Write your name here

Surname	Other names

Edexcel
International GCSE

Centre Number | | | | | |

Candidate Number | | | | |

Further Pure Mathematics

Paper 1

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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P 4 2 0 3 8 A 0 1 3 2

PEARSON

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

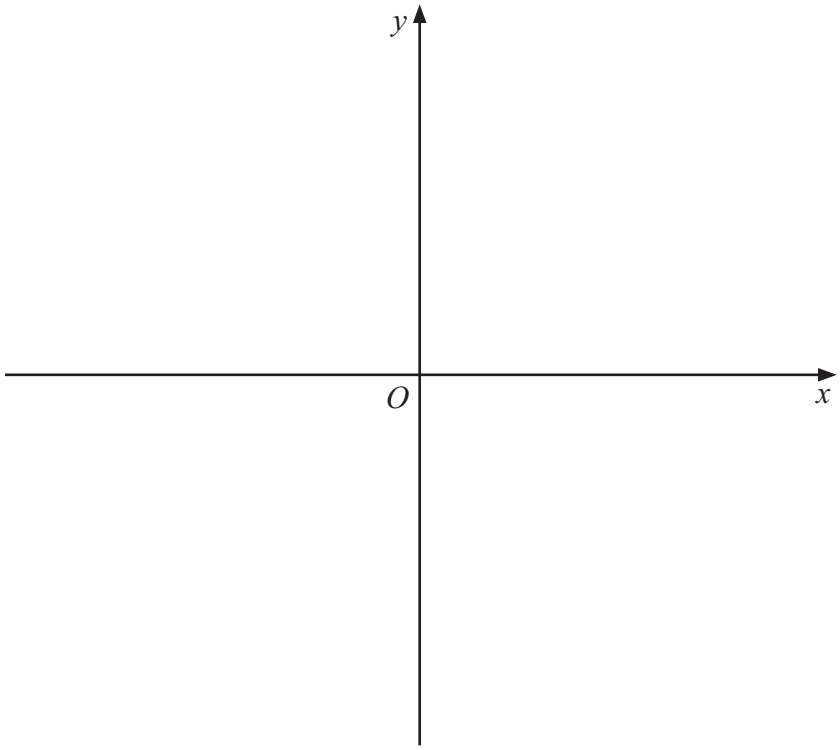
(i) $y = 8$ (ii) $y + x = 6$ (iii) $y = 3x - 4$

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

(3)

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

(1)



(Total for Question 1 is 4 marks)

2 The equation $x^2 + 4px + 9 = 0$ has unequal real roots. Find the set of possible values of p.

(4)

(Total for Question 2 is 4 marks)

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

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)

Question 4 continued

(Total for Question 4 is 8 marks)

5 A particle P moves along the x-axis. At time t seconds ($t \geqslant 0$) 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)

Question 5 continued

(Total for Question 5 is 9 marks)

6

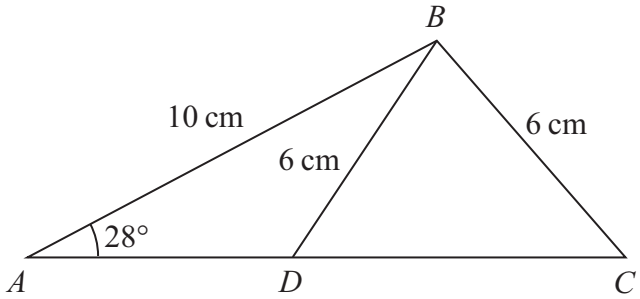


Diagram **NOT** accurately drawn

Figure 1

Figure 1 shows triangle ABC with $AB = 10$ cm, $BC = 6$ cm and $\angle BAC = 28°$. 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)

7 The point C with coordinates (2, 1) is the centre of a circle which passes through the point A with coordinates (3, 3).

(a) Find the radius of the circle.

(2)

The line AB is a diameter of the circle.

(b) Find the coordinates of B.

(2)

The points D with coordinates (0, 2) and E with coordinates (4, 0) lie on the circle.

(c) Show that DE is a diameter of the circle.

(2)

The point P has coordinates (x, y).

(d) Find an expression, in terms of x and y, for the length of CP.

