

Unit #10: Applications of Differentiation

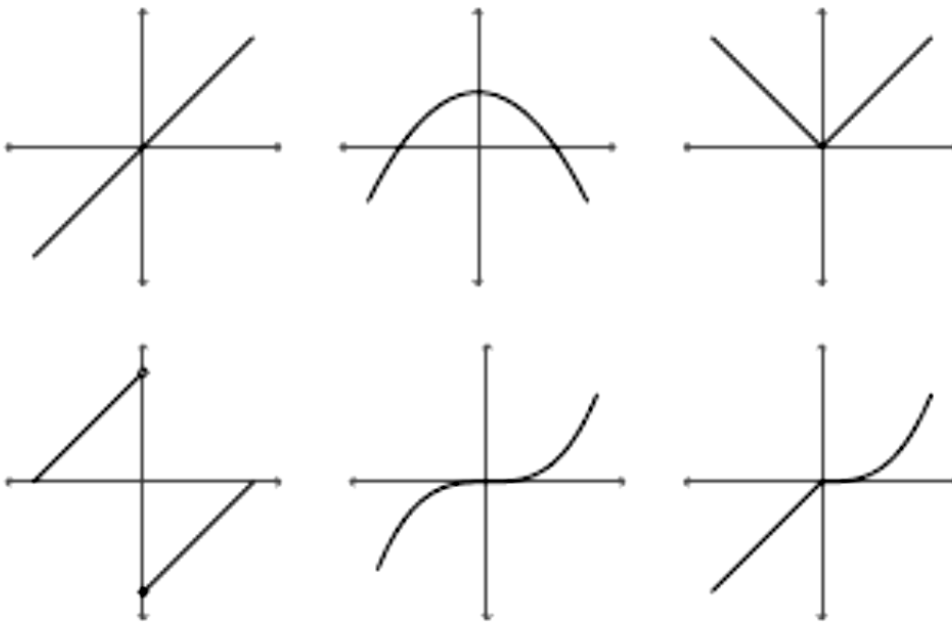
Topic: Extreme Values

Objective: SWBAT identify the extrema of a function on an interval by using the derivative.

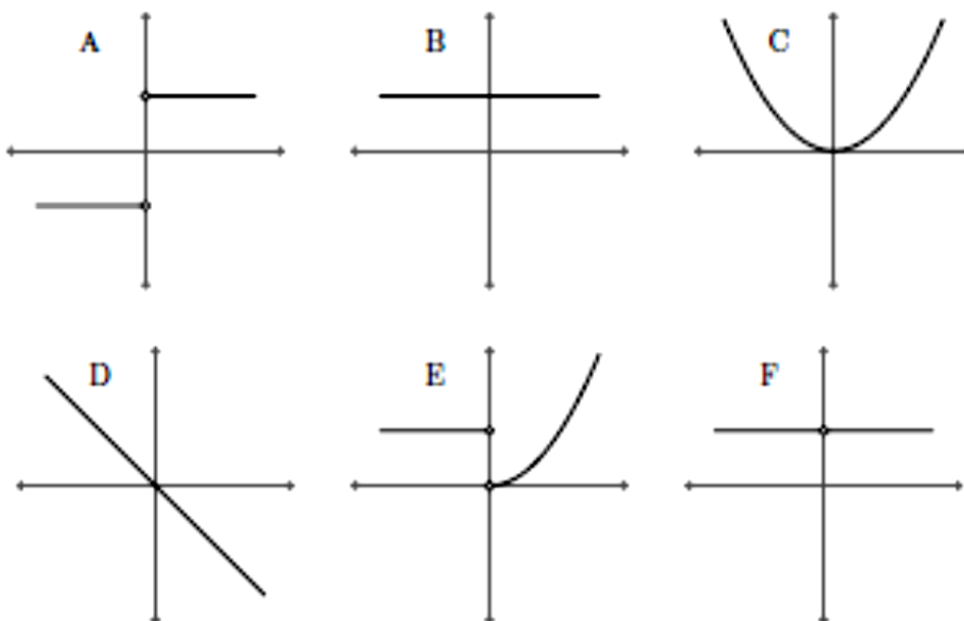
Warm Up #3:

Six graphs of functions are below, along with six graphs of derivatives. Match the graph of each function with the graph of its derivative.

Original Functions:



Their derivatives:



Now that we know how to find derivatives, we will use them to analyze the graphs of functions.

Example #1: Given the function $f(x) = x^5 - \frac{5}{3}x^3 - 1$ on the interval $[-2, 2]$.

(a) Find all the critical values of $f(x)$.

(b) Determine whether each critical value found in part (a) is a relative minimum, maximum, or neither. Explain your reasoning.

(c) Does $f(x)$ have an absolute maximum or minimum point? Show the work that justifies your answer.

Example #2: Given $g(x) = \sqrt[3]{x^2 - x - 2}$ on the interval $[-3, 6]$.

- (a) Find all the critical values of $f(x)$. (HINT: Be Verrrrrrry Observant!!)
- (b) Determine whether each critical value found in part (a) is a relative minimum, maximum, or neither. Explain your reasoning.
- (c) Does $f(x)$ have an absolute maximum or minimum point? Show the work that justifies your answer.

Problem Set #3: Find all absolute and relative extrema of the following functions. Show all necessary steps. **NO CALCULATOR!!**

1) $f(t) = 5t^{2/3} + t^{5/3}$; $[-1, 8]$

2) $y = xe^{2x}$; $[-1, 2]$

3) $g(t) = \sqrt{t}(1-t)$; $t \geq 0$

4) $f(x) = \sqrt[3]{x^2 - x}$; $(-\infty, \infty)$

$$5) y = 2x^3 - 3x^2 - 12x + 1; [-2,3]$$

$$6) f(x) = (x^2 - 1)^3; [-1,2]$$

$$7) f(x) = 3x^{2/3} - 2x ; [-1,2]$$

$$8) g(x) = \frac{2x}{x^2 + 1} ; [-2,2]$$

Answer Key

1) $x = 0$ rel min abs min is 0 at $x = 0$ abs max is 52 at $x = 8$	2) $x = -\frac{1}{2}$ rel min abs min is $-\frac{1}{e^2}$ at $x = -1$ abs max is $2e^4$ at $x = 2$
3) $x = \frac{1}{3}$ rel max abs min is 0 at $x = 0$ no abs max	4) $x = \frac{1}{2}$ rel min, $x = 0$ and 1 neither no abs min no abs max
5) $x = 2$ rel min and $x = -1$ rel max abs min is -19 at $x = 2$ abs max is 8 at $x = -1$	6) $x = 0$ rel min and $x = 1$ neither abs min is -1 at $x = 0$ abs max is 27 at $x = 2$
7) $x = 0$ rel min and $x = 1$ rel max abs min at $x = 2$ abs max is at $x = -1$	8) $x = -1$ rel min and $x = 1$ rel max abs min is -2 at $x = -1$ abs max is 2 at $x = 1$