Write your name here Surname	Other nar	nes
Pearson Edexcel GCE	Centre Number	Candidate Number
<b>Core Mat</b>	thomatic	CA
Advanced	liieiiiatic	<b>5 C 4</b>
	lorning	Paper Reference 6666/01

Candidates may use any calculator allowed by the regulations of the Joint Council for Qualifications. Calculators must not have the facility for symbolic algebra manipulation, differentiation and integration, or have retrievable mathematical formulae stored in them.

## Instructions

- Use **black** ink or ball-point pen.
- If pencil is used for diagrams/sketches/graphs it must be dark (HB or B). Coloured pencils and highlighter pens must not be used.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer all questions and ensure that your answers to parts of questions are clearly labelled.
- Answer the questions in the spaces provided
   there may be more space than you need.
- You should show sufficient working to make your methods clear. Answers without working may not gain full credit.
- When a calculator is used, the answer should be given to an appropriate degree of accuracy.

## Information

- The total mark for this paper is 75.
- The marks for each question are shown in brackets
   use this as a quide as to how much time to spend on each question.

## Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

P 5 1 5 6 6 A 0 1 3 2

Turn over ▶



1. (a) Find the binomial series expansion of

$$\sqrt{4-9x}, \ |x|<\frac{4}{9}$$

in ascending powers of x, up to and including the term in  $x^2$  Give each coefficient in its simplest form.

**(5)** 

(b) Use the expansion from part (a), with a suitable value of x, to find an approximate value for  $\sqrt{310}$ 

Show all your working and give your answer to 3 decimal places.

(3)
· /






Question 1 continued	blank
	Q1
(Total 8 marks)	



**2.** The curve *C* has equation

$$x^2 + xy + y^2 - 4x - 5y + 1 = 0$$

- (a) Use implicit differentiation to find  $\frac{dy}{dx}$  in terms of x and y. (5)
- (b) Find the x coordinates of the two points on C where  $\frac{dy}{dx} = 0$

Give exact answers in their simplest form.

(Solutions based entirely on graphical or numerical methods are not acceptable.)

(:

	Leave
	blank
Question 2 continued	



Operation 2 continued	blank
Question 2 continued	
	_
	_
	_
	_
	_
	_
	_
	_
	_
	_
	_
	_
	_
	_
	_
	_
	_
	_
	_
	_
	_
	_
	_
	_
	_
	_
	— Q2
(Total 10 mark	<u>s)</u>



**3.** (i) Given that

$$\frac{13-4x}{(2x+1)^2(x+3)} \equiv \frac{A}{(2x+1)} + \frac{B}{(2x+1)^2} + \frac{C}{(x+3)}$$

(a) find the values of the constants A, B and C.

**(4)** 

(b) Hence find

$$\int \frac{13 - 4x}{(2x+1)^2(x+3)} \, \mathrm{d}x, \quad x > -\frac{1}{2}$$

**(3)** 

(ii) Find

$$\int (e^x + 1)^3 dx$$

(3)

(iii) Using the substitution  $u^3 = x$ , or otherwise, find

$$\int \frac{1}{4x + 5x^{\frac{1}{3}}} \, \mathrm{d}x, \quad x > 0$$

**(4)** 



8

	Leave
	blank
Question 3 continued	
<b>4</b>	



nestion 3 continued	

Question 3 continued	blank	
	Q3	
(Total 14 marks)		
(10tm 14 marks)		J



DO NOT WRITE IN THIS AREA

4.

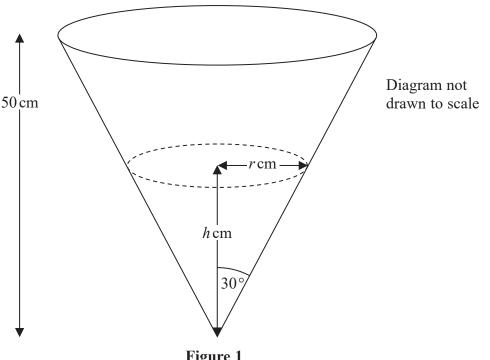


Figure 1

A water container is made in the shape of a hollow inverted right circular cone with semi-vertical angle of 30°, as shown in Figure 1. The height of the container is 50 cm.

When the depth of the water in the container is  $h \, \text{cm}$ , the surface of the water has radius r cm and the volume of water is V cm<sup>3</sup>.

(a) Show that  $V = \frac{1}{9}\pi h^3$ 

[You may assume the formula 
$$V = \frac{1}{3}\pi r^2 h$$
 for the volume of a cone.]

Given that the volume of water in the container increases at a constant rate of 200 cm<sup>3</sup> s<sup>-1</sup>,

(b) find the rate of change of the depth of the water, in cm  $s^{-1}$ , when h = 15Give your answer in its simplest form in terms of  $\pi$ .

