IYGB GCE

Core Mathematics C4

Advanced

Practice Paper K

Difficulty Rating: 3.0800/1.3699

Time: 1 hour 30 minutes

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

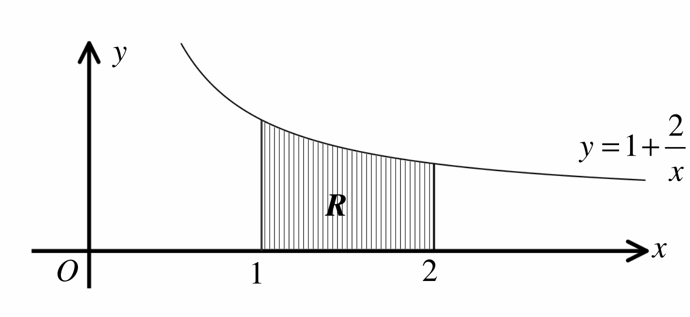
Information for Candidates

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



The figure above shows part of the graph of the curve with equation

$$y = 1 + \frac{2}{x}, \quad x \neq 0.$$

The region R, shown shaded in the figure above, is bounded by the curve, the straight lines with equations $x = 1$ and $x = 2$, and the x axis.

The region R is rotated through $360°$ about the x axis to form a solid of revolution.

Show that the volume of the solid is

$$\pi(3 + 4\ln 2).$$ **(6)**

Question 2

$$f(x) = \frac{(1+2x)^2}{1-2x}, \quad x \neq \frac{1}{2}.$$

a) Find the first 4 terms in the series expansion of $f(x)$. **(7)**

b) State the range of values of x for which the expansion of $f(x)$ is valid. **(1)**

Question 3

Solve the differential equation

$$x^2 \frac{dy}{dx} = y^2 - 3x^4 y^2$$

subject to the condition $y = \frac{1}{2}$ at $x = 1$, giving the answer in the form $y = f(x)$. **(7)**

Question 4

$$f(x) \equiv \frac{5}{3x^2 - 5x}.$$

a) Express $f(x)$ into partial fractions. **(4)**

b) Find the value of

$$\int_3^5 f(x) \; dx \; ,$$

giving the answer as a single simplified logarithm. **(5)**

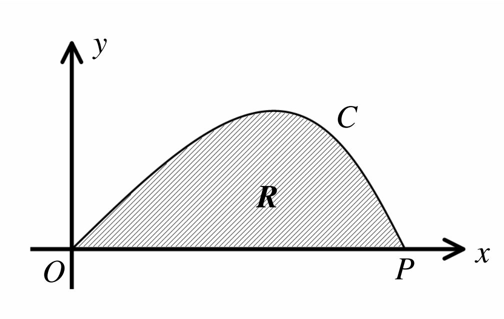
Question 5

The variables y, x and t are related by the equations

$$y = 15\left(4 - \frac{27}{(x+3)^3}\right) \quad \text{and} \quad \ln(x+3) = \frac{1}{3}t, \; x > -3.$$

Find the value of $\frac{dy}{dt}$, when $x = 9$. **(7)**

Question 6



The figure above shows the curve C, given parametrically by

$$x = 3t + \sin t, \quad y = 2\sin t \ , \ 0 \le t \le \pi .$$

The curve meets the coordinate axes at the point P and at the origin O.

The finite region R is bounded by C and the x axis.

Determine the area of R. **(7)**

Question 7

Use the substitution $u = \sqrt{2x-7}$ to find

$$\int_4^8 \frac{6x}{\sqrt{2x-7}} \, dx .$$ **(6)**

Question 8 (***+)

Relative to a fixed origin O, the points A and C have respective coordinates

$$(7,2,3) \quad \text{and} \quad (3,-2,1).$$

a) Find the vector $\overrightarrow{AC}$. **(2)**

b) State the coordinates of the midpoint of AC. **(1)**

The straight line l has vector equation

$$\mathbf{r} = \begin{pmatrix} 5 \\ 0 \\ 2 \end{pmatrix} + \lambda \begin{pmatrix} 1 \\ 1 \\ -4 \end{pmatrix},$$

where λ is a scalar parameter.

c) Show that $\overrightarrow{AC}$ is perpendicular to l. **(2)**

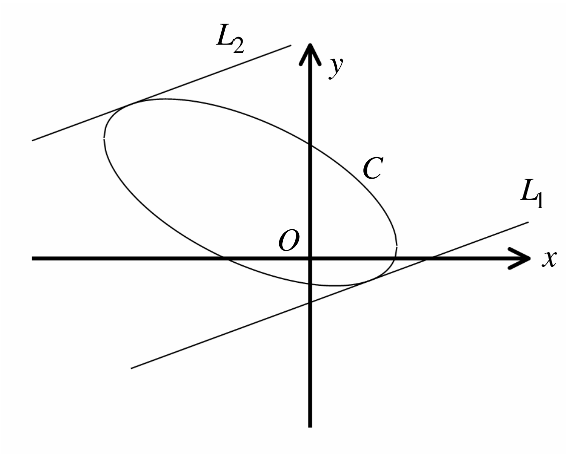
The point B lies on l, where $\lambda = 1$.

d) Show further that the triangle ABC is isosceles but not equilateral. **(4)**

The point D is such, so that $ABCD$ is a rhombus.

e) Show that the area of this rhombus is $18\sqrt{2}$ square units. **(3)**

Question 9



The figure above shows the curve C with the equation

$$4y - 2xy + 6 = y^2 + 3x^2.$$

a) Show clearly that

$$\frac{dy}{dx} = \frac{y + 3x}{2 - x - y}. \qquad \mathbf{(5)}$$

The straight lines L_1 and L_2 are parallel to each other and are both tangents to C.

The equation of L_1 is

$$y = x - 2.$$

b) Find an equation of L_2 **(8)**
