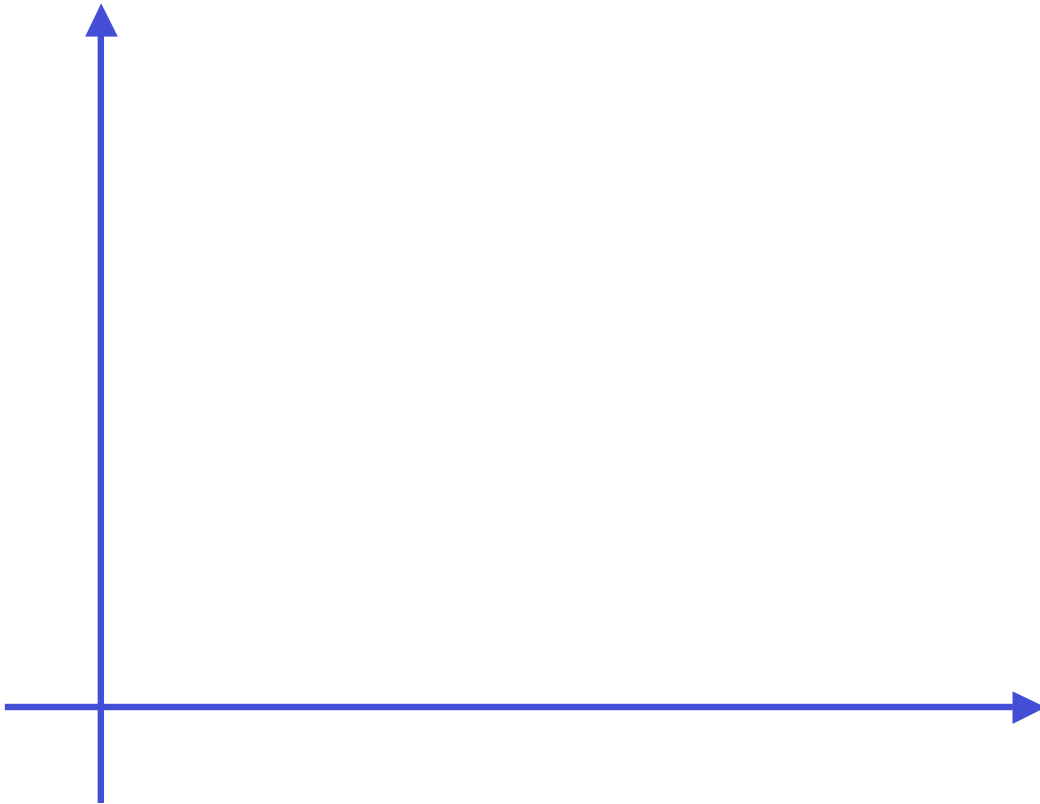


WARM UP EXERCISE

Graph the following function on $[0,10,000]$.

$$R(x) = 10x - .001x^2$$

Find its derivative.



§12.5&6 Absolute Maxima and Minima and Maximizing Profit

The student will learn about:

- **absolute maxima,**
- **absolute minima, and**
- **Application to Maximizing profit: Profit is maximized when marginal revenue equals marginal cost.**

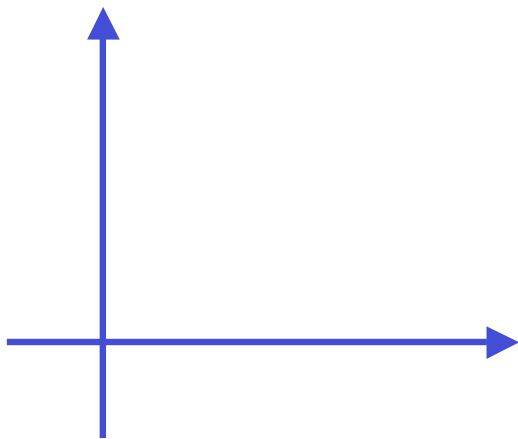
Absolute Maxima and Minima.

Definition: $f(c)$ is an absolute maxima of f if $f(c) \geq f(x)$ for all x in the domain of f .

Definition: $f(c)$ is an absolute minima of f if $f(c) \leq f(x)$ for all x in the domain of f .

