

Parametrics

Difficulty: Easy

Question Paper 1

Level	A Level
Subject	Maths Pure 3
Exam Board	CIE
Topic	Differentiation
Sub-Topic	Parametrics
Difficulty	Easy
Booklet	Question Paper 1

Time allowed: 52 minutes

Score: /37

Percentage: /100

Grade Boundaries:

A*	A	B	C	D	E
>90%	81%	70%	58%	46%	34%

Question 1

The parametric equations of a curve are

$$x = t^2 + 1, \quad y = 4t + \ln(2t - 1).$$

(i) Express $\frac{dy}{dx}$ in terms of t . [3]

(ii) Find the equation of the normal to the curve at the point where $t = 1$. Give your answer in the form $ax + by + c = 0$. [3]

Question 2

The parametric equations of a curve are

$$x = 2\theta + \sin 2\theta, \quad y = 1 - \cos 2\theta.$$

Show that $\frac{dy}{dx} = \tan \theta$. [5]

Question 3

The parametric equations of a curve are

$$x = \sin 2\theta - \theta, \quad y = \cos 2\theta + 2 \sin \theta.$$

Show that $\frac{dy}{dx} = \frac{2 \cos \theta}{1 + 2 \sin \theta}$. [5]

Question 4

The parametric equations of a curve are

$$x = 2t + \sin 2t, \quad y = 1 - 2 \cos 2t,$$

for $-\frac{1}{2}\pi < t < \frac{1}{2}\pi$.

(i) Show that $\frac{dy}{dx} = 2 \tan t$. [5]

(ii) Hence find the x -coordinate of the point on the curve at which the gradient of the normal is 2.
Give your answer correct to 3 significant figures. [2]

Question 5

The parametric equations of a curve are

$$x = 2 \sin \theta + \sin 2\theta, \quad y = 2 \cos \theta + \cos 2\theta,$$

where $0 < \theta < \pi$.

- (i) Obtain an expression for $\frac{dy}{dx}$ in terms of θ . [3]

- (ii) Hence find the exact coordinates of the point on the curve at which the tangent is parallel to the y -axis. [4]

Question 6

The parametric equations of a curve are

$$x = \frac{1}{\cos^3 t}, \quad y = \tan^3 t,$$

where $0 \leq t < \frac{1}{2} \pi$.

(i) Show that $\frac{dy}{dx} = \sin t$. [4]

(ii) Hence show that the equation of the tangent to the curve at the point with parameter t is $y = x \sin t - \tan t$. [3]