Write your name here

Surname	Other names

Edexcel
International GCSE

Centre Number | | | | | |

Candidate Number | | | | |

Further Pure Mathematics

Paper 1

Wednesday 22 May 2013 – Afternoon
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 6 6 A 0 1 2 8

PEARSON

Answer all ELEVEN questions.

Write your answers in the spaces provided.

You must write down all stages in your working.

1 A circle has centre O and radius 12 cm. The sector AOB of the circle has area 126 cm^2.
Find the length of the arc AB.

(4)

(Total for Question 1 is 4 marks)

2 Find the set of values of x for which

$$3(x + 1)^2 < 9 - x$$

(4)

(Total for Question 2 is 4 marks)

3

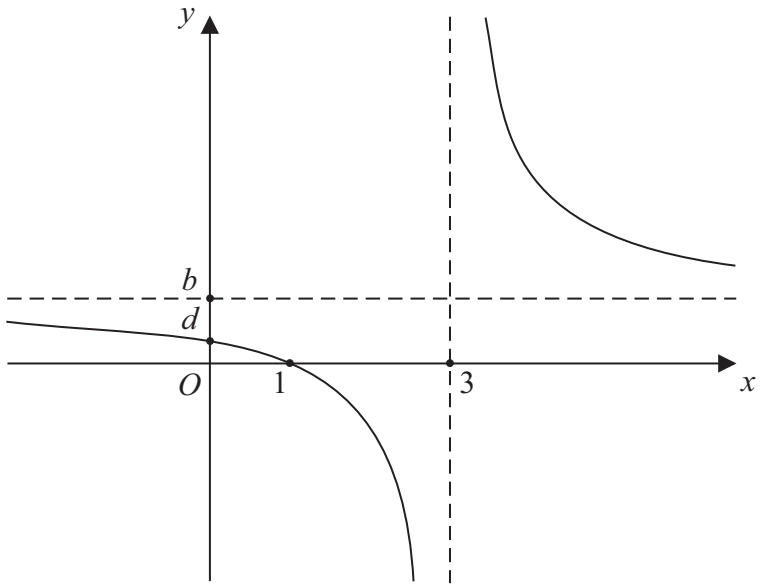

Figure 1

Figure 1 shows a sketch of the curve with equation $y = 1 + \frac{c}{x + a}$, where a and c are integers.

The equations of the asymptotes to the curve are $x = 3$ and $y = b$.

(a) Find the value of a and the value of b.

(2)

The curve crosses the x-axis at (1, 0) and the y-axis at (0, d).

(b) Find the value of c and the value of d.

(4)

Question 3 continued

(Total for Question 3 is 6 marks)

4 Solve, for $-90 < x \leqslant 90$, the equation

$$6\sin^2 x° - \cos x° - 4 = 0$$

(6)

(Total for Question 4 is 6 marks)

5 The volume of liquid in a container is V cm^3 when the depth of the liquid is h cm. Liquid is added to the container at a rate of 36 cm^3/s. Given that $V = 4h^3$, find the rate at which the depth of the liquid is increasing when $V = 500$

(7)

(Total for Question 5 is 7 marks)

6 The equation $x^2 + px + 1 = 0$ has roots α and β

(a) Find, in terms of p, an expression for

(i) $\alpha + \beta$

(ii) $\alpha^2 + \beta^2$

(iii) $\alpha^3 + \beta^3$

(6)

(b) Find a quadratic equation, with coefficients expressed in terms of p, which has roots α^3 and β^3

(2)

Question 6 continued

(Total for Question 6 is 8 marks)

7 An arithmetic series has first term a and common difference d. The nth term of the series is t_n and the sum of the first n terms of the series is S_n

(a) Write down an expression in terms of a and d for

(i) t_{58}

(ii) S_{13}

(2)

Given that $t_{58} = S_{13}$

(b) show that $d = -\frac{4}{7}a$

(2)

(c) show that $t_{176} = S_{21}$

(4)

(d) find the value of r when $t_r = 5t_9$

(3)

Question 7 continued

Question 7 continued

Question 7 continued

(Total for Question 7 is 11 marks)

8

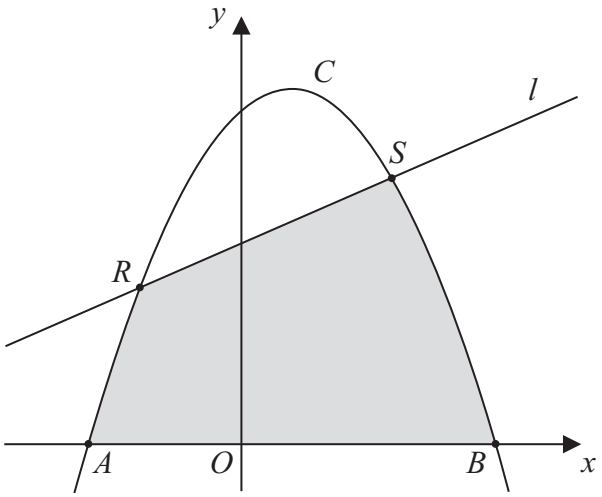

Figure 2

Figure 2 shows the curve C with equation $y = 15 + 2x - x^2$

The curve crosses the x-axis at the points A and B.

(a) Find the x-coordinate of A and the x-coordinate of B.

(3)

(b) Use calculus to find the area of the finite region bounded by C and the x-axis.

(4)

The line l with equation $y = x + 9$ intersects C at the points R and S.

