Write your name here

Surname	Other names

Pearson Edexcel International GCSE

Centre Number	Candidate Number

Further Pure Mathematics

Paper 1

Monday 8 June 2015 – 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 TEN questions

Write your answers in the spaces provided

You must write down all the stages in your working

1 The region enclosed by the curve with equation $y = 4x^2 - 9$, the positive x-axis and the negative y-axis is rotated through 360° about the x-axis.

Use algebraic integration to find, to 3 significant figures, the volume of the solid generated.

(5)

Question 1 continued

(Total for Question 1 is 5 marks)

2 Given that $y = 4x^2e^{2x}$

(a) find $\dfrac{dy}{dx}$

(3)

(b) hence show that $x\dfrac{dy}{dx} = 2y(1 + x)$

(2)

Question 2 continued

(Total for Question 2 is 5 marks)

3 $$f(x) = 4x^2 - 8x + 7$$

Given that $f(x) = l(x - m)^2 + n$, for all values of x,

(a) find the value of l, the value of m and the value of n.

(3)

(b) Hence, or otherwise, find

(i) the minimum value of $f(x)$,

(ii) the value of x for which this minimum occurs.

(2)

Question 3 continued

(Total for Question 3 is 5 marks)

4 The sum S_n of the first n terms of an arithmetic series is given by $S_n = 2n(10 - n)$

(a) Write down the first term of the series.

(1)

(b) Find the common difference of the series.

(2)

Given that $S_n > -50$

(c) (i) write down an inequality satisfied by n,

(ii) hence find the largest value of n for which $S_n > -50$

(4)

Question 4 continued

(Total for Question 4 is 7 marks)

5 (a) Show that $(\alpha + \beta)(\alpha^2 - \alpha\beta + \beta^2) = \alpha^3 + \beta^3$

(1)

The roots of the equation $2x^2 + 6x - 7 = 0$ are α and β where $\alpha > \beta$

Without solving the equation,

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

(4)

(c) show that $\alpha - \beta = \sqrt{23}$

(2)

(d) Hence find the exact value of $\alpha^3 - \beta^3$

(2)

Question 5 continued

Question 5 continued

Question 5 continued

(Total for Question 5 is 9 marks)

Turn over

6

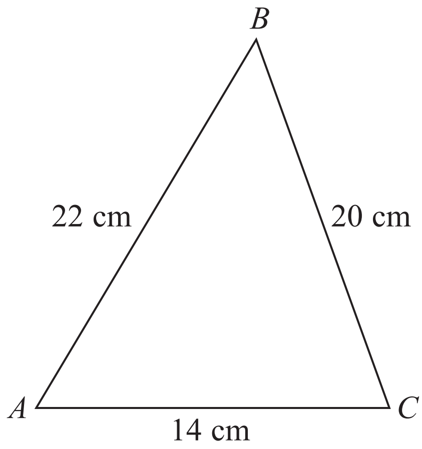


Diagram **NOT** accurately drawn

Figure 1

Figure 1 shows ΔABC with $AB = 22$ cm, $AC = 14$ cm and $BC = 20$ cm.

(a) Find, to 3 decimal places, the size of each of the three angles of ΔABC.

(5)

The bisector of angle BAC meets BC at P.

(b) Find, in cm to 3 significant figures, the length of AP.

(3)

(c) Find, to the nearest cm^2, the area of ΔABC.

(2)

Question 6 continued

Question 6 continued

Question 6 continued

(Total for Question 6 is 10 marks)

7 (a) Expand $\left(1+\frac{x}{3}\right)^{\frac{1}{4}}$ in ascending powers of x up to and including the term in x^3, giving each coefficient as an exact fraction.

(3)

(b) Expand $\left(1-\frac{x}{3}\right)^{-\frac{1}{4}}$ in ascending powers of x up to and including the term in x^3, giving each coefficient as an exact fraction.

(3)

(c) Write down the range of values of x for which both of your expansions are valid.

(1)

(d) Expand $\left(\frac{3+x}{3-x}\right)^{\frac{1}{4}}$ in ascending powers of x up to and including the term in x^2, giving each coefficient as an exact fraction.

(3)

(e) Hence obtain an estimate, to 3 significant figures, of $\int_0^{0.6}\left(\frac{3+x}{3-x}\right)^{\frac{1}{4}}\,dx$

(4)

Question 7 continued

Question 7 continued

Question 7 continued

(Total for Question 7 is 14 marks)

8 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 $\cos 2A = 1 - 2\sin^2 A$

(3)

(ii) express $\sin 2A$ in terms of $\sin A$ and $\cos A$, simplifying your answer.

(1)

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

(4)

(c) Solve, for $-90° \leqslant A \leqslant 90°$, the equation

$$8\sin^3 A - 6\sin A = 1$$

(4)

(d) (i) Find $\int \sin^3\theta \, d\theta$

(ii) Evaluate $\int_0^{\frac{\pi}{4}} \sin^3\theta \, d\theta$, giving your answer in the form $\dfrac{a - b\sqrt{2}}{c}$, where a, b, and c are integers.

