IYGB GCE

Core Mathematics C4

Advanced

Practice Paper R

Difficulty Rating: 3.3267/1.4963

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

By using the substitution $u = 1 - x^2$, or otherwise, find

$$\int \frac{12x}{\left(1-x^2\right)^{\frac{3}{2}}}\,dx\,. \qquad (6)$$

Question 2

The radius, r cm, of a circle is increasing at the constant rate of $3\ \text{cm}\,\text{s}^{-1}$.

Find the rate at which the area of the circle is increasing when its radius is 13.5 cm.

(4)

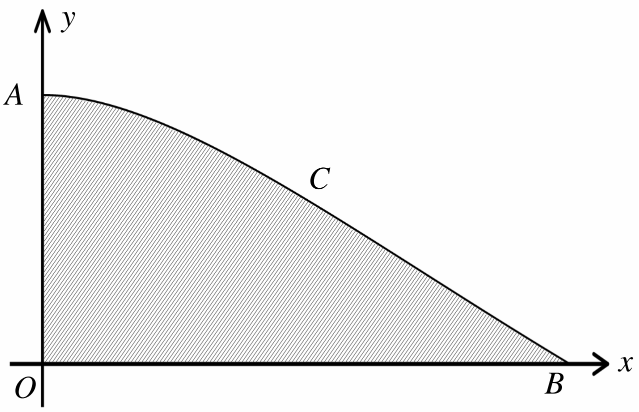
Question 3

$$I = \int_{\frac{\pi}{6}}^{\frac{\pi}{2}} \operatorname{cosec} x \ dx$$

(5)

Use the trapezium rule with 4 equally spaced strips to find an estimate for I.

Question 4



The figure above shows the curve C, with parametric equations

$$x = 36t^2 - \pi^2, \quad y = \frac{\sin 3t}{8}, \quad \frac{\pi}{6} \le t \le \frac{\pi}{3}.$$

The curve meets the coordinate axes at the points A and B.

By setting up and evaluating a suitable integral in parametric, show that the area bounded by C and the coordinate axes is $(\pi - 1)$ square units. **(9)**

Question 5

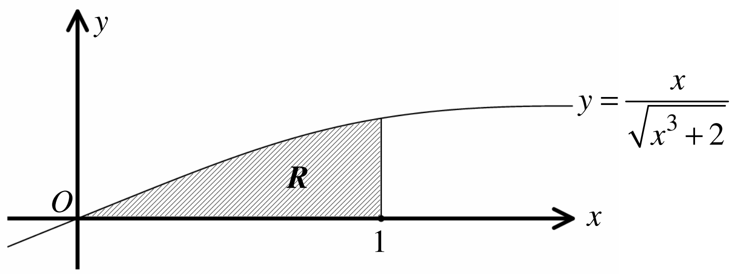
$$f(x) = \frac{8x^2 + 17x}{(1-x)(3+2x)^2}, \quad |x| < 1.$$

a) Express $f(x)$ into partial fractions. **(5)**

b) Hence show that

$$f(x) \approx \frac{1}{9}x(7x+17).$$ **(7)**

Question 6



The figure above shows part of the curve with equation

$$y = \frac{x}{\sqrt{x^3+2}}, \quad x^3 > -2 .$$

The shaded region R, bounded by the curve, the x axis and the straight line with equation $x = 1$, is rotated by $360°$ about the x axis to form a solid of revolution.

Show that the solid has a volume of

$$\frac{\pi}{3}\ln\left(\frac{3}{2}\right).$$

(7)

Question 7

The curve C is given implicitly by

$$ax(2x - y) = b - 3y^2 ,$$

where a and b are non zero constants.

The point $(2,2)$ lies on C and the gradient at that point is $-\frac{3}{2}$.

Find the value of a and the value of b. **(8)**

Question 8

The straight line l_1 passes through the points $A(6,2,0)$ and $B(5,0,5)$.

a) Find a vector equation of l_1. **(3)**

The straight line l_2 has vector equation

$$\mathbf{r}_2 = \begin{pmatrix} -7 \\ 6 \\ -4 \end{pmatrix} + \mu \begin{pmatrix} -5 \\ 0 \\ 2 \end{pmatrix},$$

where μ is a scalar parameter.

b) Show that l_1 and l_2 intersect at some point C, and find its coordinates. **(5)**

The point D lies on l_2 so that $DBC = 90°$.

c) Determine the coordinates of D. **(6)**

Question 9

Water is leaking out of a hole at the side of a tank.

Let the height of the water in the tank is y cm at time t minutes.

The rate at which the height of the water in the tank is decreasing is modelled by the differential equation

$$\frac{dy}{dt} = -6(y-7)^{\frac{2}{3}}.$$

When $t=0$, $y=132$.

a) Find how long it takes for the water level to drop from 132 cm to 34 cm. **(8)**

The tank is filled up with water again to a height of 132 cm and allowed to leak out in exactly the same fashion as the one described in part **(a)**.

b) Determine how long it takes for the water to stop leaking. **(2)**