Find the absolute minimum and maximum value of,

$$f(x) = .5(x - 3)^2 + 2$$

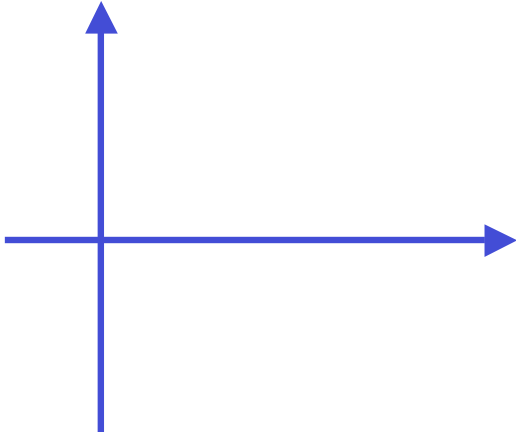


What do you notice about $f'(x)$ at the max/min?

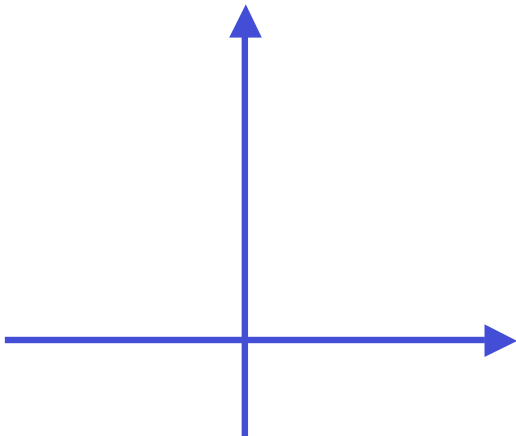
Absolute Maxima and Minima.

Find the absolute minimum and maximum value of:

$$f(x) = -.5(x - 3)^2 + 2$$



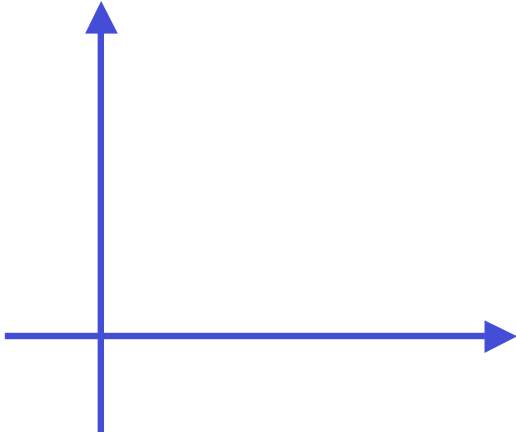
$$f(x) = (x + 1)(x)(x - 1)$$



Absolute Maxima and Minima.

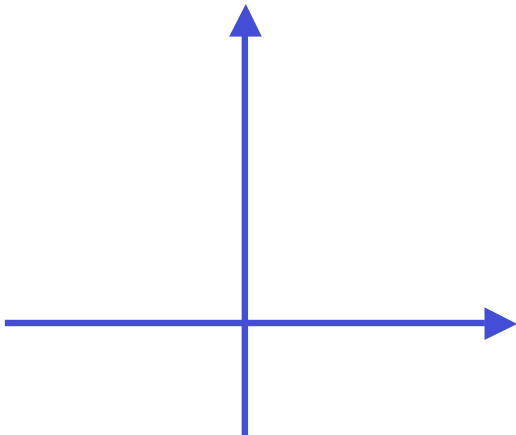
Find the absolute minimum and maximum value of $f(x)$ on the interval $[-1,1]$:

$$f(x) = \frac{2x - 1}{x - 2}$$



Find the absolute minimum and maximum value of $f(x)$ on the interval $[-1,1]$:

$$f(x) = (x + 1)(x)(x - 1)$$



What do you notice about $f'(x)$ at the max/min?

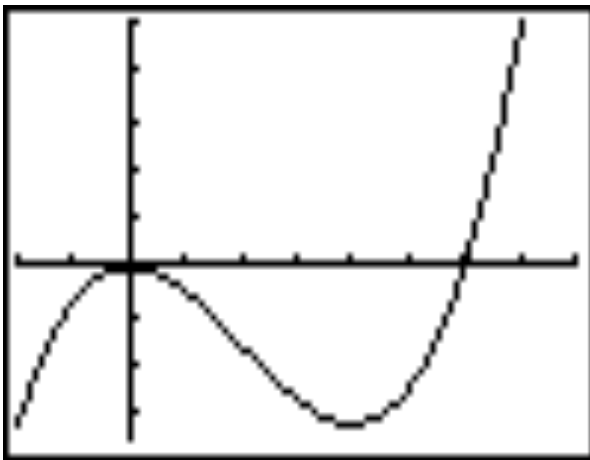
Extreme Value Theorem

Theorem 1. Extreme Value Theorem.

