adamjee maths

A-LEVEL MATHS / EDEXCEL / FREE RESOURCES

Parametric equations

Question paper

7 questions

Exam questions and marking instructions remain credited to their board.

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5. The curve C has parametric equations

$$x = \frac{t-1}{2} \qquad y = 5(t+2)^4 \qquad t \in \mathbb{R}$$

The point P with x coordinate -3 lies on C.

(a) Find the y coordinate of P.

(2)

(b) Find a Cartesian equation for C, giving the answer in the form $y = \mathrm{f}(x)$

(2)

(c) Hence, or otherwise, find the gradient of C at the point P.

(3)

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Question 5 continued

(Total for Question 5 is 7 marks)

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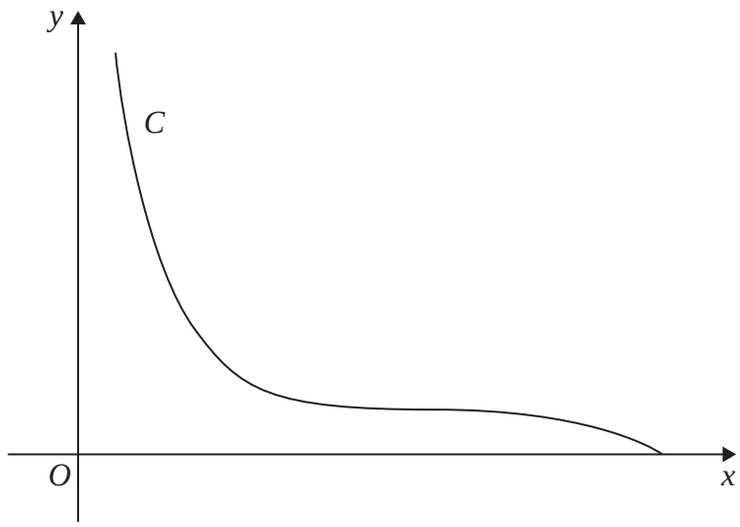


Figure 4

Figure 4 shows a sketch of the curve C with parametric equations

$$x = (t+3)^2 \qquad y = 1 - t^3 \qquad -2 \leqslant t \leqslant 1$$

The point P with coordinates (4, 2) lies on C.

(a) Using parametric differentiation, show that the tangent to C at P has equation

$$3x + 4y = 20$$

(5)

The curve C is used to model the profile of a slide at a water park.

Units are in metres, with y being the height of the slide above water level.

(b) Find, according to the model, the greatest height of the slide above water level.

(1)

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Question 10 continued

(Total for Question 10 is 6 marks)

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9. The curve C has parametric equations

$$x = t^2 + 6t - 16 \qquad y = 6\ln(t + 3) \qquad t > -3$$

(a) Show that a Cartesian equation for C is

$$y = A\ln(x + B) \qquad x > -B$$

where A and B are integers to be found.

(3)

The curve C cuts the y-axis at the point P

(b) Show that the equation of the tangent to C at P can be written in the form

$$ax + by = c\ln 5$$

where a, b and c are integers to be found.

(4)

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Question 9 continued

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Question 9 continued

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Question 9 continued

(Total for Question 9 is 7 marks)

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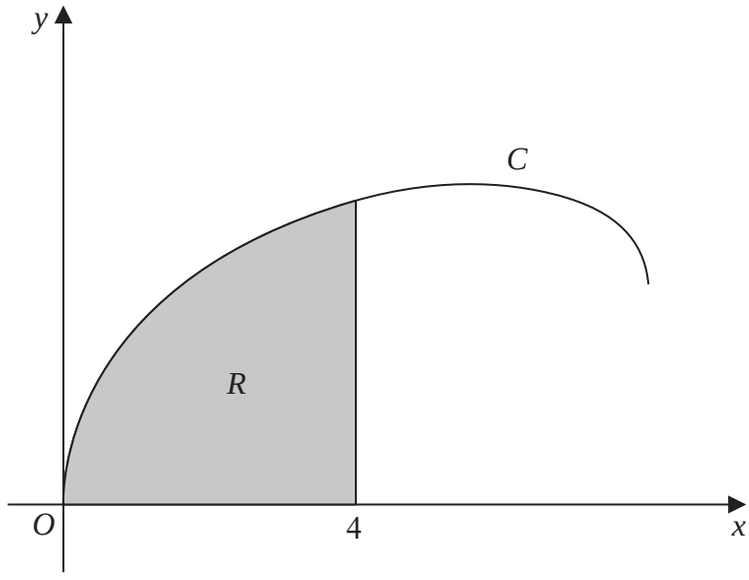


Figure 6

Figure 6 shows a sketch of the curve C with parametric equations

$$x = 8\sin^2 t \qquad y = 2\sin 2t + 3\sin t \qquad 0 \leqslant t \leqslant \frac{\pi}{2}$$

The region R, shown shaded in Figure 6, is bounded by C, the x-axis and the line with equation $x = 4$

(a) Show that the area of R is given by

$$\int_0^a \left(8 - 8\cos 4t + 48\sin^2 t \cos t\right) \mathrm{d}t$$

where a is a constant to be found.

(5)

(b) Hence, using algebraic integration, find the exact area of R.

(4)

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Question 16 continued

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Question 16 continued

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TOTAL FOR PAPER IS 100 MARKS

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13. A curve C has parametric equations

$$x = \frac{t^2 + 5}{t^2 + 1} \qquad y = \frac{4t}{t^2 + 1} \qquad t \in \mathbb{R}$$

Show that all points on C satisfy

$$(x - 3)^2 + y^2 = 4$$

(3)

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Question 13 continued

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13. The curve C has parametric equations

$$x = \sin 2\theta \qquad y = \text{cosec}^3 \theta \qquad 0 < \theta < \frac{\pi}{2}$$

(a) Find an expression for $\frac{dy}{dx}$ in terms of θ

(3)

(b) Hence find the exact value of the gradient of the tangent to C at the point where $y = 8$

(3)

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Question 13 continued

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14. A curve C has parametric equations

$$x = 3 + 2\sin t, \quad y = 4 + 2\cos 2t, \quad 0 \leqslant t < 2\pi$$

(a) Show that all points on C satisfy $y = 6 - (x - 3)^2$

(2)

(b) (i) Sketch the curve C.

(ii) Explain briefly why C does not include all points of $y = 6 - (x - 3)^2, \quad x \in \mathbb{R}$

(3)

The line with equation $x + y = k$, where k is a constant, intersects C at two distinct points.

(c) State the range of values of k, writing your answer in set notation.

(5)

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Question 14 continued

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Question 14 continued

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