

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	
10	
<b>TOTAL</b>	



General Certificate of Education  
Advanced Level Examination  
June 2013

# Mathematics

# MPC3

## Unit Pure Core 3

Thursday 6 June 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 P C 3 0 1





**2 (a)** Given that  $y = x^4 \tan 2x$ , find  $\frac{dy}{dx}$ . (3 marks)

**(b)** Find the gradient of the curve with equation  $y = \frac{x^2}{x-1}$  at the point where  $x = 3$ . (3 marks)

QUESTION  
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REFERENCE

**Answer space for question 2**













QUESTION  
PART  
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**Answer space for question 4**

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QUESTION  
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**Answer space for question 5**

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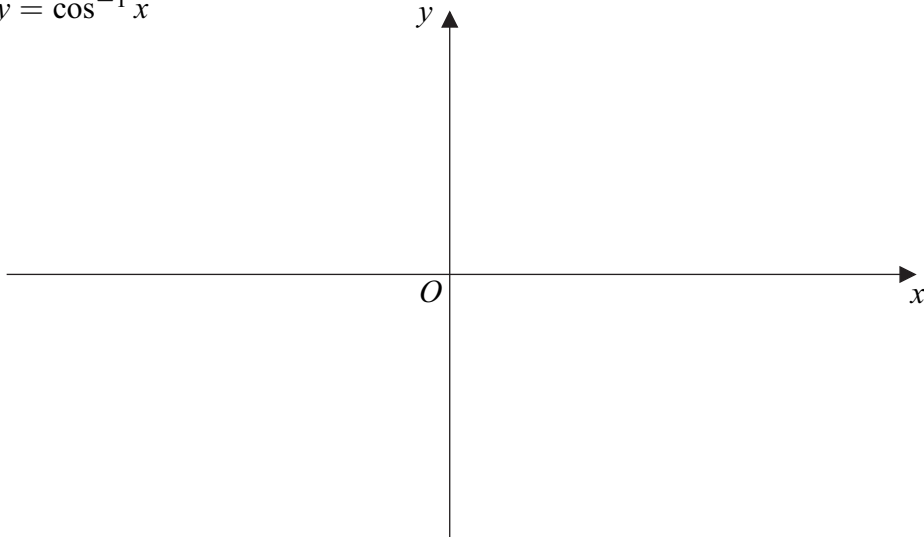
**Turn over ►**



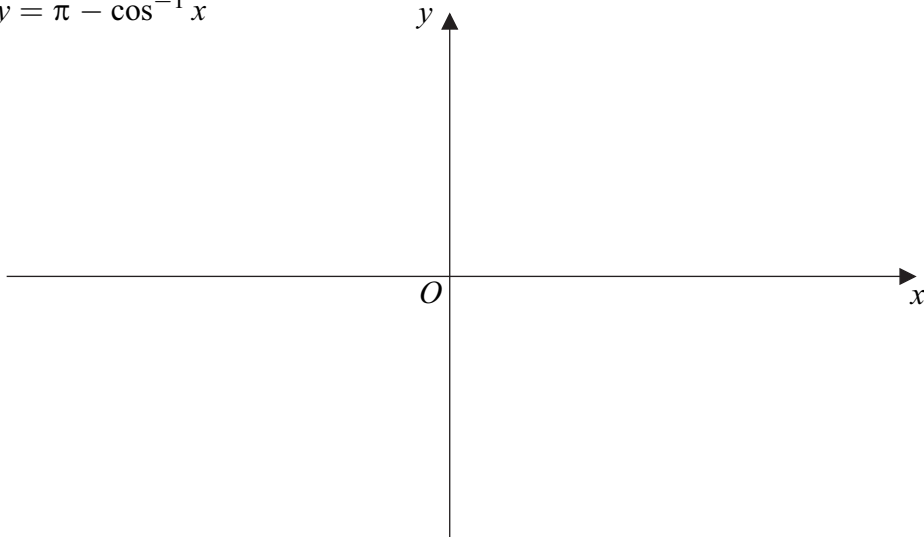
- 6 (a)** Sketch the graph of  $y = \cos^{-1} x$ , where  $y$  is in radians. State the coordinates of the end points of the graph. (2 marks)
- (b)** Sketch the graph of  $y = \pi - \cos^{-1} x$ , where  $y$  is in radians. State the coordinates of the end points of the graph. (2 marks)