(c) Find the x-coordinate of R and the x-coordinate of S.

(3)

(d) Use calculus to find the area of the region bounded by C, the line l and the x-axis, shown shaded in Figure 2.

(4)

Question 8 continued

Question 8 continued

Question 8 continued

(Total for Question 8 is 14 marks)

9

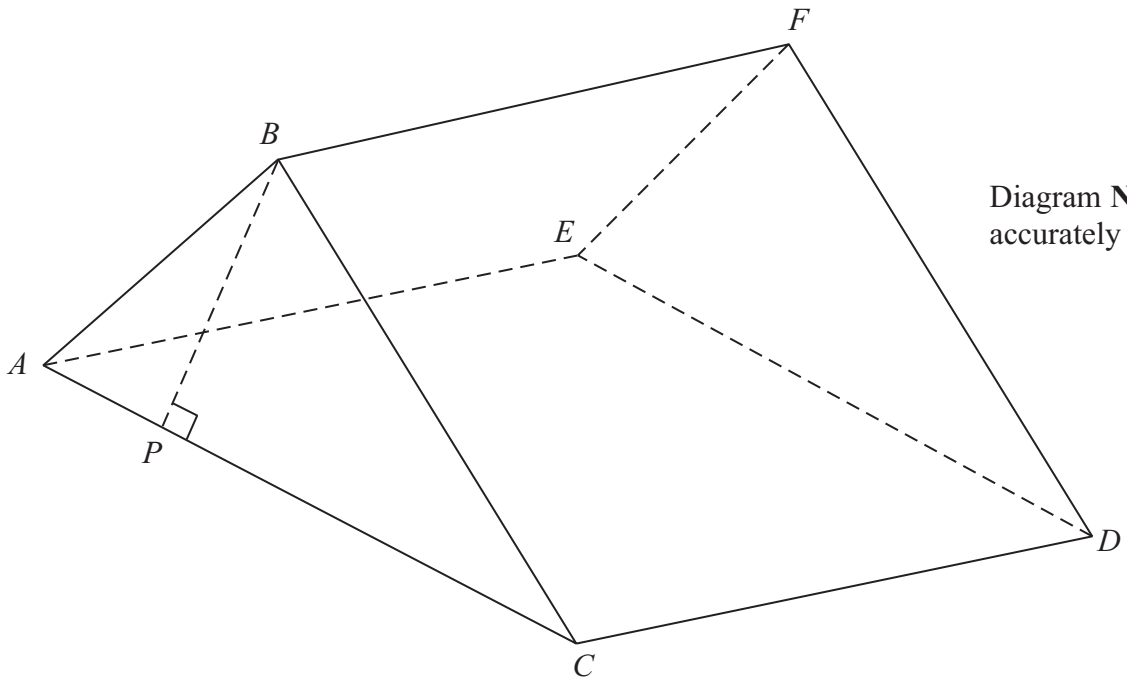

Diagram **NOT** accurately drawn

Figure 3

Figure 3 shows a triangular prism *ABCDEF*.

ACDE is a rectangle. In triangle *ABC*, $AC = 12$ cm, $\angle BAC = 60°$ and $\angle BCA = 30°$

(a) Find the exact length of *BC*.

(3)

The point *P* lies on the line *AC* and $\angle BPC = 90°$

(b) Show that $BP = 3\sqrt{3}$ cm.

(2)

The angle between the plane *AFC* and the plane *ACDE* is 25°

(c) Find, to 3 significant figures, the length of *BF*.

(3)

(d) Find the size of the angle between the line *BD* and the plane *ACDE*, giving your answer in degrees to 1 decimal place.

(4)

(e) Find, to 3 significant figures, the volume of the prism *ABCDEF*.

(2)

Question 9 continued

Question 9 continued

Question 9 continued

(Total for Question 9 is 14 marks)

10 The curve C has equation $y = x^4 - 4x^3 - 2x^2 + 13x + 5$ and the line l_1 is the tangent to C at the point $R(1, 13)$.

(a) Find an equation for l_1

(4)

The points P and Q lie on C. The x-coordinates of P and Q are p and q respectively, where $p < q$. The tangent to C at P is parallel to l_1 and the tangent to C at Q is parallel to l_1

(b) Find the coordinates of P and the coordinates of Q.

(4)

The line l_2 passes through P and Q.

(c) Find an equation for l_2

(2)

(d) Show that l_2 is a tangent to C at P and a tangent to C at Q.

(1)

The normal to C at $R(1, 13)$ intersects l_2 at the point S.

(e) Find the exact length of RS.

(5)

(f) Find the area of the triangle PQR.

(2)

Question 10 continued

Question 10 continued

Question 10 continued

(Total for Question 10 is 18 marks)

11 O, A, B and C are fixed points such that

$$\overrightarrow{OA} = \mathbf{p} + \mathbf{q} \quad \overrightarrow{OB} = 3\mathbf{p} - \mathbf{q} \quad \overrightarrow{OC} = 6\mathbf{p} - 4\mathbf{q}$$

(a) Find $\overrightarrow{AB}$ in terms of **p** and **q**.

(1)

(b) Show that the points A, B and C are collinear.

(2)

(c) Find the ratio $AB : BC$

(1)

The point D lies on AC produced such that $AC = 2CD$

(d) Find $\overrightarrow{OD}$ in terms of **p** and **q**, simplifying your answer.

(4)

Question 11 continued

Question 11 continued

(Total for Question 11 is 8 marks)

TOTAL FOR PAPER IS 100 MARKS