## Single Variable Unconstrained Optimization

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ECON 441: Introduction to Mathematical Economics

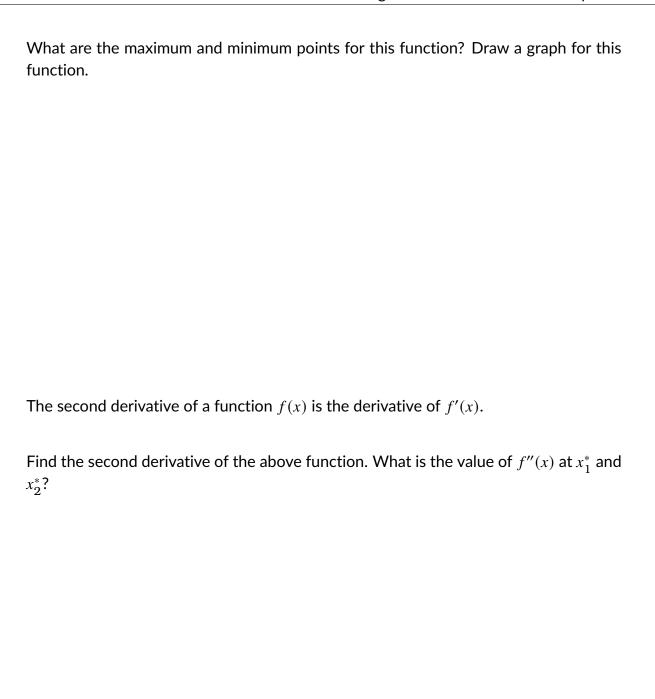
A point  $x_0$  is a critical/stationary point if  $f'(x_0) = 0$ .

Find all the critical points for the following function:

$$f(x) = x^3 - 12x^2 + 36x + 8$$

Denote the two critical points by  $x_1^*$  and  $x_2^*$ .

- What is the sign of f'(x) for  $x < x_1^*$  in the immediate neighborhood of  $x_1^*$ ?
- What is the sign of f'(x) for  $x > x_1^*$  in the immediate neighborhood of  $x_1^*$ ?
- What is the sign of f'(x) for  $x < x_2^*$  in the immediate neighborhood of  $x_2^*$ ?
- What is the sign of f'(x) for  $x < x_2^*$  in the immediate neighborhood of  $x_2^*$ ?



Given the quadratic profit function

$$\pi(Q) = hQ^2 + jQ + k$$

What parameter restrictions are called for to reflect the following assumptions:

- (a). If nothing is produced, the profit will be negative (because of fixed costs).
- (b). The profit function is strictly concave ( $\pi''(Q) < 0$  for all Q).

(c). The maximum profit occurs at a positive output level  $Q^*$ .