A-Level Starter Activity

Jethwa Maths

Topic: Stationary Points Chapter Reference: Pure 1, Chapter 12	8 minutes

1. The curve $y = x^3 - 3x + 1$ is stationary at the points P and Q.

a. Find the coordinates of the points P and Q. **(4)**

b. Find the length of PQ in the form $k\sqrt{5}$ **(2)**

2a. Find the coordinates of the stationary points on the curve, $y = 2 + 9x + 3x^2 - x^3$ **(4)**

b. Determine whether each stationary point is a maximum or minimum point. **(3)**

Solutions

1a.

$\frac{dy}{dx} = 3x^2 - 3$ At stationary point, $\frac{dy}{dx} = 0$	**M1**
$3x^2 - 3 = 0$ $x^2 = 1$ $x = \pm 1$	**M1**
When $x = 1$, $y = -1$	**M1**
When $x = -1$, $y = 3$	**M1**

1b.

$PQ^2 = 2^2 + 4^2 = 20$	**M1**
$PQ = \sqrt{20} = 2\sqrt{5}$	**M1**

2a.

$\frac{dy}{dx} = 9 + 6x - 3x^2$ At stationary point, $\frac{dy}{dx} = 0$	**M1**
$9 + 6x - 3x^2 = 0$ $-3(x+1)(x-3) = 0$ $x = -1, 3$	**M1**
When $x = -1$, $y = -3$	**M1**
When $x = 3$ $y = 29$	**M1**
(-1, -3) and (3, 29)	

2b.

$\frac{d^2y}{dx^2} = 6 - 6x$	**M1**
At (-1, -3), $\frac{d^2y}{dx^2} = 6 - 6(-1) = 12$ Therefore, minimum point	**M1**
At (3, 29), $\frac{d^2y}{dx^2} = 6 - 6(3) = -12$ Therefore, maximum point	**M1**