

# Parametrics

## Difficulty: Medium

### Question Paper 2

Level	A Level
Subject	Maths Pure 3
Exam Board	CIE
Topic	Differentiation
Sub-Topic	Parametrics
Difficulty	Medium
Booklet	Question Paper 2

**Time allowed:** 42 minutes

**Score:** /30

**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

$$x = t - \tan t, \quad y = \ln(\cos t),$$

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

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

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

## Question 2

The parametric equations of a curve are

$$x = a \cos^4 t, \quad y = a \sin^4 t,$$

where  $a$  is a positive constant.

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

- (ii) Show that the equation of the tangent to the curve at the point with parameter  $t$  is

$$x \sin^2 t + y \cos^2 t = a \sin^2 t \cos^2 t. \quad [3]$$

- (iii) Hence show that if the tangent meets the  $x$ -axis at  $P$  and the  $y$ -axis at  $Q$ , then

$$OP + OQ = a, \quad [2]$$

where  $O$  is the origin.

### Question 3

The parametric equations of a curve are

$$x = a(2\theta - \sin 2\theta), \quad y = a(1 - \cos 2\theta).$$

Show that  $\frac{dy}{dx} = \cot \theta$ .

[5]

## Question 4

The parametric equations of a curve are

$$x = \frac{t}{2t+3}, \quad y = e^{-2t}.$$

Find the gradient of the curve at the point for which  $t = 0$ .

[5]

## Question 5

The parametric equations of a curve are

$$x = 3(1 + \sin^2 t), \quad y = 2 \cos^3 t.$$

Find  $\frac{dy}{dx}$  in terms of  $t$ , simplifying your answer as far as possible.

[5]