(2)

Given that the point P lies on the circle,

(e) show that $x^2 + y^2 - 4x - 2y = 0$

(2)

Question 7 continued

Question 7 continued

Question 7 continued

(Total for Question 7 is 10 marks)

8 Solve, for $0 \leqslant \theta \leqslant \pi$, 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

Question 8 continued

(Total for Question 8 is 11 marks)

9 The sum S_n of the first n terms of an arithmetic series is given by $S_n = n(2n + 3)$. The first term of the series is a.

(a) Show that $a = 5$

(2)

(b) Find the common difference of the series.

(3)

(c) Find the 12th term of the series.

(2)

Given that $1 + S_{p+4} = 2S_p$

(d) find the value of p.

(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

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

(7)

Question 10 continued

Question 10 continued

Question 10 continued

(Total for Question 10 is 12 marks)

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

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)

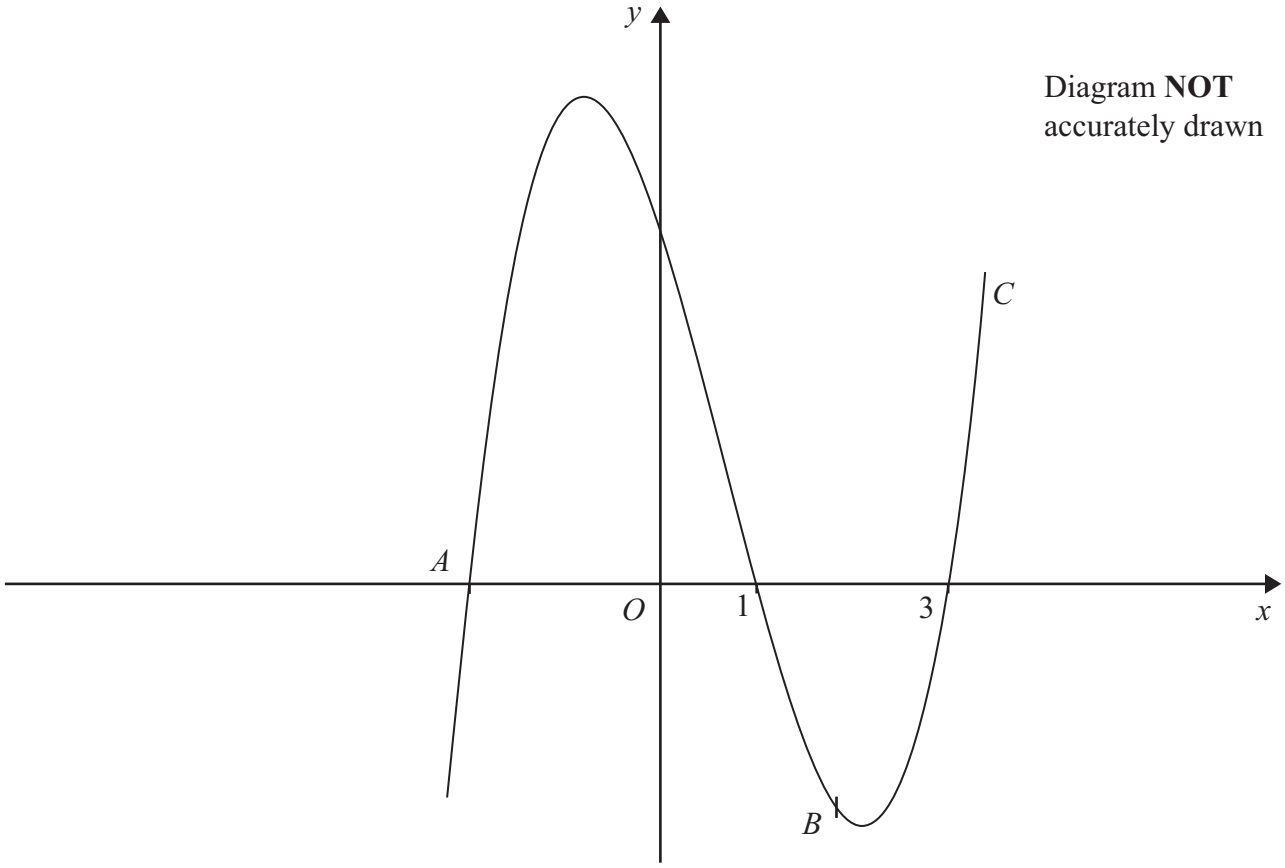


Diagram **NOT** accurately drawn

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)

Question 11 continued

Question 11 continued

Question 11 continued

Question 11 continued

(Total for Question 11 is 16 marks)

TOTAL FOR PAPER IS 100 MARKS