Parametric Differentiation - Edexcel Past Exam Questions

1. A curve has parametric equations

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

(*a*) Find an expression for $\frac{dy}{dx}$ in terms of the parameter t. **(4)**

(*b*) Find an equation of the tangent to the curve at the point where $t = \frac{\pi}{4}$. **(4)**

(*c*) Find a cartesian equation of the curve in the form $y = f(x)$. State the domain on which the curve is defined. **(4)**

June 05 Q6

2.

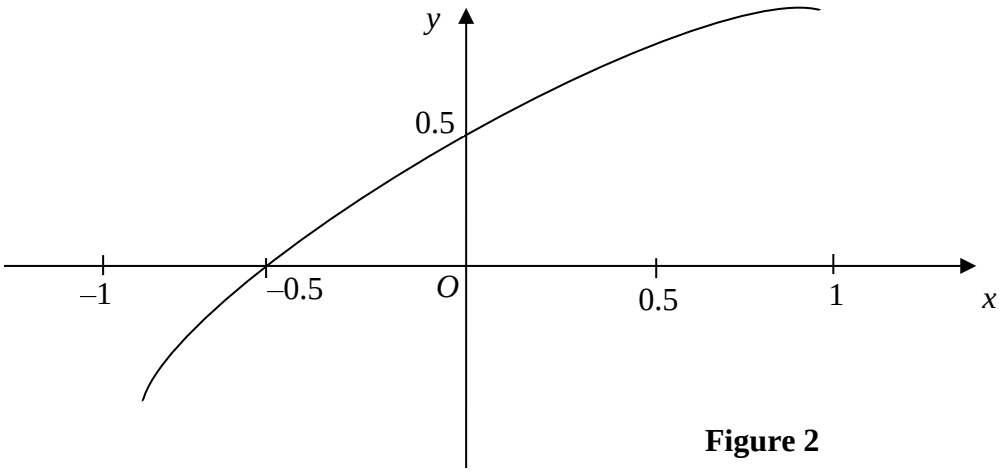

Figure 2

The curve shown in Figure 2 has parametric equations

$$x = \sin t, \quad y = \sin\left(t + \frac{\pi}{6}\right), \qquad -\frac{\pi}{2} < t < \frac{\pi}{2}.$$

(*a*) Find an equation of the tangent to the curve at the point where $t = \frac{\pi}{6}$. **(6)**

(*b*) Show that a cartesian equation of the curve is

$$y = \frac{\sqrt{3}}{2}x + \frac{1}{2}\sqrt{(1 - x^2)}, \qquad -1 < x < 1. \quad \textbf{(3)}$$

June 06 Q4

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3. A curve has parametric equations

$$x = 7\cos t - \cos 7t, \quad y = 7\sin t - \sin 7t, \quad \frac{\pi}{8} < t < \frac{\pi}{3}.$$

(*a*) Find an expression for $\frac{dy}{dx}$ in terms of t. You need not simplify your answer. **(3)**

(*b*) Find an equation of the normal to the curve at the point where $t = \frac{\pi}{6}$.

Give your answer in its simplest exact form. **(6)**

Jan 07 Q3

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4. A curve has parametric equations

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

(*a*) Find an expression for $\frac{dy}{dx}$ in terms of t. You need not simplify your answer. **(3)**

(*b*) Find an equation of the tangent to the curve at the point where $t = \frac{\pi}{4}$.

Give your answer in the form $y = ax + b$, where a and b are constants to be determined. **(5)**

(*c*) Find a cartesian equation of the curve in the form $y^2 = f(x)$. **(4)**

June 07 Q6

5.

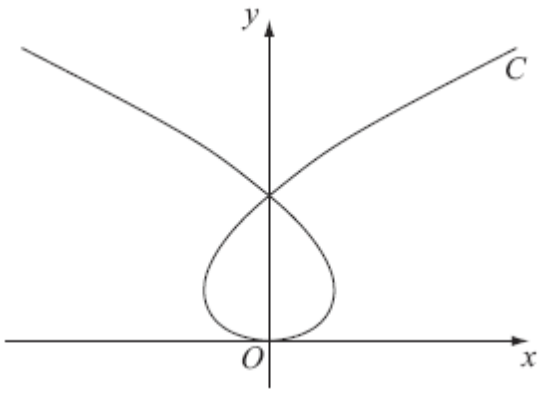

Figure 3

The curve C shown in Figure 3 has parametric equations

$$x = t^3 - 8t, \quad y = t^2$$

where t is a parameter. Given that the point A has parameter $t = -1$,

(a) find the coordinates of A. **(1)**

The line l is the tangent to C at A.