QUESTION  
PART  
REFERENCE**Answer space for question 6****(a)**

$$y = \cos^{-1} x$$

**(b)**

$$y = \pi - \cos^{-1} x$$



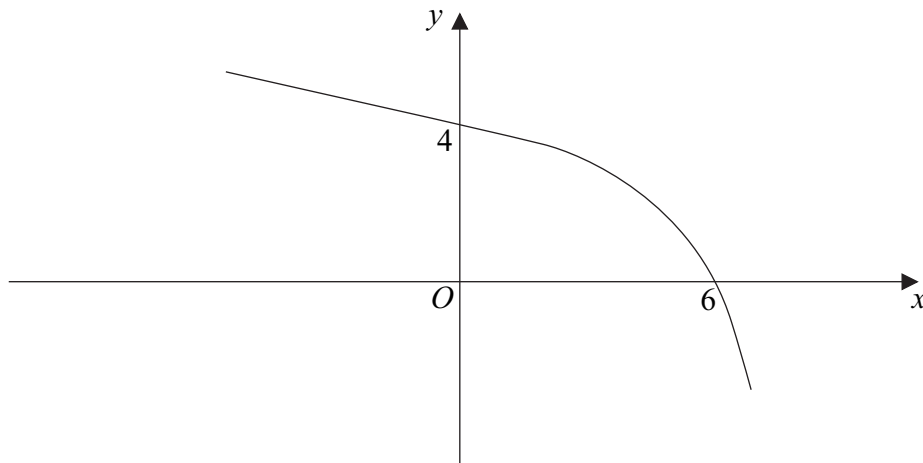
QUESTION  
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**Answer space for question 6**

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- 7 The diagram shows a sketch of the curve with equation  $y = f(x)$ .



- (a) On **Figure 1**, below, sketch the curve with equation  $y = -f(3x)$ , indicating the values where the curve cuts the coordinate axes. (2 marks)
- (b) On **Figure 2**, on the opposite page, sketch the curve with equation  $y = f(|x|)$ , indicating the values where the curve cuts the coordinate axes. (3 marks)
- (c) Describe a sequence of two geometrical transformations that maps the graph of  $y = f(x)$  onto the graph of  $y = f\left(-\frac{1}{2}x\right)$ . (4 marks)

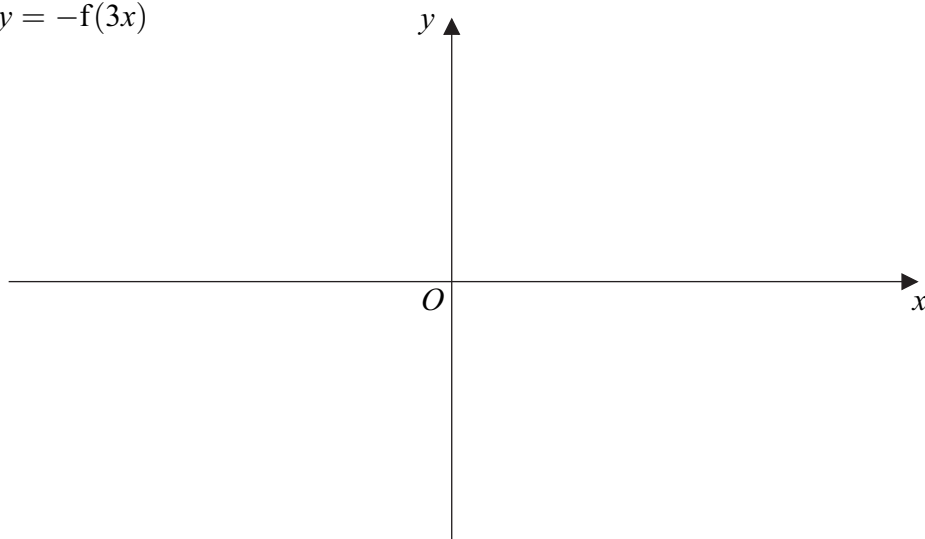
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**Answer space for question 7**

(a)

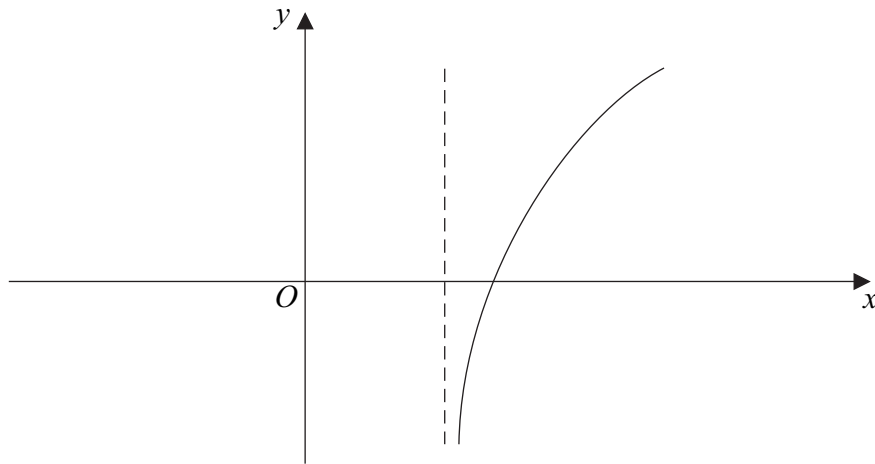
$$y = -f(3x)$$

**Figure 1**





- 8** The curve with equation  $y = f(x)$ , where  $f(x) = \ln(2x - 3)$ ,  $x > \frac{3}{2}$ , is sketched below.



