

Write your name here	
Surname	Other names
Edexcel	Centre Number
International GCSE	Candidate Number
<h1 style="margin: 0;">Further Pure Mathematics</h1> <h2 style="margin: 0;">Paper 1</h2>	
Thursday 17 January 2013 – Morning Time: 2 hours	Paper Reference 4PM0/01
Calculators may be used.	Total Marks

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Without sufficient working, correct answers may be awarded no marks.
- Answer the questions in the spaces provided
– *there may be more space than you need.*

Information

- The total mark for this paper is 100.
- The marks for **each** question are shown in brackets
– *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Check your answers if you have time at the end.

Turn over ►

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Answer all ELEVEN questions.

Write your answers in the spaces provided.

You must write down all stages in your working.

- 1** (a) On the axes below sketch the lines with equations

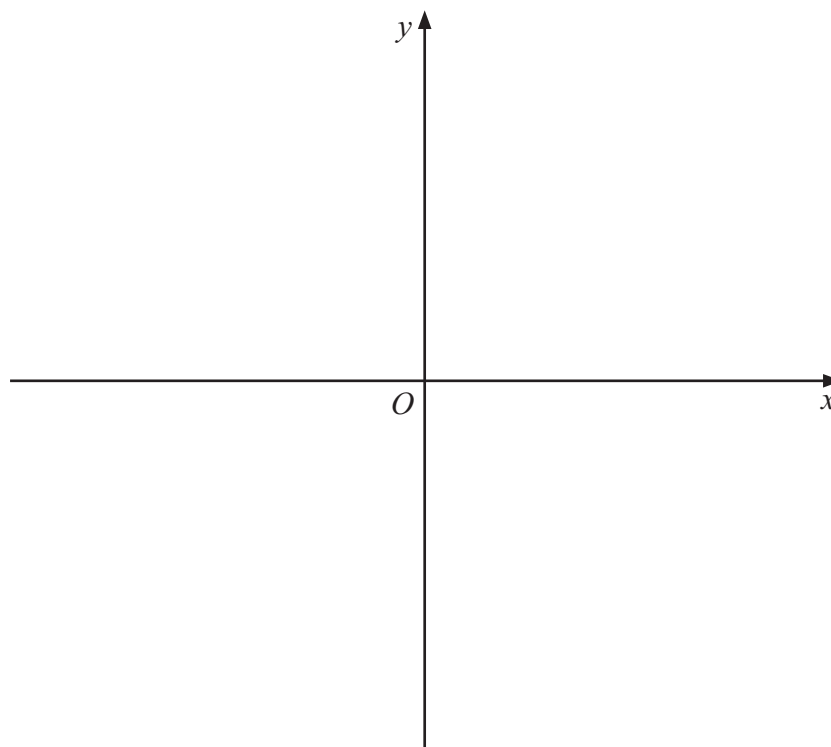
(i) $y = 8$ (ii) $y + x = 6$ (iii) $y = 3x - 4$

Show the coordinates of the points where each line crosses the coordinate axes.

(3)

- (b) Show, by shading, the region R which satisfies $y \geq 3x - 4$, $y + x \geq 6$, $x \geq 0$ and $y \leq 8$

(1)



(Total for Question 1 is 4 marks)



(4)

(Total for Question 2 is 4 marks)



$$f(x) = 3x^2 + 6x + 7$$

Given that $f(x)$ can be written in the form $A(x + B)^2 + C$, where A , B and C are rational numbers,

(a) find the value of A , the value of B and the value of C .

(3)

(b) Hence, or otherwise, find

(i) the value of x for which $\frac{1}{f(x)}$ is a maximum,

(ii) the maximum value of $\frac{1}{f(x)}$.

(2)



Question 3 continued

(Total for Question 3 is 5 marks)



4 (a) Show that $\sum_{r=1}^n (3r - 4) = \frac{n}{2}(3n - 5)$ (3)

(b) Hence, or otherwise, evaluate $\sum_{r=11}^{50} (3r - 4)$ (2)

Given that $\sum_{r=1}^n (3r - 4) = 186$

(c) find the value of n . (3)



(continued from page 10)



5 A particle P moves along the x -axis. At time t seconds ($t \geq 0$) the velocity, v m/s, of P is given by $v = 5 \cos 2t$. Find

(a) the least value of t for which P is instantaneously at rest,

(2)

(b) the magnitude of the maximum acceleration of P .

(3)

When $t = 0$, P is at the point $(2, 0)$.

(c) Find the distance of P from the origin when P first comes to instantaneous rest.

(4)

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Question 5 continued

(Total for Question 5 is 9 marks)



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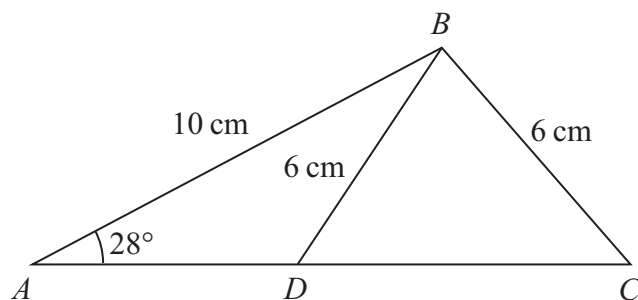


Diagram **NOT**
accurately drawn

Figure 1

Figure 1 shows triangle ABC with $AB = 10$ cm, $BC = 6$ cm and $\angle BAC = 28^\circ$. The point D lies on AC such that $BD = 6$ cm.

