

Year 2 Pure Chapter 9: Differentiation – Parametric Equations
Exam Questions (Total Marks 42)

Q1.

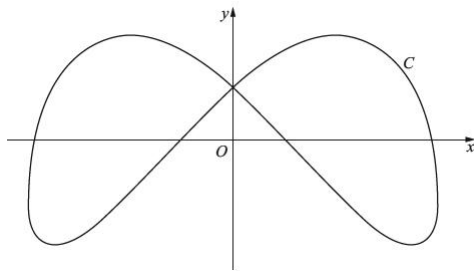


Figure 2

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

$$x = 4 \sin\left(t + \frac{\pi}{6}\right), \quad y = 3 \cos 2t, \quad 0 \leq t < 2\pi$$

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

(3)

(b) Find the coordinates of all the points on C where $\frac{dy}{dx} = 0$

(5)

(Total 8 marks)

Q2. The curve C has parametric equations

$$x = 3t - 4, y = 5 - \frac{6}{t}, \quad t > 0$$

(a) Find $\frac{dy}{dx}$ in terms of t

(2)

The point P lies on C where $t = \frac{1}{2}$

(b) Find the equation of the tangent to C at the point P . Give your answer in the form $y = px + q$, where p and q are integers to be determined.

(3)

(Total for question = 5 marks)

Q3.

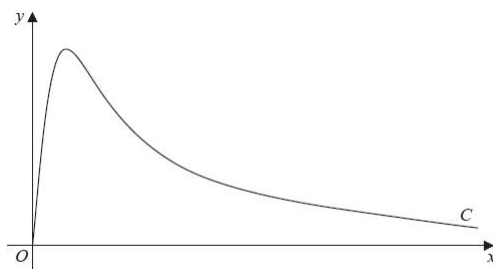


Figure 2

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

$$x = 4 \tan t, \quad y = 5\sqrt{3} \sin 2t, \quad 0 \leq t < \frac{\pi}{2}$$

The point P lies on C and has coordinates $\left(4\sqrt{3}, \frac{15}{2}\right)$.

- (a) Find the exact value of $\frac{dy}{dx}$ at the point P .

Give your answer as a simplified surd.

(4)

The point Q lies on the curve C , where $\frac{dy}{dx} = 0$

- (b) Find the exact coordinates of the point Q .

(2)

(Total for question = 6 marks)

Q4. The curve C has parametric equations

$$x = 2 \cos t, \quad y = \sqrt{3} \cos 2t, \quad 0 \leq t \leq \pi$$

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

(2)

The point P lies on C where $t = \frac{2\pi}{3}$

The line l is the normal to C at P .

(b) Show that an equation for l is

$$2x - 2\sqrt{3}y - 1 = 0$$

(5)

The line l intersects the curve C again at the point Q .

(c) Find the exact coordinates of Q .

You must show clearly how you obtained your answers.

(6)

(Total for question = 13 marks)

Q5.

A curve C has parametric equations

$$x = \sin^2 t, \quad y = 2 \tan t, \quad 0 \leq t < \frac{\pi}{2}$$

(a) Find $\frac{dy}{dx}$ in terms of t .

(4)

The tangent to C at the point where $t = \frac{\pi}{3}$ cuts the x -axis at the point P .

(b) Find the x -coordinate of P .

(6)

(Total 10 marks)