APPLICATIONS OF DIFFERENTIATION:

TANGENTS & NORMALS

AS Unit 1: Pure Mathematics A

WJEC past paper questions: 2010 – 2017

Total marks available 95 (approximately 1 hour 55 minutes)

1. The curve C has equation

$$y = \frac{6}{x^2} + \frac{7x}{4} - 2.$$

The point P has coordinates (2, 3) and lies on C. Find the equation of the **normal** to C at P. (6)

(January 10)

2. The curve C has equation

$$y = x^2 - 8x + 10.$$

a) The point P has coordinates (3, -5) and lies on C. Find the equation of the **normal** to C at P. (5)

b) The point Q lies on C and is such that the **tangent** to C at Q has equation

$$y = 4x + c,$$

where c is a constant. Find the coordinates of Q and the value of c. (4)

(Summer 10)

3. The curve C has equation

$$y = x^2 - 6x + 7.$$

a) The point P, whose x-coordinate is 5, lies on the curve C. Find the equation of the tangent to C at P. (5)

The line L has equation $y = \frac{1}{2}x - 2$.

b) i) Find the coordinates of the two points of intersection of C and L.
ii) Verify that L is in fact the normal to C at one of these points of intersection. (8)

(January 11)

4. The curve C has equation

$$y = 3x^2 - 9x + 1.$$

The point P, whose x-coordinate is 2, lies on the curve C. Find the equation of the tangent to C at P. (5)

(May 11)

5. The curve C has equation

$$y = 2x^2 - 8x + 13.$$

The point P, whose x-coordinate is 3, lies on the curve C. Find the equation of the **normal** to C at P. (6)

(January 12)

6. The curve C has equation

$$y = 2x^2 - 11x + 13.$$

a) The point P has coordinates (2, -1) and lies on C. Find the equation of the **tangent** to C at P. (4)

b) The point Q lies on C and is such that the gradient of the **normal** to C at Q is $\frac{-1}{9}$. Find the x-coordinate of Q. (3)

(Summer 12)

7. The curve C has equation

$$y = 3x^2 - 14x + 13.$$

The point P, whose x-coordinate is 3, lies on the curve C. Find the equation of the **tangent** to C at P. (5)

(January 13)

8. The curve C has equation

$$y = 2x^2 - 10x + 7.$$

a) The point P has coordinates (3, -5) and lies on C. Find the equation of the **normal** to C at P. (5)

b) The point Q lies on C and is such that the **tangent** to C at Q is parallel to the x-axis. Find the x-coordinate of Q. (2)

(Summer 13)

9. The curve C has equation

$$y = \frac{20}{x} + 2x^2 - 11.$$

The point P has coordinates (2, 7) and lies on C. Find the equation of the **normal** to C at P. (6)

(January 14)

10. The curve C has equation

$$y = x^2 - 8x + 14.$$

a) The point P has coordinates (6, 2) and lies on C. Find the equation of the **normal** to C at P. (5)

b) The point Q lies on C is such that the **tangent** to C at Q has equation

$$y = 2x + c,$$

where c is a constant. Find the coordinates of Q and the value of c. (4)

(Summer 14)

11. The curve C has equation

$$y = x^3 - x^2 - 13x + 18.$$

a) The point P whose x-coordinate is 2, lies on C. Find the equation of the **normal** to C at P. (6)

b) The point Q whose x-coordinate is a, lies on C is such that the **tangent** to C at Q is parallel to the line with equation

$$y = -8x + 7.$$

Find the possible values of a. (3)

(Summer 15)

12. The curve C has equation

$$y = \frac{12}{x^2} + 7x - 6.$$

The point P, whose x-coordinate is 2, lies on C. Find the equation of the **tangent** to C at P. (6)

(Summer 16)

13. The curve C has equation

$$y = \frac{3}{4}x^2 - 4x - 10.$$

a) The point P has coordinates (6, -7) and lies on the curve C. Find the equation of the **tangent** to C at P. (4)

b) The point Q lies on C and is such that the gradient of the **normal** to C at Q is -2. Find the x-coordinate of Q. (3)

(Summer 17)