Parametric Differentiation 2 - Edexcel Past Exam Questions

1.

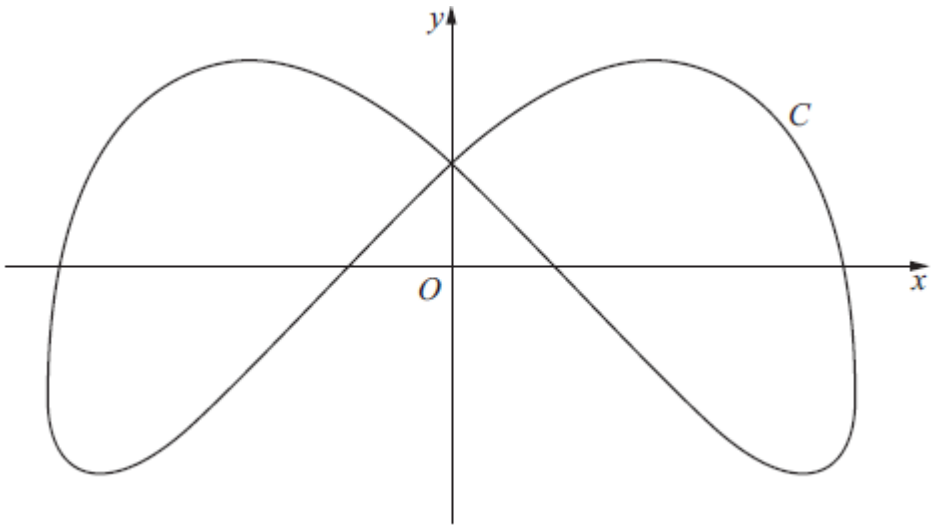

Figure 2

Figure 2 shows a sketch of the curve C with parametric equations

$$x = 4\sin\left(t + \frac{\pi}{6}\right), \qquad y = 3\cos 2t, \qquad 0 \leq t < 2\pi.$$

(*a*) Find an expression for $\frac{dy}{dx}$ in terms of t. **(3)**

(*b*) Find the coordinates of all the points on C where $\frac{dy}{dx} = 0$. **(5)**

Jan 12 Q5

2.

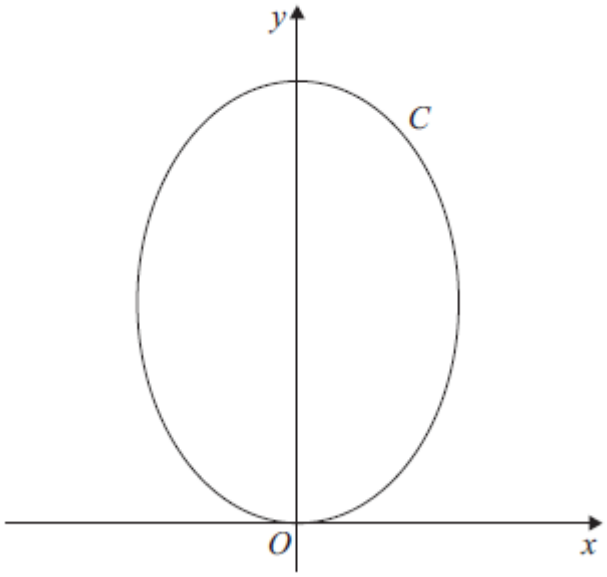

Figure 2

Figure 2 shows a sketch of the curve C with parametric equations

$$x = \sqrt{3} \sin 2t, \qquad y = 4 \cos^2 t, \qquad 0 \leq t \leq \pi.$$

(*a*) Show that $\frac{dy}{dx} = k\sqrt{3} \tan 2t$, where k is a constant to be determined. **(5)**

(*b*) Find an equation of the tangent to C at the point where $t = \frac{\pi}{3}$.

Give your answer in the form $y = ax + b$, where a and b are constants. **(4)**

(*c*) Find a cartesian equation of C. **(3)**

June 12 Q6

3. A curve C has parametric equations

$$x = 2\sin t, \qquad y = 1 - \cos 2t, \qquad -\frac{\pi}{2} \leq t \leq \frac{\pi}{2}$$

(a) Find $\frac{dy}{dx}$ at the point where $t = \frac{\pi}{6}$. **(4)**

(b) Find a cartesian equation for C in the form

$$y = f(x), \qquad -k \leq x \leq k,$$

stating the value of the constant k. **(3)**

(c) Write down the range of $f(x)$. **(2)**

June 13 Q4

4.

