2 identity matrix, and state the corresponding value of k . (4 marks)

QUESTION
PART
REFERENCE

Answer space for question 2



QUESTION
PART
REFERENCE

Answer space for question 2

A large rectangular area with horizontal dotted lines for writing an answer.

Turn over ►



3 (a) Find the general solution, in degrees, of the equation

$$\cos(5x + 40^\circ) = \cos 65^\circ \quad (5 \text{ marks})$$

(b) Given that

$$\sin \frac{\pi}{12} = \frac{\sqrt{3} - 1}{2\sqrt{2}}$$

express $\sin \frac{\pi}{12}$ in the form $\left(\cos \frac{\pi}{4}\right) \left(\cos(a\pi) + \cos(b\pi)\right)$, where a and b are rational.
(3 marks)

QUESTION
PART
REFERENCE

Answer space for question 3



QUESTION
PART
REFERENCE

Answer space for question 3

A large rectangular area with horizontal dotted lines for writing.



Turn over ►

4 (a) It is given that $z = x + yi$, where x and y are real numbers.

(i) Write down, in terms of x and y , an expression for $(z - 2i)^*$. (1 mark)

(ii) Solve the equation

$$(z - 2i)^* = 4iz + 3$$

giving your answer in the form $a + bi$. (5 marks)

(b) It is given that $p + qi$, where p and q are real numbers, is a root of the equation $z^2 + 10iz - 29 = 0$.

Without finding the values of p and q , **state** why $p - qi$ is **not** a root of the equation $z^2 + 10iz - 29 = 0$. (1 mark)

QUESTION
PART
REFERENCE

Answer space for question 4

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....



QUESTION
PART
REFERENCE

Answer space for question 4

A large rectangular area with horizontal dotted lines for writing an answer.



Turn over ►

QUESTION
PART
REFERENCE

Answer space for question 5

A large rectangular area with horizontal dotted lines for writing an answer.

Turn over ►



QUESTION
PART
REFERENCE

Answer space for question 6

A large rectangular area with horizontal dotted lines for writing an answer.

Turn over ►



- 7 (a)** Show that the equation $4x^3 - x - 540\,000 = 0$ has a root, α , in the interval $51 < \alpha < 52$. (2 marks)
- (b)** It is given that $S_n = \sum_{r=1}^n (2r - 1)^2$.
- (i)** Use the formulae for $\sum_{r=1}^n r^2$ and $\sum_{r=1}^n r$ to show that $S_n = \frac{n}{3}(kn^2 - 1)$, where k is an integer to be found. (5 marks)
- (ii)** Hence show that $6S_n$ can be written as the product of three consecutive integers. (2 marks)
- (c)** Find the smallest value of N for which the sum of the squares of the first N odd numbers is greater than 180 000. (2 marks)

QUESTION
PART
REFERENCE**Answer space for question 7**

QUESTION
PART
REFERENCE

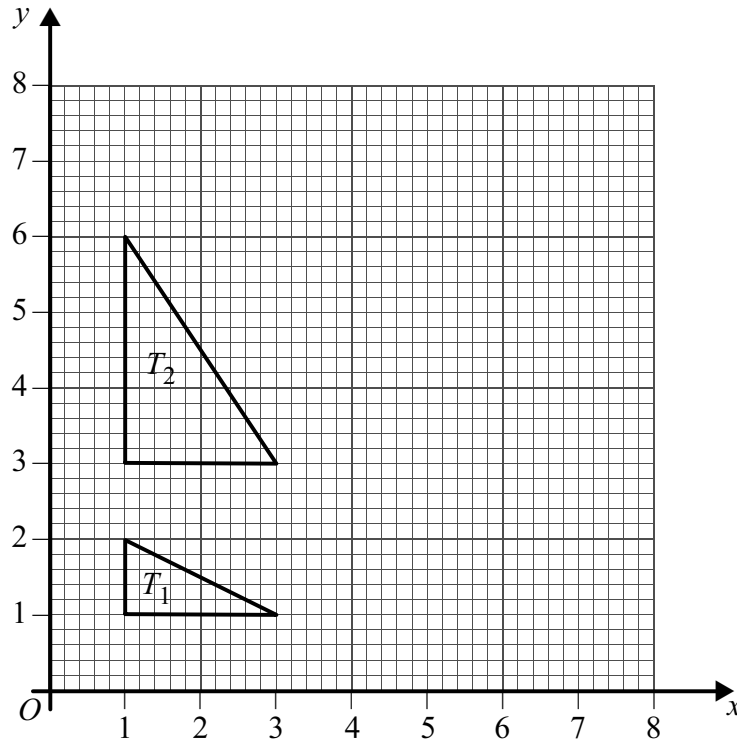
Answer space for question 7

A large rectangular area with horizontal dotted lines for writing an answer.

Turn over ►



8 The diagram shows two triangles, T_1 and T_2 .



- (a) Find the matrix which represents the stretch that maps triangle T_1 onto triangle T_2 . (2 marks)
- (b) The triangle T_2 is reflected in the line $y = \sqrt{3}x$ to give a third triangle, T_3 . Find, using surd forms where appropriate:
 - (i) the matrix which represents the reflection that maps triangle T_2 onto triangle T_3 ; (2 marks)
 - (ii) the matrix which represents the combined transformation that maps triangle T_1 onto triangle T_3 . (2 marks)

QUESTION
PART
REFERENCE

Answer space for question 8

.....

.....

.....

.....

.....

.....

.....

.....



QUESTION
PART
REFERENCE

Answer space for question 8

A large rectangular area with horizontal dotted lines for writing an answer.



9 A curve has equation

$$y = \frac{x^2 - 2x + 1}{x^2 - 2x - 3}$$

(a) Find the equations of the three asymptotes of the curve. (3 marks)

(b) (i) Show that if the line $y = k$ intersects the curve then

$$(k - 1)x^2 - 2(k - 1)x - (3k + 1) = 0 \quad (1 \text{ mark})$$

(ii) Given that the equation $(k - 1)x^2 - 2(k - 1)x - (3k + 1) = 0$ has real roots, show that

$$k^2 - k \geq 0 \quad (3 \text{ marks})$$

(iii) Hence show that the curve has only one stationary point and find its coordinates.

(No credit will be given for solutions based on differentiation.) (4 marks)

(c) Sketch the curve and its asymptotes. (3 marks)

QUESTION
PART
REFERENCE

Answer space for question 9



QUESTION
PART
REFERENCE

Answer space for question 9

A large rectangular area with horizontal dotted lines for writing an answer.

Turn over ►



QUESTION
PART
REFERENCE

Answer space for question 9

A large rectangular area for writing, bounded by a solid line on the left and top, and a dotted line on the bottom. The interior of the box is filled with horizontal dotted lines, providing a guide for handwriting.

END OF QUESTIONS

Copyright © 2013 AQA and its licensors. All rights reserved.

