Please check the examination det	tails below before ente	ering your candidate i	nformation
Candidate surname		Other names	
Pearson Edexcel GCE	Centre Number	Cand	idate Number
Thursday 20	June 20	019	
Morning (Time: 1 hour 30 minut	es) Paper R	eference 6666	/01
Core Mathema Advanced	tics C4		
You must have: Mathematical Formulae and Sta	atistical Tables (Pi	nk)	Total Marks

Candidates may use any calculator allowed by Pearson regulations. 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.

Turn over ▶







1. The binomial series expansion of

$$(1+ax)^{\frac{2}{3}} \qquad |ax| < 1$$

up to and including the term in x^2 is

$$1+\frac{1}{2}x+kx^2$$

where a and k are constants.

(a) Find the value of a.

(2)

(b) Find the value of k, giving your answer in its simplest form.

(2)

(c) Hence find the numerical coefficient of x^2 in the series expansion of

$$(4 - 9x)(1 + ax)^{\frac{2}{3}} |ax| < 1 (2)$$

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(Total 6 marks)	



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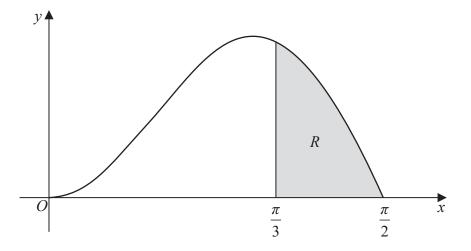


Figure 1

Figure 1 shows a sketch of the curve with equation

$$y = \sin 2x \sin x \qquad 0 \leqslant x \leqslant \frac{\pi}{2}$$

The finite region R, shown shaded in Figure 1, is bounded by the curve, the x-axis and the line with equation $x = \frac{\pi}{3}$

The table below shows corresponding values of x and y for $y = \sin 2x \sin x$, with the values of y given to 5 significant figures where appropriate.

x	$\frac{\pi}{3}$	$\frac{7\pi}{18}$	$\frac{4\pi}{9}$	$\frac{\pi}{2}$
y	0.75	0.60402	0.33682	0

- (a) Use the trapezium rule, with all the values of y in the table, to find an estimate for the area of R, giving your answer to 4 significant figures.

 (3)
- (b) Use calculus to find the exact area of R, giving your answer in the form $a + b\sqrt{3}$, where a and b are constants to be found.

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

(4)

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3. The curve C has equation

$$x^2 - y^3 - x - x \sin(\pi y) = -2$$

(a) Find $\frac{dy}{dx}$ in terms of x and y.

(5)

The point P with coordinates (3, 2) lies on C.

The tangent to C at P meets the y-axis at the point Q.

(b) Find the y coordinate of Q, giving your answer in the form $\frac{a\pi + b}{\pi + c}$ where a, b and c are integers to be found.

(3)

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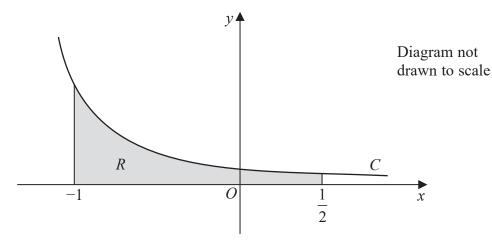


Figure 2

Figure 2 shows a sketch of part of the curve C with equation

$$y = \frac{8}{5(2x+3)^2} \qquad x > -\frac{3}{2}$$

The finite region R, shown shaded in Figure 2, is bounded by the line with equation x = -1, the curve C, the line with equation $x = \frac{1}{2}$ and the x-axis. The region R is rotated through 360° about the x-axis to form a solid of revolution with volume V.

Use calculus to find the exact value of V, giving your answer in its simplest form. (Solutions based entirely on graphical or numerical methods are not acceptable.)



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Figure 3

A container with a circular cross-section is shown in Figure 3.

Initially the container is empty. At time t seconds after water begins to flow into the container, the height of water in the container is h cm.

The height of water in the container satisfies the differential equation

$$\frac{\mathrm{d}h}{\mathrm{d}t} = \frac{k}{h+4} \qquad 0 \leqslant h \leqslant 35$$

where k is a constant.

When h = 16, the height of water in the container is increasing at a rate of $0.6 \,\mathrm{cm}\,\mathrm{s}^{-1}$

(a) Find the value of k.

(1)

(b) Find the time taken to fill the container with water from empty to a height of 30 cm. (4)

Given that the water flows into the container at a constant rate of 96π cm³ s⁻¹

(c) find the volume of water in the container when h = 30 Give your answer in cm³ to 3 significant figures.

(2)

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6. (i) Find, in its simplest form,

$$\int \frac{5}{6e^{3x}} dx$$

(2)

(ii) (a) Express $\frac{4y^2 + 3y - 4}{y(2y - 1)}$ in partial fractions.

(4)

(b) Hence find

$$\int \frac{4y^2 + 3y - 4}{y(2y - 1)} dy \qquad y > \frac{1}{2}$$
 (3)

(iii) Use integration by parts to find

$$\int_{1}^{4} \frac{1}{\sqrt{x}} \ln(2x) dx$$

giving your answer in the form $a + b \ln 2$, where a and b are constants to be found. (5)





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(Total 14 marks)	



7. The curve C has parametric equations

$$x = -3 + 6\sin\theta \qquad y = 4\sqrt{3}\cos 2\theta \qquad -\frac{\pi}{2} < \theta < \frac{\pi}{2}$$

where θ is a parameter.

(a) Find an expression for $\frac{dy}{dx}$ in terms of θ .

(2)

(6)

The curve C cuts the y-axis at the point A.

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

(b) Show that an equation for l is

$$\sqrt{3} x - 4y + 8\sqrt{3} = 0 ag{6}$$

The line l intersects the curve C again at the point B.

(c) Find the coordinates of B. Give your answer in the form $(p, q\sqrt{3})$, where p and q are rational constants.

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

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8. With respect to a fixed origin O, the line l_1 is given by the equation

$$\mathbf{r} = \begin{pmatrix} -6 \\ 13 \\ 1 \end{pmatrix} + \mu \begin{pmatrix} 4 \\ -5 \\ 3 \end{pmatrix}$$

where μ is a scalar parameter.

The point P lies on l_1 and has coordinates (2, c, d), where c and d are constants.

The point A does **not** lie on l_1 and has coordinates (6, -1, 7).

(a) Find the exact value of the distance PA. Give your answer in the form $k\sqrt{2}$, where k is a numerical constant to be found.

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

(b) Write down a vector equation for the line l_2 (2)

The acute angle between PA and l_2 is θ

(c) Show that
$$\cos \theta = \frac{9}{10}$$
 (3)

The point B lies on the line l_2 such that PA = PB.

(d) Find the coordinates of the point B.

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TOTAL FOR	PAPER: 75 MARKS	
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