

**Question 1**

Let:

$$f(x) = 2x^3 - 9x^2 + 12x + 1$$

- (a) Find the critical points of  $f(x)$ .
- (b) Use the second derivative test to determine whether each critical point is a local minimum, maximum, or neither.

## Question 1 - Solution

We are given:

$$f(x) = 2x^3 - 9x^2 + 12x + 1$$

(a) First derivative:

$$f'(x) = 6x^2 - 18x + 12 = 6(x^2 - 3x + 2) = 6(x - 1)(x - 2)$$

**Critical points:**  $x = 1, 2$

(b) Use the second derivative:

$$f''(x) = \frac{d}{dx}(f'(x)) = 12x - 18$$

Evaluate at each critical point:

$$f''(1) = 12(1) - 18 = -6 \Rightarrow \text{local maximum at } x = 1$$

$$f''(2) = 12(2) - 18 = 6 \Rightarrow \text{local minimum at } x = 2$$

**Answer:**

Local maximum at  $x = 1$

Local minimum at  $x = 2$

Graph of  $f(x)$ 