(b) Show that an equation for l is $2x - 5y - 9 = 0$. **(5)**

The line l also intersects the curve at the point B.

(c) Find the coordinates of B. **(6)**

Jan 09 Q7

6.

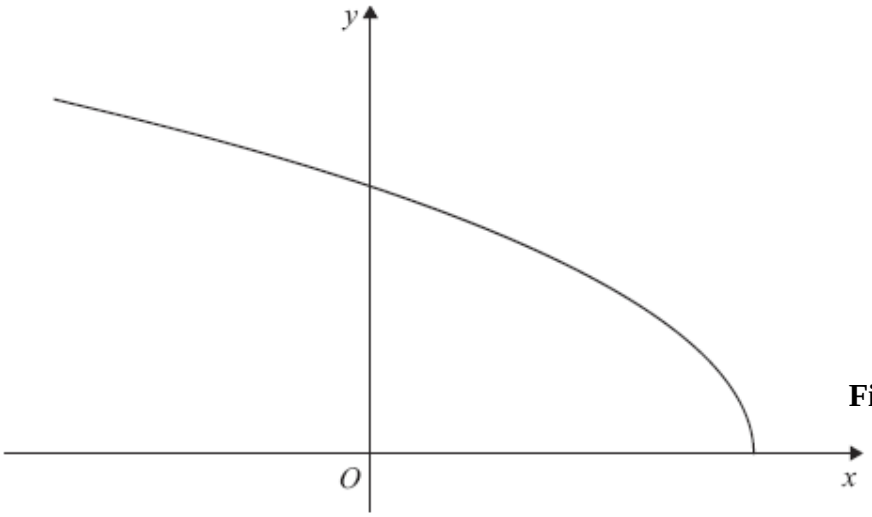

Figure 2

Figure 2 shows a sketch of the curve with parametric equations

$$x = 2\cos 2t, \quad y = 6\sin t, \quad 0 \le t \le \frac{\pi}{2}.$$

(*a*) Find the gradient of the curve at the point where $t = \frac{\pi}{3}$. **(4)**

(*b*) Find a cartesian equation of the curve in the form

$$y = \mathrm{f}(x), \quad -k \le x \le k,$$

stating the value of the constant k. **(4)**

(*c*) Write down the range of $\mathrm{f}(x)$. **(2)**

June 09 Q5

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7. A curve C has parametric equations

$$x = \sin^2 t, \; y = 2\tan t, \; 0 \le t < \frac{\pi}{2}.$$

(*a*) Find $\frac{\mathrm{d}y}{\mathrm{d}x}$ 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)**

June 10 Q4

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8. The curve C has parametric equations

$$x = \ln t, \qquad y = t^2 - 2, \qquad t > 0.$$

Find

(a) an equation of the normal to C at the point where $t = 3$, **(6)**

(b) a cartesian equation of C. **(3)**

Jan 11 Q6*(edited)*

9.

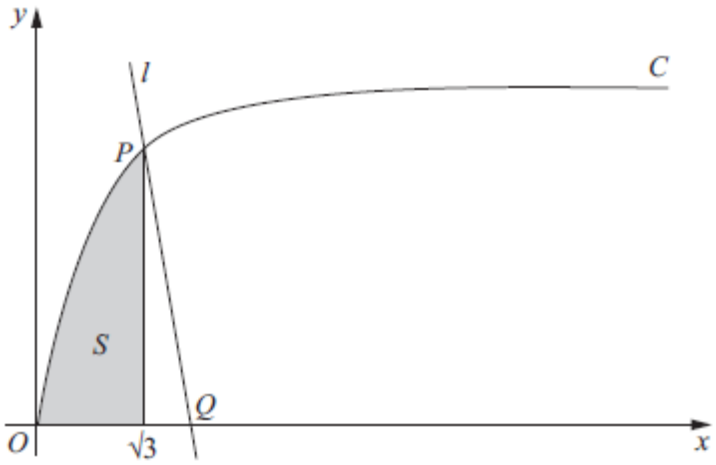

Figure 3

Figure 3 shows part of the curve C with parametric equations

$$x = \tan\theta, \qquad y = \sin\theta, \qquad 0 \leq \theta < \frac{\pi}{2}.$$

The point P lies on C and has coordinates $\left(\sqrt{3}, \frac{1}{2}\sqrt{3}\right)$.

(a) Find the value of θ at the point P. **(2)**

The line l is a normal to C at P. The normal cuts the x-axis at the point Q.

(b) Show that Q has coordinates $(k\sqrt{3}, 0)$, giving the value of the constant k. **(6)**

June 11 Q7*(edited)*
