

2.

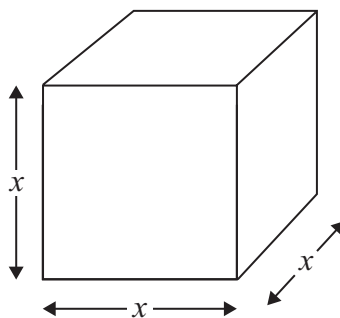


Figure 1

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 cm³, increases at a constant rate of 0.048 cm³s⁻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 cm²s⁻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)



6.

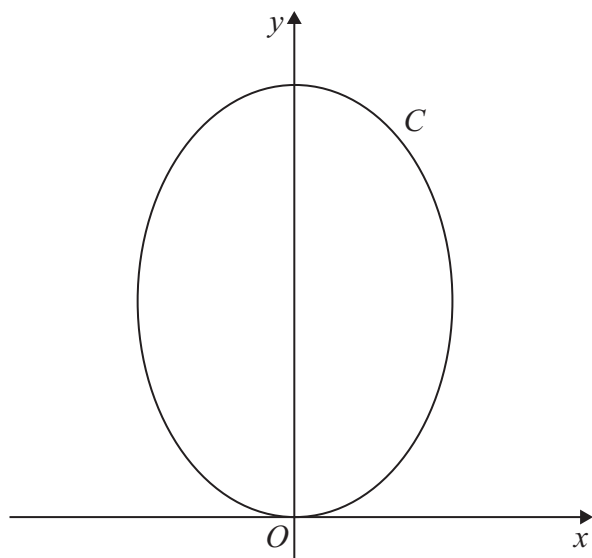


Figure 2

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)



Question 6 continued

Lined area for writing the answer to Question 6.



7.

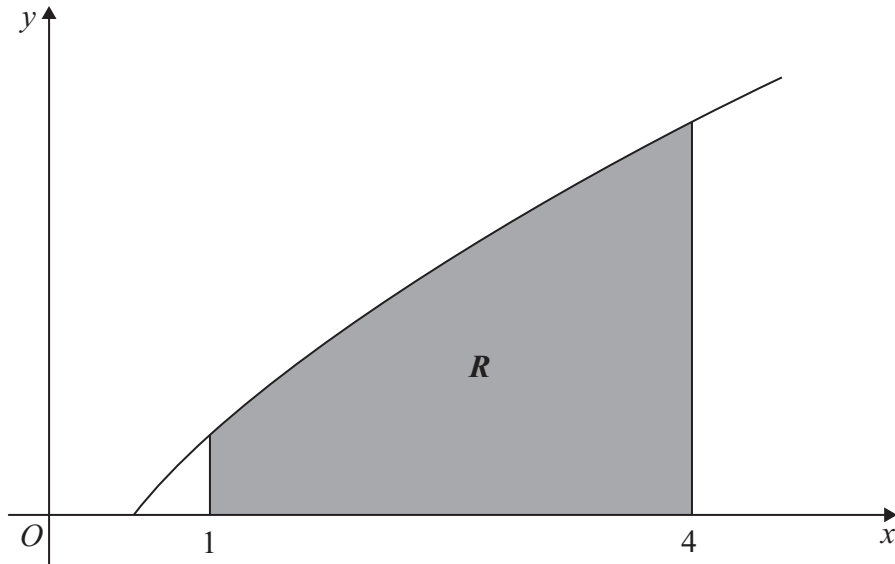


Figure 3

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

The finite region R , shown shaded in Figure 3, is bounded by the curve, the x -axis and the lines $x = 1$ and $x = 4$

- (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)