- (a) Find, to the nearest 0.1° , the size of $\angle DBC$. (4)
- (b) Find, to 3 significant figures, the length of AD . (3)
- (c) Find, to 3 significant figures, the area of triangle ABC . (3)



Question 6 continued

(Total for Question 6 is 10 marks)



- (2)

(2)

(2)

(2)

(2)

Question 7 continued



Question 7 continued



Question 7 continued

(Total for Question 7 is 10 marks)



8 Solve, for $0 \leq \theta \leq \pi$, giving each solution to 3 significant figures,

(a) $5 \sin \theta - 1 = 0$

(3)

$$(b) \tan\left(2\theta + \frac{\pi}{3}\right) = 0.4$$

(4)

(c) $4 \sin^2 \theta - 7 \cos \theta = 2$

(4)





Question 8 continued



Question 8 continued

(Total for Question 8 is 11 marks)



- (2)

- (3)

- (2)

(4)

Question 9 continued



Question 9 continued



Question 9 continued

(Total for Question 9 is 11 marks)



10

$$f(x) = 2x^2 - 5x + 1$$

The equation $f(x) = 0$ has roots α and β . Without solving the equation

(a) find the value of $\alpha^2 + \beta^2$ (3)

(b) show that $\alpha^4 + \beta^4 = \frac{433}{16}$ (2)

(c) form a quadratic equation with integer coefficients which has roots

$$\left(\alpha^2 + \frac{1}{\alpha^2}\right) \text{ and } \left(\beta^2 + \frac{1}{\beta^2}\right) \quad (7)$$



Question 10 continued



Question 10 continued



Question 10 continued

(Total for Question 10 is 12 marks)



11 $f(x) = x^3 + px^2 + qx + 6 \quad p, q \in \mathbb{Z}$

Given that $f(x) = (x - 1)(x - 3)(x + r)$

(a) find the value of r .

(1)

Hence, or otherwise,

(b) find the value of p and the value of q .

(3)

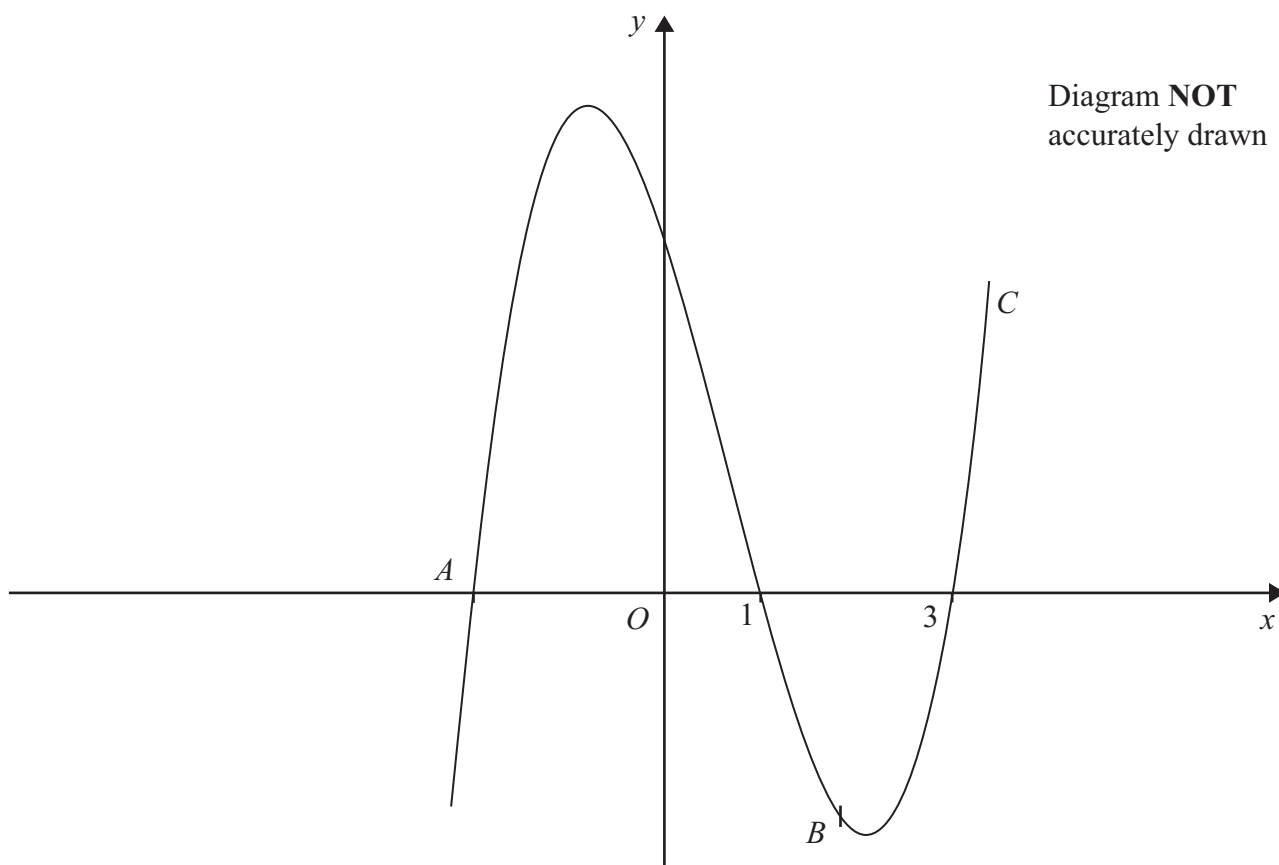


Figure 2

Figure 2 shows the curve C with equation $y = f(x)$ which crosses the x -axis at the points with coordinates $(3, 0)$ and $(1, 0)$ and at the point A . The point B on C has x -coordinate 2

(c) Find an equation of the tangent to C at B .

(5)

(d) Show that the tangent at B passes through A .

(2)

(e) Use calculus to find the area of the finite region bounded by C and the tangent at B .

(5)

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Question 11 continued



Question 11 continued



Question 11 continued



TOTAL FOR PAPER IS 100 MARKS