Write your name here

Surname	Other names

Pearson Edexcel
International GCSE

Centre Number | | | | | |

Candidate Number | | | | |

Further Pure Mathematics

Paper 2

Friday 23 May 2014 – Afternoon
Time: 2 hours

Paper Reference
4PM0/02

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 3 0 2 5 A 0 1 3 2

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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

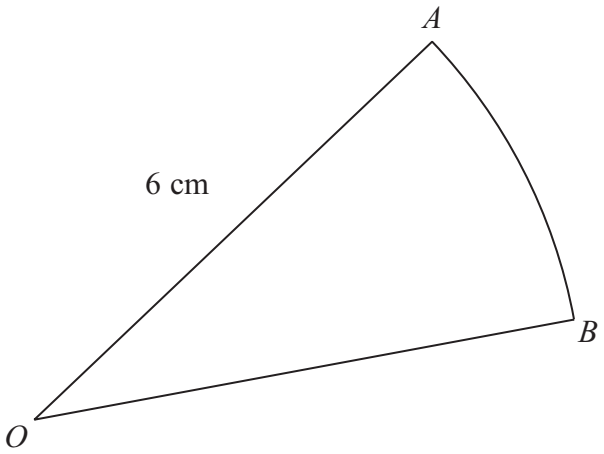

Diagram **NOT** accurately drawn

Figure 1

Figure 1 shows the sector OAB of a circle. The circle has centre O and radius 6 cm. The area of the sector is 12 cm^2.

(a) Find, in radians, the size of angle AOB.

(2)

(b) Find, in cm, the length of the arc AB.

(2)

Question 1 continued

(Total for Question 1 is 4 marks)

2 Evaluate $\sum_{r=5}^{60}(2r + 7)$

(4)

(Total for Question 2 is 4 marks)

3 Relative to a fixed origin O, the point A has position vector $3\mathbf{i} - 4\mathbf{j}$

The point B is such that $\overrightarrow{AB} = \mathbf{i} + 7\mathbf{j}$

(a) Show that the triangle OAB is isosceles.

(4)

(b) Find a unit vector parallel to $\overrightarrow{OB}$.

(1)

(Total for Question 3 is 5 marks)

4 (a) Find the coordinates of the points where the line with equation $y = 4x - 4$ meets the curve with equation $y = x^2 - 3x + 6$

(5)

(b) Hence, or otherwise, find the set of values of x for which $x^2 - 3x + 6 \geqslant 4x - 4$

(2)

Question 4 continued

(Total for Question 4 is 7 marks)

5 Solve the equation

(a) $\log_x 243 = 5$

(2)

(b) $\log_6 (2y + 4) = 2$

(2)

(c) $\log_4 p + \log_p 64 = 4$

(5)

Question 5 continued

(Total for Question 5 is 9 marks)

6 The sum to infinity of a convergent geometric series with common ratio r is S.

Given that $S = 200$ and that the sum of the first 3 terms is 175

(a) find the value of r,

(4)

(b) find the first term of the series.

(1)

The sum of the first n terms of the series is S_n

Given also that $\frac{S_n}{S} = \frac{255}{256}$

(c) find the value of n.

(4)

Question 6 continued

Question 6 continued

Question 6 continued

(Total for Question 6 is 9 marks)

7

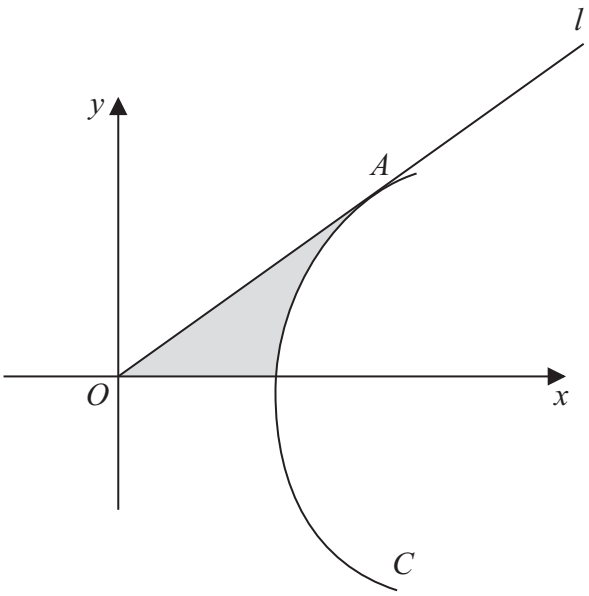

Diagram **NOT** accurately drawn

Figure 2

Figure 2 shows the curve C with equation $y^2 = 8(x - 2)$ and the line l with equation $y = x$

The line l is the tangent to C at the point A.

