

Find the absolute extrema of the following functions.

1) $f(x) = \frac{x}{x-2}$ in the interval of $[3,5]$ 2) $f(x) = \frac{x^2}{x^2+3}$ in the interval of $[-1,1]$

3) $f(x) = -x^2 + 3x$ in the interval from $[0,3]$ 4) $f(x) = -x^3 - 12x$ in the interval $[0,4]$

5) **Inventory Cost** A retailer has determined that the cost C of ordering and storing x units of a product is

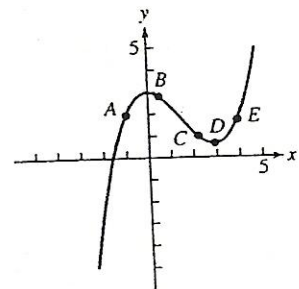
$$C = 2x + \frac{300,000}{x}, \quad 1 \leq x \leq 300.$$

The delivery truck can bring at most 300 units per order. Find the order size that will minimize cost. Could the cost be decreased if the truck were replaced with one that could bring at most 400 units? Explain.

6. For the graph shown, at which point is it true that

$$\frac{dy}{dx} < 0 \text{ and } \frac{d^2y}{dx^2} > 0?$$

- (A) A (B) B (C) C (D) D (E) E



7) **Vertical Motion** The height of a ball t seconds after it is thrown upward from a height of 32 feet and with an initial velocity of 48 feet per second is $f(t) = -16t^2 + 48t + 32$.

- (a) Verify that $f(1) = f(2)$.
 (b) According to Rolle's Theorem, what must be the velocity at some time in the interval $(1, 2)$? Find that time.

8) A company introduces a new product for which the number of units sold S is

$$S(t) = 200 \left(5 - \frac{9}{2+t} \right) \text{ where } t \text{ is the time in months.}$$

- (a) Find the average number of products sold during the 1st year.
 (b) Is it possible for the company to sell 500 products between month 1 and month 7? Justify.
 (c) Use the intermediate value theorem to determine the month the company sold the number of products found in part (a)

9) $f(x) = \frac{x^2 - 3x - 4}{x - 2}$ Find the relative extrema and any points of inflection.

10) $f(x) = x^4 - 32x + 4$ Find the relative extrema and any points of inflection.

11) The graph of a function $y = f(x)$ is shown.

Which of the following are true for the function f ?

- I. $f'(2)$ is defined.
 II. $\lim_{x \rightarrow 2^+} f(x) = \lim_{x \rightarrow 2^-} f(x)$
 III. $f'(x) < 0$ for all x in the open interval $(-1, 2)$.

- (A) I only (B) II only (C) III only
 (D) II and III (E) I, II, and III

