APPLICATIONS OF DIFFERENTIATION: STATIONARY POINTS

AS Unit 1: Pure Mathematics A

WJEC past paper questions: 2010 – 2017

Total marks available 75 (approximately 1 hour 30 minutes)

1. The curve C has equation

$$y = x^3 - 6x^2 + 20$$

a) Find the coordinates and the nature of each of the stationary points of C. (6)

b) Sketch C, indicating the coordinates of each of the stationary points. (2)

c) Given that the equation

$$x^3 - 6x^2 + 20 = k$$

has three **distinct** real roots, find the range of possible values for k. (2)

(January 10)

2. The curve C has equation

$$y = \frac{1}{2}x^3 - 6x + 3$$

Find the coordinates and the nature of each of the stationary points of C. (6)

(Summer 10)

3. The curve C has equation

$$y = x^3 + kx^2 - 9x - 10,$$

where k is a constant. The two stationary points on the graph of C are denoted by Q and R. The x-coordinate of Q is -1.

a) Find $\frac{dy}{dx}$ and hence show that $k = -3$. (3)

b) Find the x-coordinate of R. (2)

c) Determine the nature of each of the stationary points Q and R. (2)

(January 11)

4. The curve C has equation

$$y = x^3 - 6x^2 + 12x - 9$$

a) Show that C has only one stationary point. Find the coordinates of this point. (4)

b) Verify that this stationary point is a point of inflection. (2)

(January 12)

5. The curve C has equation

$$y = x^3 + 3x^2 - 1,$$

a) Find the coordinates and the nature of each of the stationary points of C. (6)

b) Sketch C, indicating the coordinates of each of the stationary points. (2)

c) Write down the number of **positive** real roots of the equation

$$x^3 + 3x^2 - 1 = 0$$ (1)

(Summer 12)

6. The curve C has equation

$$y = x^3 - 3x^2 - 9x + 14,$$

a) Find the coordinates and the nature of each of the stationary points of C. (6)

b) Sketch C, indicating the coordinates of each of the stationary points. (2)

c) Given that the equation

$$x^3 - 3x^2 - 9x + 14 = k$$

has only one real root, find the range of possible values for k. (2)

(January 13)

7. The curve C has equation

$$y = -2x^3 + 12x^2 - 18x + 5,$$

a) Find the coordinates and the nature of each of the stationary points of C. (6)

b) Sketch C, indicating the coordinates of each of the stationary points. (2)

c) Given that the equation

$$-2x^3 + 12x^2 - 18x + 5 = k$$

has three distinct real roots, find the range of possible values for k. (2)

(January 14)

8. The curve C has equation

$$y = x^3 + 9x^2 + 27x + 31$$

a) Show that C has only one stationary point. Find the coordinates of this point. (4)

b) Verify that this stationary point is a point of inflection. (2)

c) Sketch the graph of C, indicating the coordinates of its stationary point. (1)

(Summer 14)

9. The curve C has equation

$$y = x^3 - 9x^2 + 15x + 10$$

a) i) Find the coordinates of each of the stationary points of C.

ii) Determine the nature of each of these stationary points. (6)

b) Sketch C, indicating the coordinates of each of the stationary points. (2)

c) Given that the equation

$$x^3 - 9x^2 + 15x + 10 = k$$

has only one real root, find the range of possible values for k. (2)

(Summer 17)