- (a)** The inverse of  $f$  is  $f^{-1}$ .
- (i)** Find  $f^{-1}(x)$ . (3 marks)
- (ii)** State the range of  $f^{-1}$ . (1 mark)
- (iii)** Sketch, on the axes given on the opposite page, the curve with equation  $y = f^{-1}(x)$ , indicating the value of the  $y$ -coordinate of the point where the curve intersects the  $y$ -axis. (2 marks)
- (b)** The function  $g$  is defined by
- $$g(x) = e^{2x} - 4, \text{ for all real values of } x$$
- (i)** Find  $gf(x)$ , giving your answer in the form  $(ax - b)^2 - c$ , where  $a$ ,  $b$  and  $c$  are integers. (3 marks)
- (ii)** Write down an expression for  $fg(x)$ , and hence find the exact solution of the equation  $fg(x) = \ln 5$ . (3 marks)

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QUESTION  
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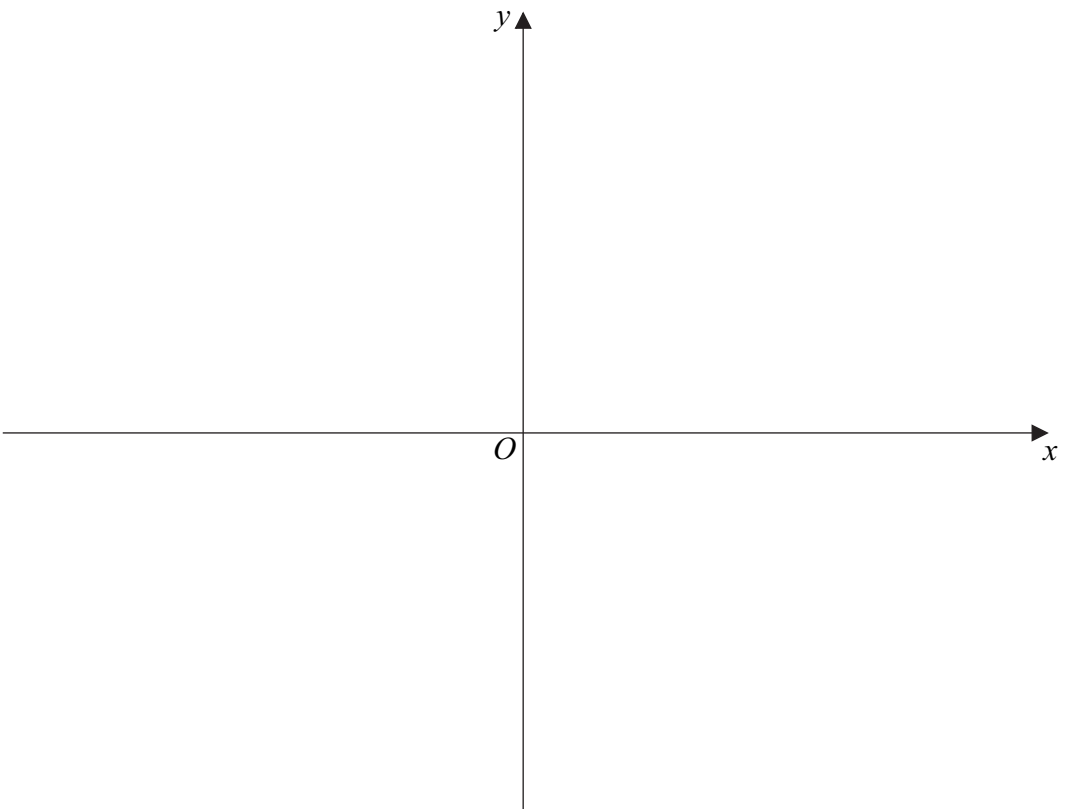
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**(a)(iii)**



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QUESTION  
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**10 (a) (i)** By writing  $\ln x$  as  $(\ln x) \times 1$ , use integration by parts to find  $\int \ln x \, dx$ . (4 marks)

**(ii)** Find  $\int (\ln x)^2 \, dx$ . (4 marks)

**(b)** Use the substitution  $u = \sqrt{x}$  to find the exact value of

$$\int_1^4 \frac{1}{x + \sqrt{x}} \, dx \quad (7 \text{ marks})$$

QUESTION  
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**Answer space for question 10**



QUESTION  
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**Answer space for question 10**

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QUESTION  
PART  
REFERENCE

**Answer space for question 10**

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**END OF QUESTIONS**

