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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P 4 4 4 0 6 A 0 1 3 2

PEARSON

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 $\frac{dy}{dx}$

(3)

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

(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)

6

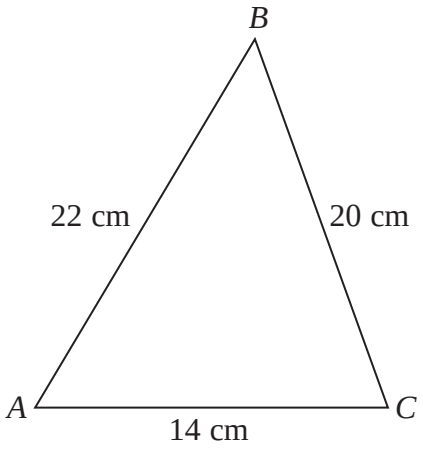


Diagram **NOT** accurately drawn

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 $\int_0^{0.6}\left(\frac{3+x}{3-x}\right)^{\frac{1}{4}}\mathrm{d}x$

(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 $\frac{a - b\sqrt{2}}{c}$, 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.

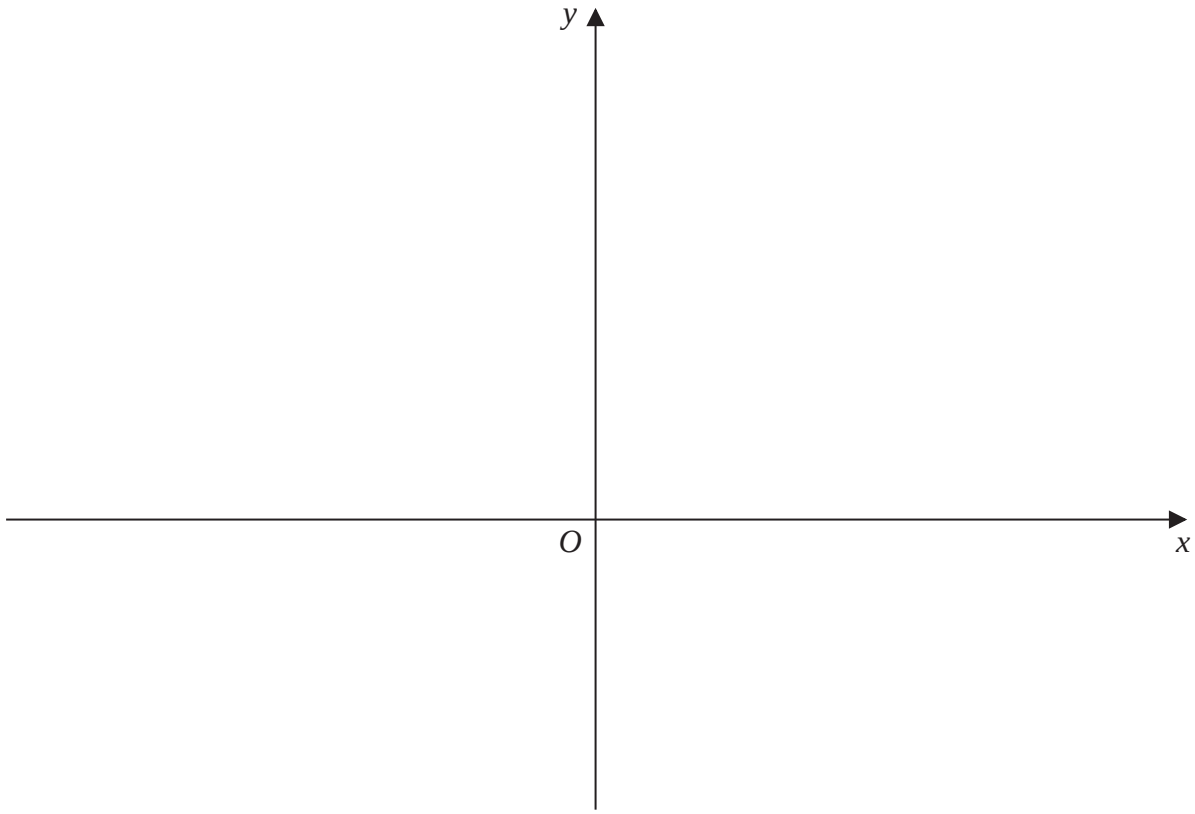
(5)

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)

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

Question 10 continued

(Total for Question 10 is 11 marks)

TOTAL FOR PAPER IS 100 MARKS