

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 2010

# Mathematics

# MFP1

## Unit Further Pure 1

Thursday 27 May 2010 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 the questions in the spaces provided. 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.



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Answer **all** questions in the spaces provided.

- 1** A curve passes through the point (1, 3) and satisfies the differential equation

$$\frac{dy}{dx} = 1 + x^3$$

Starting at the point (1, 3), use a step-by-step method with a step length of 0.1 to estimate the  $y$ -coordinate of the point on the curve for which  $x = 1.3$ . Give your answer to three decimal places.

(No credit will be given for methods involving integration.)

*(6 marks)*

QUESTION  
PART  
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QUESTION  
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0 3

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3

Find the general solution, in degrees, of the equation

$$\cos(5x - 20^\circ) = \cos 40^\circ$$

(5 marks)

QUESTION  
PART  
REFERENCE

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4 The variables  $x$  and  $y$  are related by an equation of the form

$$y = ax^2 + b$$

where  $a$  and  $b$  are constants.

The following approximate values of  $x$  and  $y$  have been found.

$x$	2	4	6	8
$y$	6.0	10.5	18.0	28.2

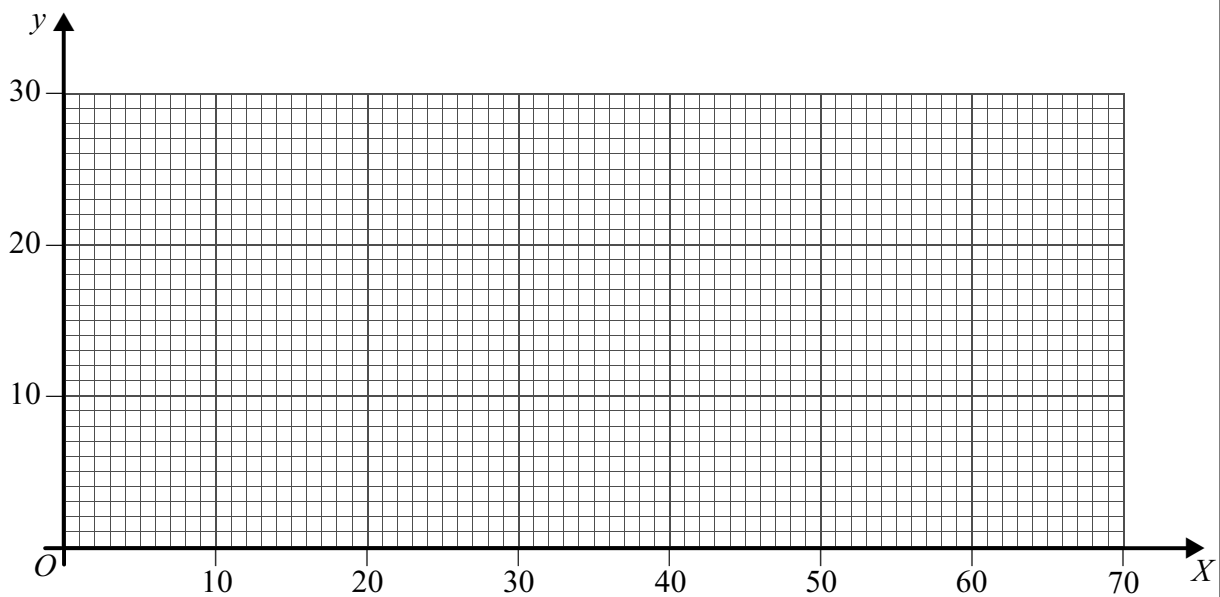
- (a) Complete the table below, showing values of  $X$ , where  $X = x^2$ . (1 mark)
- (b) On the diagram below, draw a linear graph relating  $X$  and  $y$ . (2 marks)
- (c) Use your graph to find estimates, to two significant figures, for:
- (i) the value of  $x$  when  $y = 15$ ; (2 marks)
- (ii) the values of  $a$  and  $b$ . (3 marks)

QUESTION  
PART  
REFERENCE

(a)

$x$	2	4	6	8
$X$				
$y$	6.0	10.5	18.0	28.2

(b)







5

A curve has equation  $y = x^3 - 12x$ .