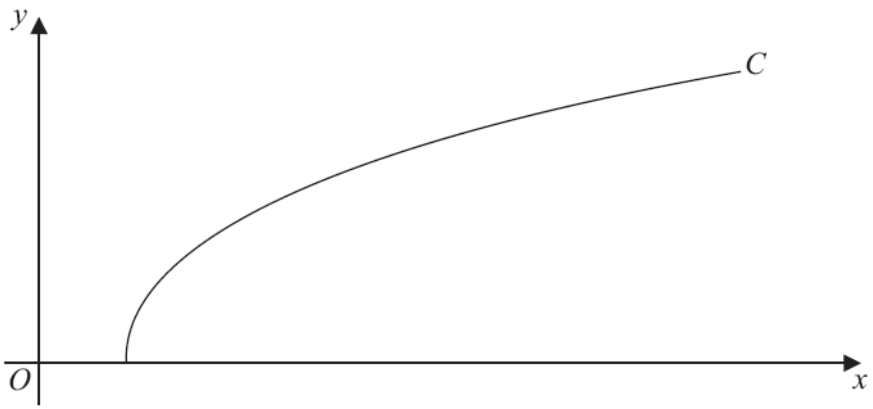

Figure 2

Figure 2 shows a sketch of the curve C with parametric equations

$$x = 27\sec^3 t, \quad y = 3\tan t, \quad 0 \leq t \leq \frac{\pi}{3}$$

(a) Find the gradient of the curve C at the point where $t = \frac{\pi}{6}$. **(4)**

(b) Show that the cartesian equation of C may be written in the form

$$y = (x^{\frac{2}{3}} - 9)^{\frac{1}{2}}, \qquad a \leq x \leq b$$

stating values of a and b. **(3)**

June 13(R) Q7 ***(edited)***

5.

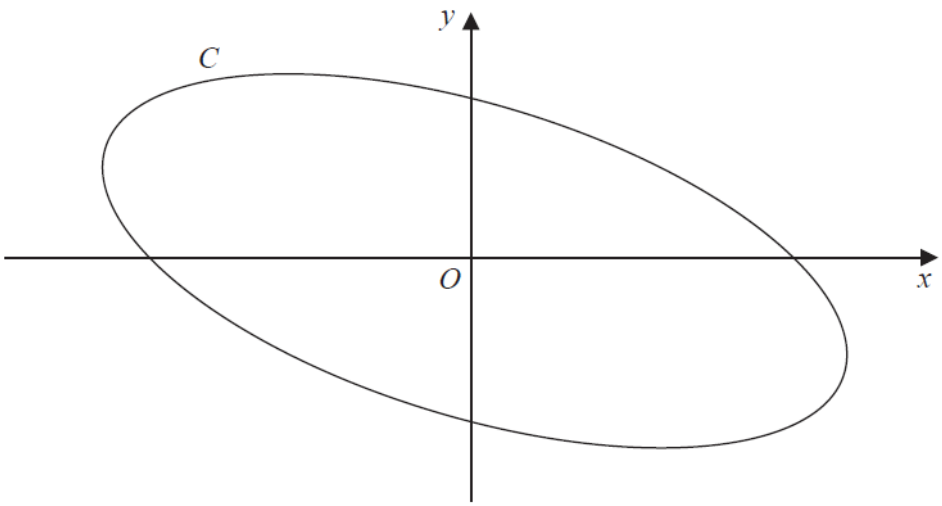

Figure 3

Figure 3 shows a sketch of the curve C with parametric equations

$$x = 4\cos\left(t + \frac{\pi}{6}\right), \qquad y = 2\sin t, \qquad 0 \leq t \leq 2\pi$$

(a) Show that

$$x + y = 2\sqrt{3}\cos t$$

(3)

(b) Show that a cartesian equation of C is

$$(x + y)^2 + ay^2 = b$$

where a and b are integers to be determined.

(2)

June 14 Q5

6.

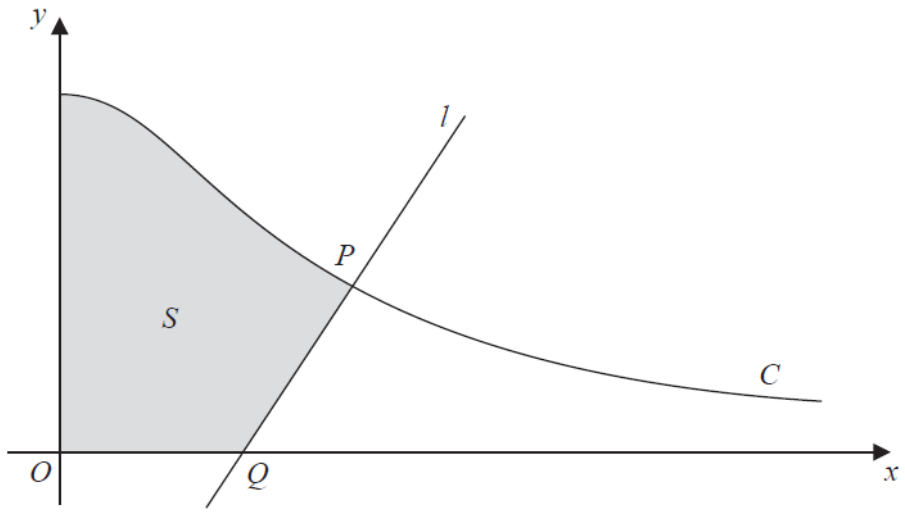

Figure 4

Figure 4 shows a sketch of part of the curve C with parametric equations

$$x = 3\tan\theta, \quad y = 4\cos^2\theta, \quad 0 \leq \theta < \frac{\pi}{2}$$

The point P lies on C and has coordinates (3, 2).

