MATHSAURUS

A Level Mathematics Year 2 Exam Questions by Topic
Chapter 11: Parametric equations

These questions are taken from the Specimen Exam materials and the real 2018 papers for the new syllabus AS and A-level mathematics courses and arranged by chapter of the textbooks by Goldie et al (available here: `https://amzn.to/39umfr5` and `https://amzn.to/3hE8kBL`). There are a mixture of questions from OCR A, OCR B (MEI), Edexcel and AQA. Although the style of questions varies a little across the exam boards the content of the syllabus is almost identical so these are suitable for students preparing for any exam board.

Free problem sets for all other chapters, as well as video solutions, full past papers and other content for GCSE and A-level maths can be found at:

`https://mathsaurus.com/`

OCR B MEI Sample Paper 1 Question 11:

11 Fig. 11 shows the curve with parametric equations

$$x = 2\cos\theta,\ y = \sin\theta,\ 0 \le \theta \le 2\pi.$$

The point P has parameter $\frac{1}{4}\pi$. The tangent at P to the curve meets the axes at A and B.

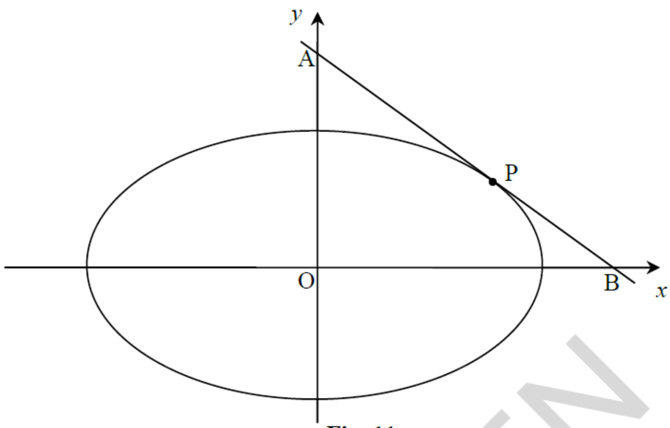

Fig. 11

(i) Show that the equation of the line AB is $x + 2y = 2\sqrt{2}$. **[6]**

(ii) Determine the area of the triangle AOB. **[3]**

AQA 2018 Paper 1 Question 5:

5 A curve is defined by the parametric equations

$$x = 4 \times 2^{-t} + 3$$

$$y = 3 \times 2^{t} - 5$$

5 (a) Show that $\frac{dy}{dx} = -\frac{3}{4} \times 2^{2t}$

[3 marks]

5 (b) Find the Cartesian equation of the curve in the form $xy + ax + by = c$, where a, b and c are integers.

[3 marks]

AQA Sample Paper 2 Question 3:

3 A curve is defined by the parametric equations

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

3 (a) Find the gradient of the curve at the point where $t = -2$

[4 marks]

3 (b) Find a Cartesian equation of the curve.

[2 marks]

Edexcel 2018 Paper 1 Question 14:

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)

Edexcel Sample Paper 1 Question 5:

5. A curve C has parametric equations

$$x = 2t - 1, \quad y = 4t - 7 + \frac{3}{t}, \quad t \neq 0$$

Show that the Cartesian equation of the curve C can be written in the form

$$y = \frac{2x^2 + ax + b}{x + 1}, \quad x \neq -1$$

where a and b are integers to be found.

(3)

OCR B MEI 2018 Paper 3 Question 8:

8 A curve has parametric equations $x = \frac{t}{1+t^3}$, $y = \frac{t^2}{1+t^3}$, where $t \neq -1$.

(i) **In this question you must show detailed reasoning.**

Determine the gradient of the curve at the point where $t = 1$. **[5]**

(ii) Verify that the cartesian equation of the curve is $x^3 + y^3 = xy$. **[3]**

Edexcel Sample Paper 1 Question 13:

13. The curve C has parametric equations

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

(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)

OCR A 2018 Paper 1 Question 10:

10 A curve has parametric equations $x = t + \frac{2}{t}$ and $y = t - \frac{2}{t}$, for $t \neq 0$.

(i) Find $\frac{dy}{dx}$ in terms of t, giving your answer in its simplest form. **[4]**

(ii) Explain why the curve has no stationary points. **[2]**

(iii) By considering $x + y$, or otherwise, find a cartesian equation of the curve, giving your answer in a form not involving fractions or brackets. **[4]**

OCR A Sample Paper 1 Question 12:

12 The parametric equations of a curve are given by $x = 2\cos\theta$ and $y = 3\sin\theta$ for $0 \le \theta < 2\pi$.

(i) Find $\frac{dy}{dx}$ in terms of θ. **[2]**

The tangents to the curve at the points P and Q pass through the point (2, 6).

(ii) Show that the values of θ at the points P and Q satisfy the equation $2\sin\theta + \cos\theta = 1$. **[4]**

(iii) Find the values of θ at the points P and Q. **[5]**