eClassroom

Differentiation

Questions

Suitable for:

Pearson Edexcel International A-Level (iAL) — Pure Mathematics 4

Question 1

A curve has parametric equations

$$x = t^2 + 1, \quad y = 2t^3$$

(a) Find dy/dx in terms of t.

(2 marks)

(b) Find the gradient of the curve when $t = 2$.

(1 marks)

Total for question = 3 marks

Question 2

A curve has parametric equations

$$x = t + \frac{1}{t}, \quad y = t^2 - \frac{1}{t^2}, \quad t > 0$$

(a) Find dy/dx in terms of t, simplifying your answer.

(3 marks)

(b) Find the equation of the tangent to the curve at the point where $t = 2$.

(4 marks)

Total for question = 7 marks

Question 3

A curve has parametric equations

$$x = 3\sin\theta, \quad y = 2\cos 2\theta$$

(a) Find dy/dx in terms of θ, simplifying your answer fully.

(3 marks)

(b) Find the equation of the tangent to the curve at the point where θ = π/6.

(4 marks)

Total for question = 7 marks

Question 4

A curve has parametric equations

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

(a) Show that

$$\frac{dy}{dx} = \frac{\cos\theta - \sin\theta}{2\sin\theta\cos\theta}$$

(3 marks)

(b) Find the gradient of the curve at $\theta = \pi/4$, and comment on the significance of your answer.

(2 marks)

Total for question = 5 marks

Question 5

A circle has equation $x^2 + y^2 = 25$.

(a) Use implicit differentiation to show that

$$\frac{dy}{dx} = -\frac{x}{y}$$

(2 marks)

(b) Find the equation of the tangent to the circle at the point (3, 4).

(3 marks)

Total for question = 5 marks

Question 6

A curve has equation

$$x^2y + y^3 = 10$$

(a) Find dy/dx in terms of x and y.

(4 marks)

(b) Find the gradient of the curve at the point (1, 2).

(2 marks)

Total for question = 6 marks

Question 7

A curve satisfies the equation

$$\ln(xy) + y^2 = 3$$

Find dy/dx in terms of x and y.

(5 marks)

Total for question = 5 marks

Question 8

A curve satisfies the equation

$$\sin(x + y) = x\cos y$$

Find dy/dx in terms of x and y.

(5 marks)

Total for question = 5 marks

Question 9

A curve has equation

$$x^2 + xy + y^2 = 7$$

(a) Find dy/dx in terms of x and y.

(3 marks)

(b) Find the coordinates of the stationary points of the curve, giving your answers in exact form.

(4 marks)

Total for question = 7 marks

Question 10

A sphere has radius r cm and volume V cm^3, where $V = 4\pi r^3/3$. The volume of the sphere is increasing at a rate of 4 cm^3/s.

Find the rate at which the radius is increasing when $r = 3$, giving your answer in exact form.

(4 marks)

Total for question = 4 marks

Question 11

Water flows into an inverted conical tank. The cone has a half-angle of 30° and the volume of water is $V = \pi h^3/9$, where h is the depth of water in cm.

Given that the volume is increasing at 9π cm^3/s, find the rate at which h is increasing when $h = 6$ cm.

(4 marks)

Total for question = 4 marks

Question 12

A ladder of length 5 m leans against a vertical wall on horizontal ground. The foot of the ladder slides away from the wall at a constant rate of 0.5 m/s.

Find the rate at which the top of the ladder slides down the wall when the foot is 3 m from the wall.

(5 marks)

Total for question = 5 marks