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

Find the x coordinate of the point Q. **(6)**

June 14 Q7 ***(edited)***

7.

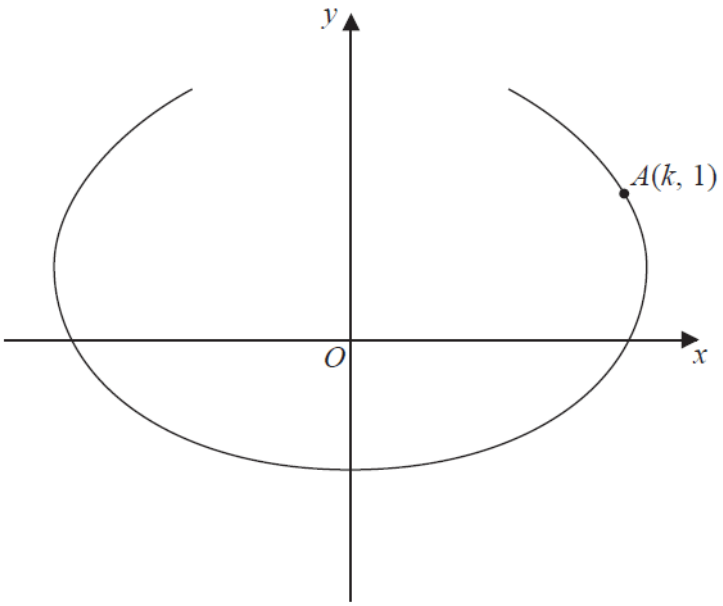

Figure 3

The curve shown in Figure 3 has parametric equations

$$x = t - 4\sin t,\ y = 1 - 2\cos t, \qquad -\frac{2\pi}{3} \le t \le \frac{2\pi}{3}$$

The point A, with coordinates $(k, 1)$, lies on the curve.

Given that $k > 0$

(a) find the exact value of k, **(2)**

(b) find the gradient of the curve at the point A. **(4)**

There is one point on the curve where the gradient is equal to $-\frac{1}{2}$.

(c) Find the value of t at this point, showing each step in your working and giving your answer to 4 decimal places.

[*Solutions based entirely on graphical or numerical methods are not acceptable.*] **(6)**

June 14(R) Q8

8. A curve C has parametric equations

$$x = 4t + 3, \qquad y = 4t + 8 + \frac{5}{2t}, \qquad t \neq 0.$$

(a) Find the value of $\frac{dy}{dx}$ at the point on C where $t = 2$, giving your answer as a fraction in its simplest form. **(3)**

(b) Show that the cartesian equation of the curve C can be written in the form

$$y = \frac{x^2 + ax + b}{x - 3}, \qquad x \neq 3,$$

where a and b are integers to be determined. **(3)**

June 15 Q5

9.

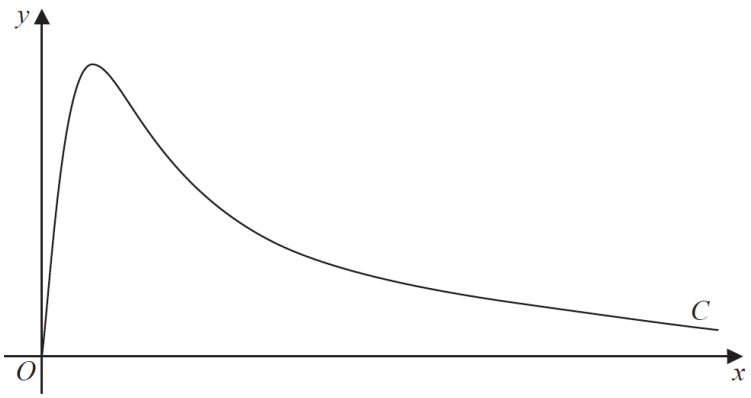

Figure 2

Figure 2 shows a sketch of the curve C with parametric equations

$$x = 4\tan t, \qquad y = 5\sqrt{3}\sin 2t, \quad 0 \leq t < \frac{\pi}{2}.$$

The point P lies on C and has coordinates $\left(4\sqrt{3}, \frac{15}{2}\right)$.

(a) Find the exact value of $\frac{dy}{dx}$ at the point P.
Give your answer as a simplified surd. **(4)**

The point Q lies on the curve C, where $\frac{dy}{dx} = 0$.

(b) Find the exact coordinates of the point Q. **(2)**

June 16 Q5

10. The curve C has parametric equations

$$x = 3t - 4, \quad y = 5 - \frac{6}{t}, \quad t > 0$$

(a) Find $\frac{dy}{dx}$ in terms of t **(2)**

The point P lies on C where $t = \frac{1}{2}$

(b) Find the equation of the tangent to C at the point P. Give your answer in the form $y = px + q$, where p and q are integers to be determined. **(3)**

(c) Show that the cartesian equation for C can be written in the form

$$y = \frac{ax + b}{x + 4}, \quad x > -4$$

where a and b are integers to be determined. **(3)**

June 17 Q1