

2.

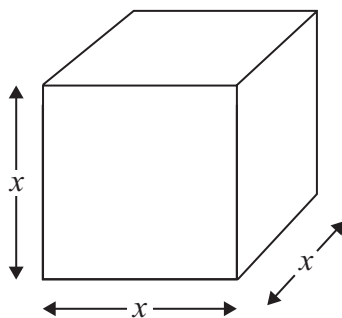


Figure 1

Figure 1 shows a metal cube which is expanding uniformly as it is heated. At time t seconds, the length of each edge of the cube is x cm, and the volume of the cube is V cm³.

(a) Show that $\frac{dV}{dx} = 3x^2$ (1)

Given that the volume, $V \text{ cm}^3$, increases at a constant rate of $0.048 \text{ cm}^3 \text{ s}^{-1}$,

(b) find $\frac{dx}{dt}$, when $x = 8$ (2)

(c) find the rate of increase of the total surface area of the cube, in cm^2s^{-1} , when $x = 8$

(3)



3.

$$f(x) = \frac{6}{\sqrt{9-4x}}, \quad |x| < \frac{9}{4}$$

- (a) Find the binomial expansion of $f(x)$ in ascending powers of x , up to and including the term in x^3 . Give each coefficient in its simplest form.

(6)

Use your answer to part (a) to find the binomial expansion in ascending powers of x , up to and including the term in x^3 , of

(b) $g(x) = \frac{6}{\sqrt{9+4x}}, \quad |x| < \frac{9}{4}$

(1)

(c) $h(x) = \frac{6}{\sqrt{9-8x}}, \quad |x| < \frac{9}{8}$

(2)





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

(5)





6.

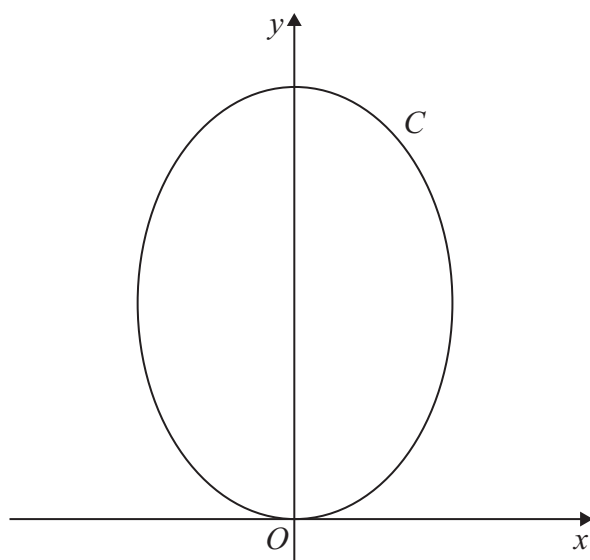


Figure 2

Figure 2 shows a sketch of the curve C with parametric equations

$$x = (\sqrt{3})\sin 2t, \quad y = 4 \cos^2 t, \quad 0 \leq t \leq \pi$$

- (a) Show that $\frac{dy}{dx} = k(\sqrt{3})\tan 2t$, where k is a constant to be determined.

(5)

- (b) Find an equation of the tangent to C at the point where $t = \frac{\pi}{3}$.

Give your answer in the form $y = ax + b$, where a and b are constants.

(4)

- (c) Find a cartesian equation of C .

(3)





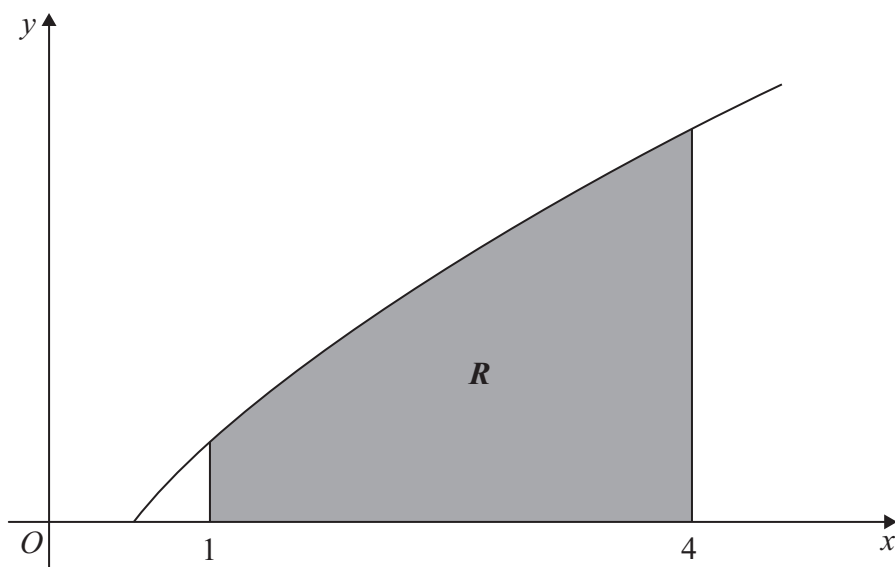


Figure 3 shows a sketch of part of the curve with equation $y = x^{\frac{1}{2}} \ln 2x$.

(a) Use the trapezium rule, with 3 strips of equal width, to find an estimate for the area of R , giving your answer to 2 decimal places.

(4)

(b) Find $\int x^{\frac{1}{2}} \ln 2x \, dx$.

(4)

(c) Hence find the exact area of R , giving your answer in the form $a \ln 2 + b$, where a and b are exact constants.

(3)

This image shows a single sheet of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page. There are approximately 20 lines visible. The paper has a slight shadow on its right side, suggesting it's resting on a surface.



Question 8 continued

(Total 10 marks)

TOTAL FOR PAPER: 75 MARKS

END

Q8

