PARAMETRIC EQUATIONS

A2 Unit 3: Pure Mathematics B

WJEC past paper questions: 2010 – 2017

Total marks available 74 (approximately 1 hour 30 minutes)

1.

The parametric equations of the curve C are

$$x = \frac{2}{t},\ y = 4t.$$

(a) Show that the tangent to C at the point P with parameter p has equation

$$y = -2p^2x + 8p.$$ [4]

(b) The tangent to C at the point P passes through the point (2, 3). Show that P can be one of two points. Find the coordinates of each of these two points. [4]

(Summer 10)

2.

The curve C has the parametric equations

$$x = 3\cos t,\ y = 4\sin t.$$

The point P lies on C and has parameter p.

(a) Show that the equation of the tangent to C at the point P is

$$(3\sin p)y + (4\cos p)x - 12 = 0.$$ [5]

(b) The tangent to C at the point P meets the x-axis at the point A and the y-axis at the point B. Given that $p = \frac{\pi}{6}$,

(i) find the coordinates of A and B,

(ii) show that the exact length of AB is $2\sqrt{19}$. [4]

(Summer 11)

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3. The parametric equations of the curve C are $x = t^2$, $y = 2t$.

(a) Show that the normal to C at the point P with parameter p has equation

$$y + px = p^3 + 2p.$$ [5]

(b) The normal to C at the point P intersects C again at the point with parameter 3.

(i) Show that $p^3 - 7p - 6 = 0$.

(ii) Hence show that P can be one of two points. Find the coordinates of each of these two points. [6]

(Summer 12)

4. The curve C has the parametric equations

$$x = at,\ y = \frac{b}{t},$$

where a, b are positive constants.
The point P lies on C and has parameter p.

(a) Show that the equation of the tangent to C at the point P is

$$ap^2y + bx - 2abp = 0.$$ [5]

(b) The tangent to C at the point P meets the x-axis at the point A and the y-axis at the point B. Find the area of triangle AOB, where O denotes the origin. Give your answer in its simplest form. [3]

(c) The point D has coordinates $(2a, b)$. Show that there is no point P on C such that the tangent to C at the point P passes through D. [3]

(Summer 13)

5. The curve C has the parametric equations $x = 2t$, $y = 5t^3$. The point P lies on C and has parameter p.

(a) Show that the equation of the tangent to C at the point P is

$$2y = 15p^2x - 20p^3.$$ [4]

(b) The tangent to C at the point P intersects C again at the point $Q(2q, 5q^3)$. Given that $p = 1$, show that q satisfies the equation

$$q^3 - 3q + 2 = 0.$$

Hence find the value of q. [5]

(Summer 14)

6\.

The parametric equations of the curve *C* are $x = at^2$, $y = 2at$, where a is a positive constant. The points *P* and *Q* lie on *C* and have parameters p and q respectively.

(a) Simplifying your answer in each case, find

(i) the gradient of the tangent to *C* at the point *P*,

(ii) the equation of the tangent to *C* at the point *P*. [4]

(b) (i) Find an expression, in its simplest form, for the gradient of the line *PQ*.

(ii) Explain how you could use the answer of *(b)*(i) to derive the gradient of the tangent to *C* at the point *P*. [4]

(Summer 15)

7\.

The parametric equations of the curve *C* are

$$x = \frac{3}{t}, \quad y = 4t.$$

(a) Show that the tangent to *C* at the point *P* with parameter p has equation

$$3y = -4p^2x + 24p. \quad [4]$$

(b) The tangent to *C* at the point *P* passes through the point (1, 9). Show that *P* can be one of two points. Find the coordinates of each of these two points. [4]

(Summer 16)

8\.

The curve *C* has the parametric equations $x = at^2$, $y = bt^3$, where a, b are positive constants. The point *P* lies on *C* and has parameter p.

(a) Show that the equation of the tangent to *C* at the point *P* is

$$2ay = 3bpx - abp^3. \quad [5]$$

(b) The tangent to *C* at the point *P* intersects *C* again at the point with coordinates $(4a, 8b)$. Show that p satisfies the equation

$$p^3 - 12p + 16 = 0.$$

Hence find the value of p. [5]

(Summer 17)