IYGB GCE

Core Mathematics C4

Advanced

Practice Paper B

Difficulty Rating: 3.0933/1.3761

Time: 1 hour 30 minutes

Candidates may use any calculator allowed by the Regulations of the Joint Council for Qualifications.

Information for Candidates

This practice paper follows the Edexcel Syllabus.
The standard booklet "Mathematical Formulae and Statistical Tables" may be used.
Full marks may be obtained for answers to ALL questions.
The marks for the parts of questions are shown in round brackets, e.g. **(2)**.
There are 9 questions in this question paper.
The total mark for this paper is 75.

Advice to Candidates

You must ensure that your answers to parts of questions are clearly labelled.
You must show sufficient working to make your methods clear to the Examiner.
Answers without working may not gain full credit.
Non exact answers should be given to an appropriate degree of accuracy.
The examiner may refuse to mark any parts of questions if deemed not to be legible.

Question 1

Evaluate each of the following integrals, giving the answers in exact form.

a) $\displaystyle\int_0^2 \frac{1}{\sqrt{4x+1}}\ dx$. **(3)**

b) $\displaystyle\int_{\frac{\pi}{6}}^{\frac{\pi}{3}} \cos 3x\ dx$. **(3)**

Question 2

$$f(x) = \frac{5x+3}{(1-x)(1+3x)},\ |x| < \frac{1}{3}.$$

a) Express $f(x)$ into partial fractions. **(3)**

b) Hence find the series expansion of $f(x)$, up and including the term in x^3. **(7)**

Question 3

A curve C is defined implicitly by

$$y^2 - 3xy + 4x^2 = 28,\quad x \in \mathbb{R},\ y \in \mathbb{R}.$$

a) Find, in terms of x and y, a simplified expression for $\frac{dy}{dx}$. **(4)**

b) Determine the coordinates of the stationary points of C. **(6)**

Question 4

Use integration by parts **twice** to find an exact value for

$$\int_0^{\frac{\pi}{2}} 4x^2 \cos x \ dx .$$ **(7)**

Question 5

Relative to a fixed origin O, the points P and Q have respective position vectors

$$(-7\mathbf{j}+4\mathbf{k}) \quad \text{and} \quad (3\mathbf{i}-8\mathbf{j}+2\mathbf{k}).$$

The straight line l_1 passes through P and Q.

a) Determine a vector equation for l_1. **(3)**

The straight line l_2 has vector equation

$$\mathbf{r} = (7\mathbf{i}+a\mathbf{j}+b\mathbf{k}) + \mu(\mathbf{i}+4\mathbf{j}-\mathbf{k}),$$

where a and b are scalar constants, and μ is a scalar parameter.

b) Given that l_1 and l_2 intersect at Q, find the value of a and the value of b. **(3)**

c) Calculate the acute angle between l_1 and l_2. **(3)**

Question 6

The area, A cm^2, of a circle is increasing at the constant rate of 12 cm^{2}s^{-1}.

Find the rate at which the radius, r cm, of the circle is increasing, when the circle's area has reached 576π cm^2. **(5)**

Question 7

$$-5\frac{dy}{dx} = 2y - 150, \quad y < 75$$

Solve the above differential equation, given that when $x = 0$, $y = 275$.

Give the answer in the form $y = f(x)$. **(7)**

Question 8

x	0	$\frac{\pi}{18}$	$\frac{\pi}{9}$	$\frac{\pi}{6}$
y	0	0.1632		0.2500

The table above shows tabulated values for the equation

$$y = \sin x \cos 2x, \quad 0 \le x \le \frac{\pi}{6}.$$

a) Complete the missing value in the table. **(1)**

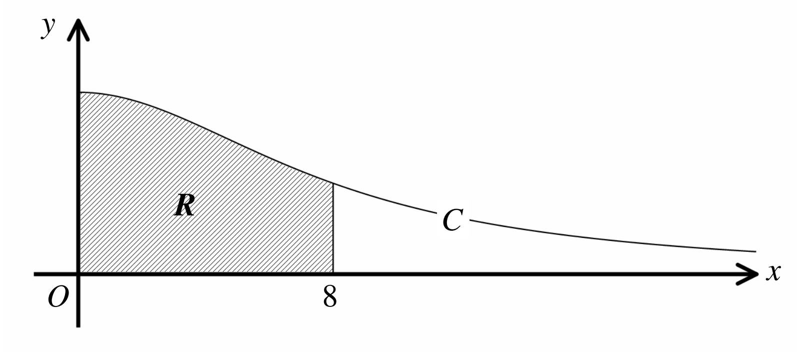
b) Use the trapezium rule with all the values from the table to find an approximate value for

$$\int_0^{\frac{\pi}{6}} \sin x \cos 2x \; dx. \quad \textbf{(3)}$$

c) By using the substitution $u = \cos x$, or otherwise, find an exact value for

$$\int_0^{\frac{\pi}{6}} \sin x \cos 2x \; dx. \quad \textbf{(8)}$$

Question 9



The figure above shows the curve C with parametric equations

$$x = 8\tan t, \ \ y = \cos^2 t \, , \ \ 0 \le t < \frac{\pi}{2} .$$

The finite region R is bounded by C, the coordinate axes and the straight line with equation $x = 8$.

The region R is revolved in the x axis by 2π radians to form a solid of revolution S.

a) Show the volume of S is given by the integral

$$8\pi \int_{t_1}^{t_2} \cos^2 t \ \ dt \, ,$$

for some appropriate limits t_1 and t_2. **(5)**

b) Hence find an exact value for the volume of S. **(4)**