

1.

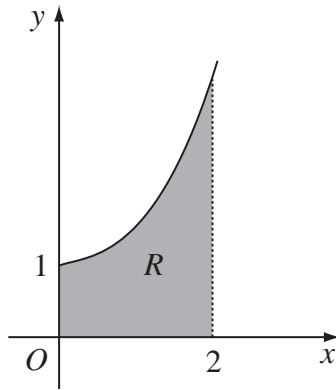


Figure 1

Figure 1 shows part of the curve with equation $y = e^{0.5x^2}$. The finite region R , shown shaded in Figure 1, is bounded by the curve, the x -axis, the y -axis and the line $x = 2$.

(a) Complete the table with the values of y corresponding to $x = 0.8$ and $x = 1.6$.

x	0	0.4	0.8	1.2	1.6	2
y	e^0	$e^{0.08}$		$e^{0.72}$		e^2

(1)

(b) Use the trapezium rule with all the values in the table to find an approximate value for the area of R , giving your answer to 4 significant figures.

(3)



3.

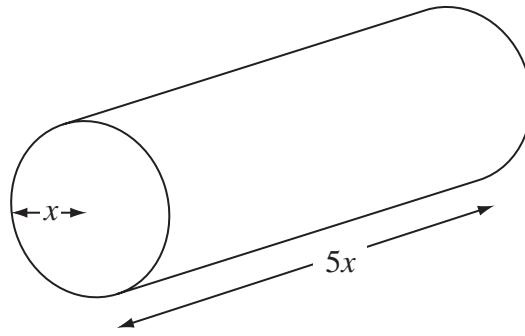


Figure 2

Figure 2 shows a right circular cylindrical metal rod which is expanding as it is heated. After t seconds the radius of the rod is x cm and the length of the rod is $5x$ cm. The cross-sectional area of the rod is increasing at the constant rate of $0.032 \text{ cm}^2 \text{ s}^{-1}$.

(a) Find $\frac{dx}{dt}$ when the radius of the rod is 2 cm, giving your answer to 3 significant figures. (4)

(b) Find the rate of increase of the volume of the rod when $x = 2$. (4)



Question 3 continued

A large area of horizontal lines for writing, intended for the response to Question 3.



5. (a) Expand $\frac{1}{\sqrt{4-3x}}$, where $|x| < \frac{4}{3}$, in ascending powers of x up to and including the term in x^2 . Simplify each term. (5)

(b) Hence, or otherwise, find the first 3 terms in the expansion of $\frac{x+8}{\sqrt{4-3x}}$ as a series in ascending powers of x . (4)



6. With respect to a fixed origin O , the lines l_1 and l_2 are given by the equations

$$l_1: \mathbf{r} = (-9\mathbf{i} + 10\mathbf{k}) + \lambda(2\mathbf{i} + \mathbf{j} - \mathbf{k})$$

$$l_2: \mathbf{r} = (3\mathbf{i} + \mathbf{j} + 17\mathbf{k}) + \mu(3\mathbf{i} - \mathbf{j} + 5\mathbf{k})$$

where λ and μ are scalar parameters.

(a) Show that l_1 and l_2 meet and find the position vector of their point of intersection. (6)

(b) Show that l_1 and l_2 are perpendicular to each other. (2)

The point A has position vector $5\mathbf{i} + 7\mathbf{j} + 3\mathbf{k}$.

(c) Show that A lies on l_1 . (1)

The point B is the image of A after reflection in the line l_2 .

(d) Find the position vector of B . (3)



8.

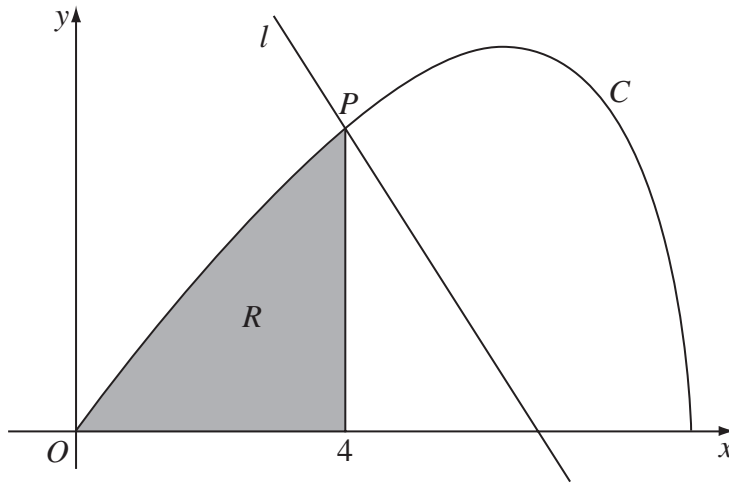


Figure 3

Figure 3 shows the curve C with parametric equations

$$x = 8\cos t, \quad y = 4\sin 2t, \quad 0 \leq t \leq \frac{\pi}{2}.$$

The point P lies on C and has coordinates $(4, 2\sqrt{3})$.

- (a) Find the value of t at the point P . (2)

The line l is a normal to C at P .

- (b) Show that an equation for l is $y = -x\sqrt{3} + 6\sqrt{3}$. (6)

The finite region R is enclosed by the curve C , the x -axis and the line $x = 4$, as shown shaded in Figure 3.

- (c) Show that the area of R is given by the integral $\int_{\frac{\pi}{3}}^{\frac{\pi}{2}} 64 \sin^2 t \cos t \, dt$. (4)

- (d) Use this integral to find the area of R , giving your answer in the form $a + b\sqrt{3}$, where a and b are constants to be determined. (4)



