Areas & Volumes
Question Paper 10

Level	International A Level
Subject	Maths
Exam Board	CIE
Topic	Integration
Sub Topic	Areas & Volumes
Booklet	Question Paper 10

Time Allowed: 66   minutes

Score: /55

Percentage: /100

Grade Boundaries:

A*	A	B	C	D	E	U
>85%	'77.5%	70%	62.5%	57.5%	45%	<45%

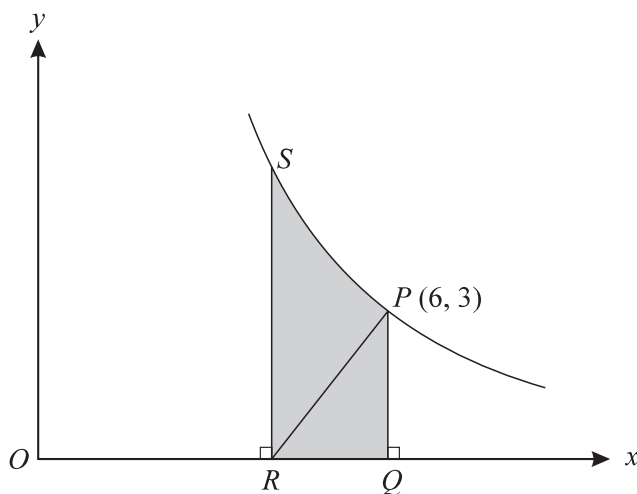**1** A curve has equation $y = x^2 + \dfrac{2}{x}$.

    (i) Write down expressions for $\dfrac{dy}{dx}$ and $\dfrac{d^2y}{dx^2}$.   [3]

    (ii) Find the coordinates of the stationary point on the curve and determine its nature.   [4]

    (iii) Find the volume of the solid formed when the region enclosed by the curve, the x-axis and the lines $x = 1$ and $x = 2$ is rotated completely about the x-axis.   [6]

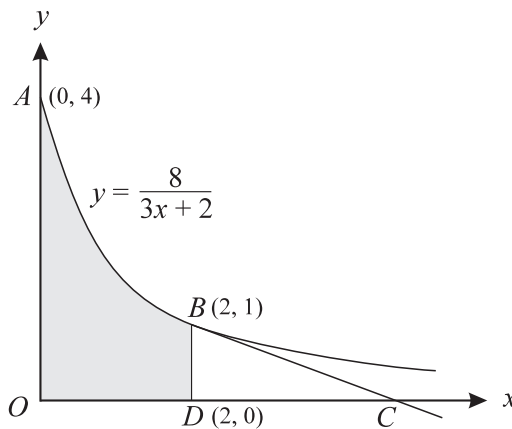**2** Evaluate $\displaystyle\int_0^1 \sqrt{(3x + 1)}\, dx$.   [4]

3

The diagram shows part of the graph of $y = \dfrac{18}{x}$ and the normal to the curve at $P\,(6, 3)$. This normal meets the x-axis at R. The point Q on the x-axis and the point S on the curve are such that PQ and SR are parallel to the y-axis.

    (i) Find the equation of the normal at P and show that R is the point $(4\frac{1}{2}, 0)$.   [5]

    (ii) Show that the volume of the solid obtained when the shaded region $PQRS$ is rotated through $360°$ about the x-axis is 18π.   [4]
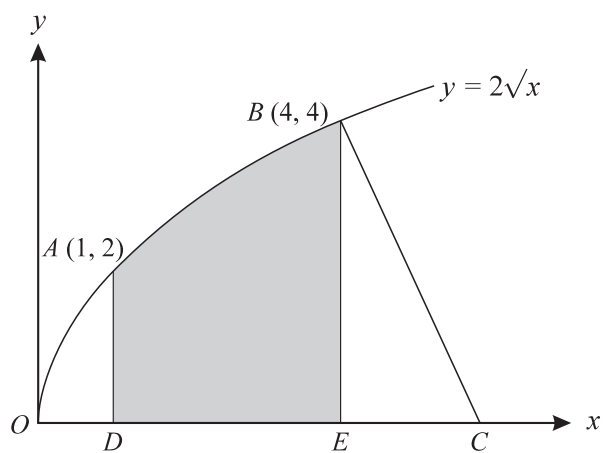
4

The diagram shows points A (0, 4) and B (2, 1) on the curve $y = \dfrac{8}{3x + 2}$. The tangent to the curve at B crosses the x-axis at C. The point D has coordinates (2, 0).

  (i) Find the equation of the tangent to the curve at B and hence show that the area of triangle BDC is $\frac{4}{3}$. [6]

  (ii) Show that the volume of the solid formed when the shaded region $ODBA$ is rotated completely about the x-axis is 8π. [5]

5   The equation of a curve is $y = \sqrt{(5x + 4)}$.

  (i) Calculate the gradient of the curve at the point where $x = 1$. [3]

  (ii) A point with coordinates (x, y) moves along the curve in such a way that the rate of increase of x has the constant value 0.03 units per second. Find the rate of increase of y at the instant when $x = 1$. [2]

  (iii) Find the area enclosed by the curve, the x-axis, the y-axis and the line $x = 1$. [5]

6

The diagram shows the points A (1, 2) and B (4, 4) on the curve $y = 2\sqrt{x}$. The line BC is the normal to the curve at B, and C lies on the x-axis. Lines AD and BE are perpendicular to the x-axis.

  (i) Find the equation of the normal BC.   [4]

  (ii) Find the area of the shaded region.   [4]