**(4)** 

DO NOT WRITE IN THIS AREA

	Leave
	blank
	Oldlik
Question 4 continued	



estion 4 continued	

	Leave
	blank
Question 4 continued	
	Q4
(Total 6 marks)	
· · · · · · · · · · · · · · · · · · ·	



5.

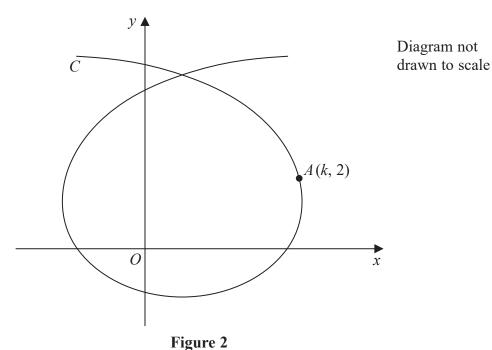


Figure 2 shows a sketch of the curve C with parametric equations

$$x = 1 + t - 5\sin t$$
,  $y = 2 - 4\cos t$ ,  $-\pi \leqslant t \leqslant \pi$ 

The point A lies on the curve C.

Given that the coordinates of A are (k, 2), where k > 0

(a) find the exact value of k, giving your answer in a fully simplified form.

**(2)** 

(b) Find the equation of the tangent to C at the point A. Give your answer in the form y = px + q, where p and q are exact real values.

**(5)** 

Question 5 continued	Leave blank	



estion 5 continued	

	blank
Question 5 continued	
	Q5
(Total 7 marks)	



**6.** Given that y = 2 when  $x = -\frac{\pi}{8}$ , solve the differential equation

$$\frac{\mathrm{d}y}{\mathrm{d}x} = \frac{y^2}{3\cos^2 2x} \qquad -\frac{1}{2} < x < \frac{1}{2}$$

giving your answer in the form y = f(x).

-		1
(	0	)

	Leave	
	blank	
Question 6 continued		



estion 6 continued	

	blank
Question 6 continued	
	_
	_
	_
	_
	_
	_
	_
	_
	_
	_
	_
	_
	_
	_
	_
	_
	_
	_
	_
	_
	_
	_
	_
	_
	_
	_
	_
	-
	_
	Q6
	a)
(Total 6 mark	<u>s)</u>



7. The point A with coordinates (-3, 7, 2) lies on a line  $l_1$ . The point B also lies on the line  $l_1$ .

Given that  $\overrightarrow{AB} = \begin{pmatrix} 4 \\ -6 \\ 2 \end{pmatrix}$ ,

(a) find the coordinates of point B.

(2)

The point P has coordinates (9, 1, 8)

(b) Find the cosine of the angle PAB, giving your answer as a simplified surd.

(3)

(c) Find the exact area of triangle PAB, giving your answer in its simplest form.

**(3)** 

The line  $l_2$  passes through the point P and is parallel to the line  $l_1$ 

(d) Find a vector equation for the line  $l_2$ 

**(2)** 

The point Q lies on the line  $l_2$ 

Given that the line segment AP is perpendicular to the line segment BQ,

(e) find the coordinates of the point Q.

**(5)** 



Question 7 continued	L b



	Leav blan
Question 7 continued	

Question 7 continued	blank
Question / continued	
	Q7
(Total 15 marks)	
·	



DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

8.

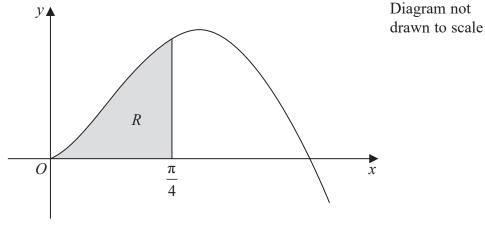


Figure 3

(a) Find 
$$\int x \cos 4x \, dx$$

(3)

Figure 3 shows part of the curve with equation  $y = \sqrt{x} \sin 2x$ ,  $x \ge 0$ 

The finite region R, shown shaded in Figure 3, is bounded by the curve, the x-axis and the line with equation  $x = \frac{\pi}{4}$ 

The region R is rotated through  $2\pi$  radians about the x-axis to form a solid of revolution.

(b) Find the exact value of the volume of this solid of revolution, giving your answer in its simplest form.

(Solutions based entirely on graphical or numerical methods are not acceptable.)

(6)

	Leave
	blank
Question 8 continued	
4.001.00 0.001.000	
	]



	Leav blank
Question 8 continued	Ulaili

	1	blank
	[	oiank
Question 8 continued		



DO NOT WRITE IN THIS AREA