(a) Find the coordinates of A.

(4)

The region shown shaded in Figure 2 is rotated through 360° about the x-axis.

(b) Use algebraic integration to find the volume of the solid formed.

Give your answer in terms of π.

(5)

Question 7 continued

Question 7 continued

Question 7 continued

(Total for Question 7 is 9 marks)

8 A curve has equation $y = \dfrac{3x - 2}{4x + 5}, \quad x \neq -\dfrac{5}{4}$

(a) Write down an equation of the asymptote to the curve which is parallel to

(i) the x-axis, (ii) the y-axis.

(2)

(b) Find the coordinates of the point where the curve crosses

(i) the x-axis, (ii) the y-axis.

(2)

(c) Sketch the curve, showing clearly the asymptotes and the coordinates of the points where the curve crosses the coordinate axes.

(3)

(d) Find an equation of the normal to the curve at the point where $x = -1$

Give your answer in the form $ax + by + c = 0$ where a, b and c are integers.

(7)

Question 8 continued

Question 8 continued

Question 8 continued

(Total for Question 8 is 14 marks)

9 $f(x) = x^3 + 5x^2 + px - q \qquad p, q \in \mathbb{Z}$

Given that $(x + 2)$ and $(x - 1)$ are factors of $f(x)$,

(a) form a pair of simultaneous equations in p and q,

(2)

(b) show that $p = 2$ and find the value of q,

(3)

(c) factorise $f(x)$ completely.

(1)

(d) Sketch the curve with equation $y = f(x)$ showing the coordinates of the points where the curve crosses the x-axis.

(2)

The curve with equation $y = x^3 + 2x^2 + 4x$ meets the curve with equation $y = f(x)$ at two points A and B. The x-coordinate of A is $-\frac{4}{3}$ and the x-coordinate of B is 2

(e) Use algebraic integration to find, to 3 significant figures, the area of the finite region bounded by the two curves.

(5)

Question 9 continued

Question 9 continued

Question 9 continued

(Total for Question 9 is 13 marks)

10 Using the identities $\cos(A + B) = \cos A \cos B - \sin A \sin B$

$\sin(A + B) = \sin A \cos B + \cos A \sin B$

(a) (i) show that $\cos 2A = 1 - 2\sin^2 A$

(ii) write down an expression for $\sin 2A$ in terms of $\sin A$ and $\cos A$

(4)

(b) Hence show that $\sin 3A = 3\sin A - 4\sin^3 A$

(4)

(c) Solve, for $0 \leqslant x \leqslant \pi$, the equation $16\sin^3 x - 12\sin x + 1 = 0$

Give your answers correct to 3 significant figures.

(4)

(d) Find $\int(24\sin^3\theta + 6\cos\theta)\,d\theta$

(2)

(e) Hence evaluate $\int_0^{\frac{\pi}{3}}(24\sin^3\theta + 6\cos\theta)\,d\theta$, giving your answer in the form $a + b\sqrt{c}$, where a, b and c are integers.

(2)

Question 10 continued

Question 10 continued

Question 10 continued

(Total for Question 10 is 16 marks)

11 In triangle ABC, $\angle BAC = 60°$, $AB = (3x - 1)$ cm, $AC = (3x + 1)$ cm and $BC = 2\sqrt{7x}$ cm.

(a) Show that $(9x - 1)(x - 3) = 0$

(3)

(b) Hence find the value of x, justifying your answer.

(2)

(c) Find, to the nearest 0.1°, the size of angle ABC.

(3)

(d) Find the exact value, in cm^2, of the area of triangle ABC.

(2)

Question 11 continued

Question 11 continued

(Total for Question 11 is 10 marks)

TOTAL FOR PAPER IS 100 MARKS