

Name of Student

Instructor's Name

Course Code

Date

Calculus (UoL Worldwide style)

1) Critical points and classification

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

Critical points where  $f'(x) = 0$ :  $x = 1$  and  $x = 3$ .

Second derivative:  $f''(x) = 6x - 12$ .

- At  $x = 1$ :  $f''(1) = -6 < 0 \Rightarrow$  local maximum.

$$f(1) = 1 - 6 + 9 + 1 = 5 \Rightarrow (1, 5).$$

- At  $x = 3$ :  $f''(3) = 6 > 0 \Rightarrow$  local minimum.

$$f(3) = 27 - 54 + 27 + 1 = 1 \Rightarrow (3, 1).$$

Local max at (1,5); local min at (3,1).

2) Definite integral

$$\int f(x) dx = \frac{x^4}{4} - 2x^3 + \frac{9}{2}x^2 + x + C.$$

Evaluate from 0 to 3:

$$\left[\frac{3^4}{4} - 2 \cdot 3^3 + \frac{9}{2} \cdot 3^2 + 3\right] - 0 = \left[\frac{81}{4} - 54 + \frac{81}{2} + 3\right].$$

Convert to quarters:

$$\frac{81}{4} - \frac{216}{4} + \frac{162}{4} + \frac{12}{4} = \frac{39}{4}.$$

Answer:  $\int_0^3 f(x) dx = \frac{39}{4}.$