

Write your name here

Surname

Other names

**Pearson Edexcel**  
**International GCSE**

Centre Number

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Candidate Number

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# 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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**PEARSON**





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)

A series of horizontal dotted lines for writing the solution to the problem.









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)

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**Question 4 continued**

Dotted lines for writing.

**(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  $\alpha$  and  $\beta$  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)

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**Question 5 continued**

Handwriting practice area consisting of 25 horizontal dotted lines.



**Question 5 continued**

A series of horizontal dotted lines for writing.





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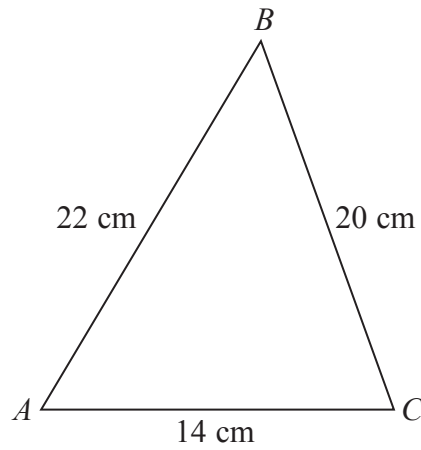


Diagram **NOT** accurately drawn

**Figure 1**

Figure 1 shows  $\triangle ABC$  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  $\triangle ABC$ . (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  $\text{cm}^2$ , the area of  $\triangle ABC$ . (2)

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**Question 6 continued**

Handwriting practice area consisting of 25 horizontal dotted lines.



**Question 6 continued**

A series of horizontal dotted lines for writing.





**Question 6 continued**

Handwriting practice area consisting of multiple horizontal dotted lines for writing.

**(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)

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**Question 7 continued**

Handwriting practice area with 25 horizontal dotted lines.



**Question 7 continued**

A large rectangular area with rounded corners, containing 25 horizontal dotted lines for writing.



**Question 7 continued**

Area with horizontal dotted lines for writing.

**(Total for Question 7 is 14 marks)**



P 4 4 4 0 6 A 0 2 1 3 2

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  $-90^\circ \leq A \leq 90^\circ$ , 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)

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**Question 8 continued**

A series of horizontal dotted lines for writing.



**Question 8 continued**

A series of horizontal dotted lines for writing.





**Question 8 continued**

A series of horizontal dotted lines for writing the answer to Question 8.

**(Total for Question 8 is 17 marks)**



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

(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)

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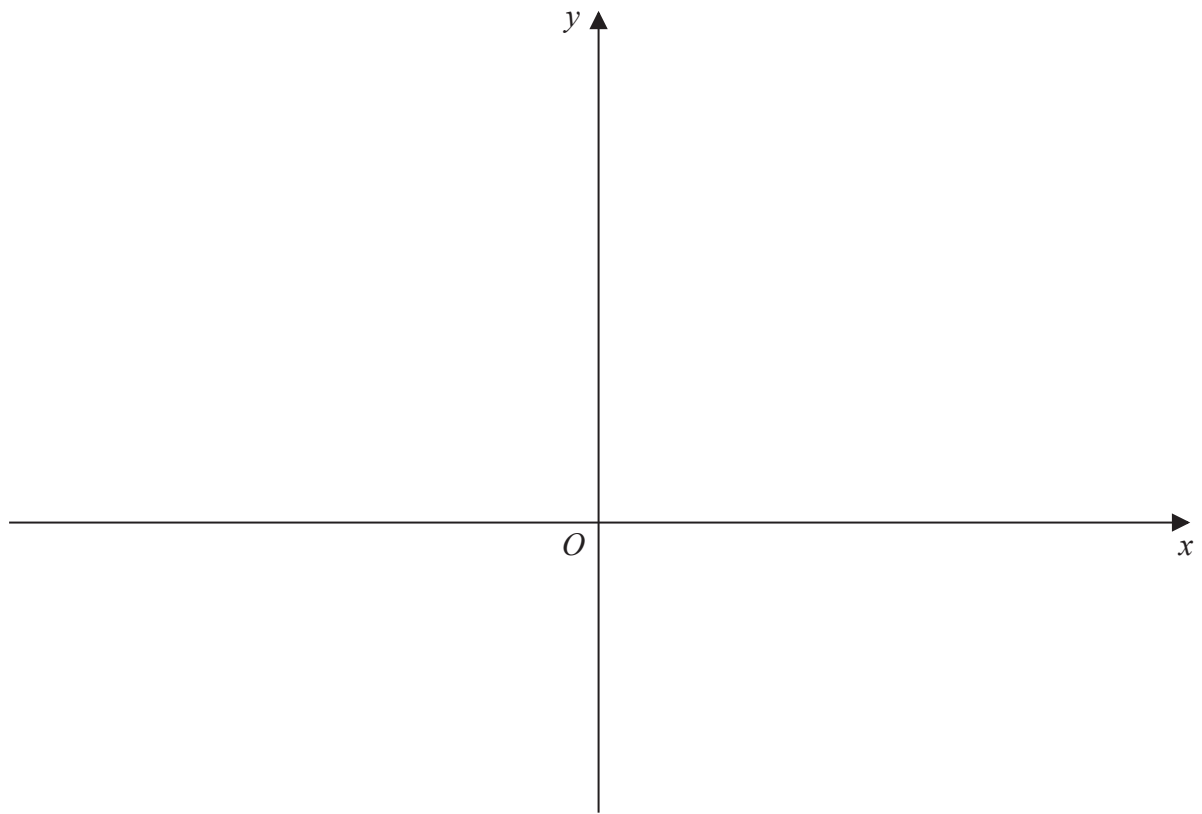
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Question 9 continued



A series of horizontal dotted lines for writing, consisting of 15 lines spaced evenly down the page.



**Question 9 continued**

Handwriting practice area with 25 horizontal dotted lines.



**Question 9 continued**

*(The page contains 25 horizontal dotted lines for writing.)*

**(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  $50\text{ cm}^3$  and the total surface area is  $A\text{ cm}^2$ .

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

A series of horizontal dotted lines for writing answers.



**Question 10 continued**

Handwriting practice area with 25 horizontal dotted lines.



**Question 10 continued**

Handwriting practice area consisting of 25 horizontal dotted lines.

**(Total for Question 10 is 11 marks)**

**TOTAL FOR PAPER IS 100 MARKS**