(5)

Question 8 continued

Question 8 continued

Question 8 continued

(Total for Question 8 is 17 marks)

9 A curve C has equation $y = \dfrac{3x+1}{2x+3} \qquad x \neq -\dfrac{3}{2}$

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

(i) the x-axis,

(ii) the y-axis.

(2)

(b) Find the coordinates of the points where C crosses

(i) the x-axis,

(ii) the y-axis.

(2)

(c) Using the axes opposite, sketch the curve C, showing clearly the asymptotes and the coordinates of the points where C crosses the axes.

(3)

The curve C intersects the x-axis at the point A.

The line l is the normal to C at A.

(d) Find an equation for l.

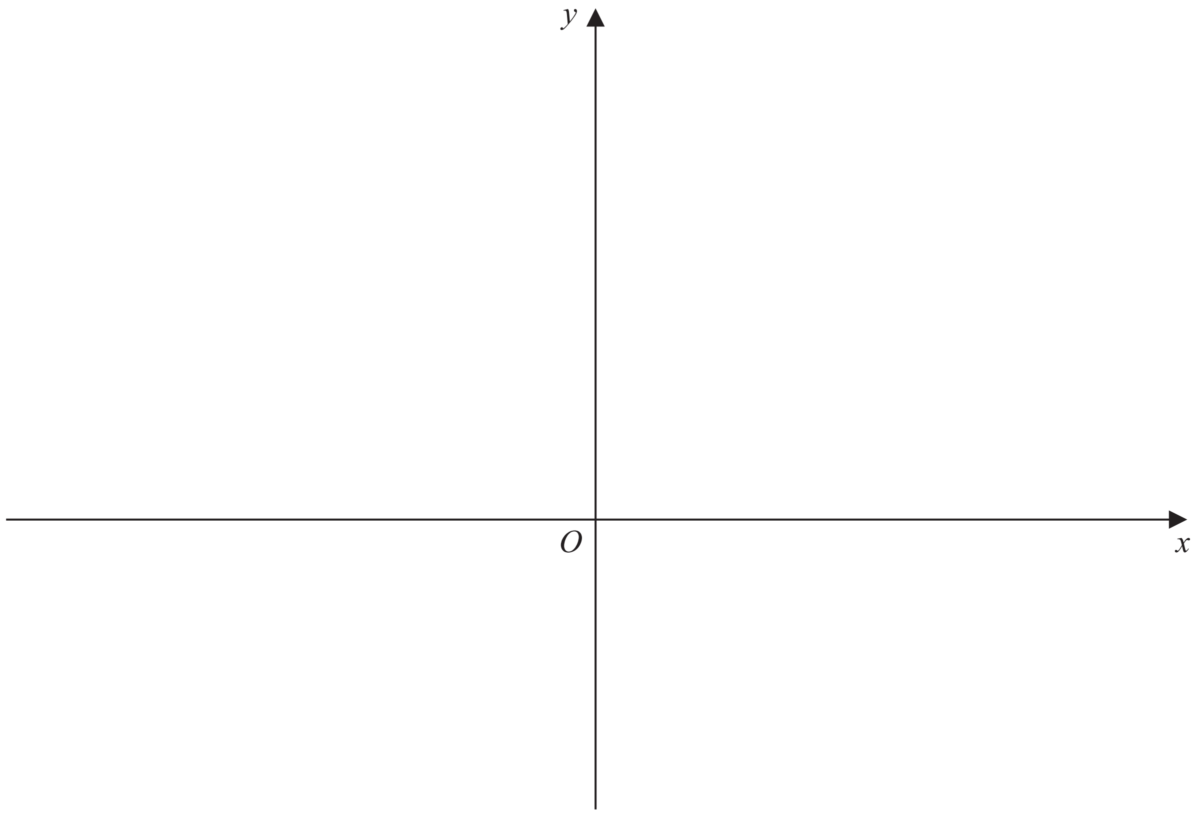
(5)

The line l meets C again at the point B.

(e) Find the x-coordinate of B.

(5)

Question 9 continued



Question 9 continued

Question 9 continued

(Total for Question 9 is 17 marks)

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10 A solid right circular cylinder has base radius r cm and height h cm. The volume of the cylinder is 50 cm^3 and the total surface area is A cm^2.

(a) Show that $A = 2\pi r^2 + \dfrac{100}{r}$ **(3)**

(b) Use calculus to find, to 4 significant figures, the value of r for which A is a minimum. **(3)**

(c) Use calculus to verify that the value of r found in part (b) does give a minimum value of A. **(3)**

(d) Find, to the nearest whole number, the minimum value of A. **(2)**

Question 10 continued

Turn over

Question 10 continued

(Total for Question 10 is 11 marks)

TOTAL FOR PAPER IS 100 MARKS