The point  $A$  on the curve has coordinates  $(2, -16)$ .

The point  $B$  on the curve has  $x$ -coordinate  $2 + h$ .

- (a) Show that the gradient of the line  $AB$  is  $6h + h^2$ . (4 marks)
- (b) Explain how the result of part (a) can be used to show that  $A$  is a stationary point on the curve. (2 marks)

QUESTION  
PART  
REFERENCE





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

$$\mathbf{A} = \begin{bmatrix} \frac{1}{\sqrt{2}} & -\frac{1}{\sqrt{2}} \\ \frac{1}{\sqrt{2}} & \frac{1}{\sqrt{2}} \end{bmatrix}, \quad \mathbf{B} = \begin{bmatrix} \frac{1}{\sqrt{2}} & \frac{1}{\sqrt{2}} \\ \frac{1}{\sqrt{2}} & -\frac{1}{\sqrt{2}} \end{bmatrix}$$

Describe fully the geometrical transformation represented by each of the following matrices:

- (a) **A**; (2 marks)
- (b) **B**; (2 marks)
- (c) **A**<sup>2</sup>; (2 marks)
- (d) **B**<sup>2</sup>; (2 marks)
- (e) **AB**. (3 marks)

QUESTION  
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**7 (a) (i)** Write down the equations of the two asymptotes of the curve  $y = \frac{1}{x-3}$ . (2 marks)

**(ii)** Sketch the curve  $y = \frac{1}{x-3}$ , showing the coordinates of any points of intersection with the coordinate axes. (2 marks)

**(iii)** On the same axes, again showing the coordinates of any points of intersection with the coordinate axes, sketch the line  $y = 2x - 5$ . (1 mark)

**(b) (i)** Solve the equation

$$\frac{1}{x-3} = 2x - 5 \quad (3 \text{ marks})$$

**(ii)** Find the solution of the inequality

$$\frac{1}{x-3} < 2x - 5 \quad (2 \text{ marks})$$

QUESTION  
PART  
REFERENCE





**8** The quadratic equation

$$x^2 - 4x + 10 = 0$$

has roots  $\alpha$  and  $\beta$ .

**(a)** Write down the values of  $\alpha + \beta$  and  $\alpha\beta$ . (2 marks)

**(b)** Show that  $\frac{1}{\alpha} + \frac{1}{\beta} = \frac{2}{5}$ . (2 marks)

**(c)** Find a quadratic equation, with integer coefficients, which has roots  $\alpha + \frac{2}{\beta}$  and  $\beta + \frac{2}{\alpha}$ . (6 marks)

QUESTION  
PART  
REFERENCE







**9** A parabola  $P$  has equation  $y^2 = x - 2$ .

**(a) (i)** Sketch the parabola  $P$ . (2 marks)

**(ii)** On your sketch, draw the two tangents to  $P$  which pass through the point  $(-2, 0)$ . (2 marks)

**(b) (i)** Show that, if the line  $y = m(x + 2)$  intersects  $P$ , then the  $x$ -coordinates of the points of intersection must satisfy the equation

$$m^2x^2 + (4m^2 - 1)x + (4m^2 + 2) = 0 \quad (3 \text{ marks})$$

**(ii)** Show that, if this equation has equal roots, then

$$16m^2 = 1 \quad (3 \text{ marks})$$

**(iii)** Hence find the coordinates of the points at which the tangents to  $P$  from the point  $(-2, 0)$  touch the parabola  $P$ . (3 marks)

QUESTION  
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QUESTION  
PART  
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**END OF QUESTIONS**

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