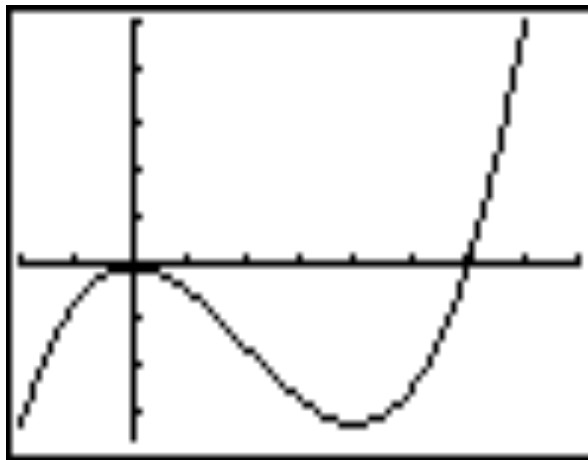
A function f that is continuous on a closed interval $[a, b]$ has both an absolute maximum value and an absolute minimum value on that interval.

Find the absolute minimum and maximum value of $f(x)$ on the intervals below:

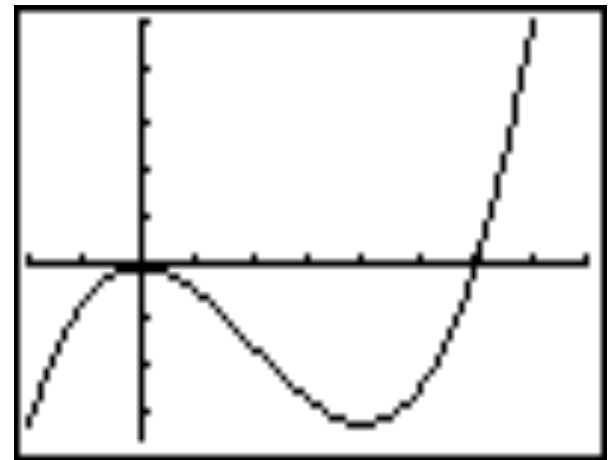
$$f(x) = x^3 - 6x^2$$



$[-1, 5]$



$[-1, 7]$



$[1, 4]$

Steps in finding absolute maximum and minimum values

Definition. The values of x in the domain of f where $f'(x) = 0$ or where $f'(x)$ does not exist are called the critical values of f .

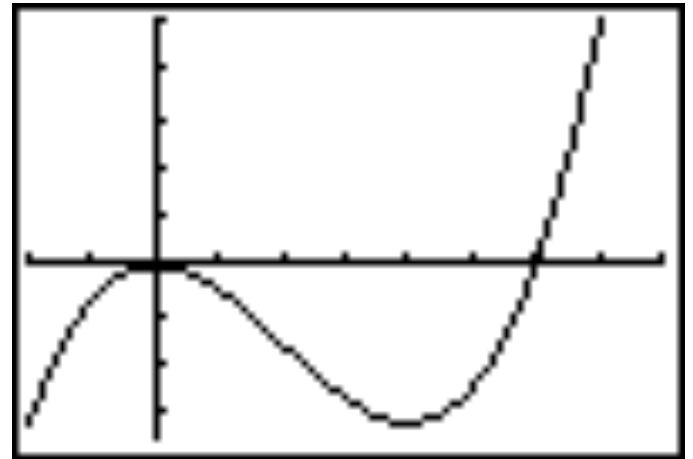
Theorem 2. Absolute extrema (if they exist) must always occur at critical values of the derivative **or** at end points.

- a. Check to make sure f is continuous over $[a, b]$.
- b. Find the critical values of f in the interval $[a, b]$.
- c. Evaluate f at the end points a and b and at the critical values found in step b .
- d. The absolute maximum of $f(x)$ on $[a, b]$ is the largest of the values found in step c .

Example 2

Use algebra to find the **absolute** maximum and **absolute** minimum value on $[-1, 7]$ of,

$$f(x) = x^3 - 6x^2$$



Maximize Revenue

An office supply company sells x mechanical pencils per year at $\$p$ per pencil.

The price demand equation for these pencils is $p = 10 - .001x$.

What price should the company charge for these pencils to maximize their revenue?

What is the maximum revenue?

Maximize Profit

An office supply company sells x mechanical pencils per year at $\$p$ per pencil.

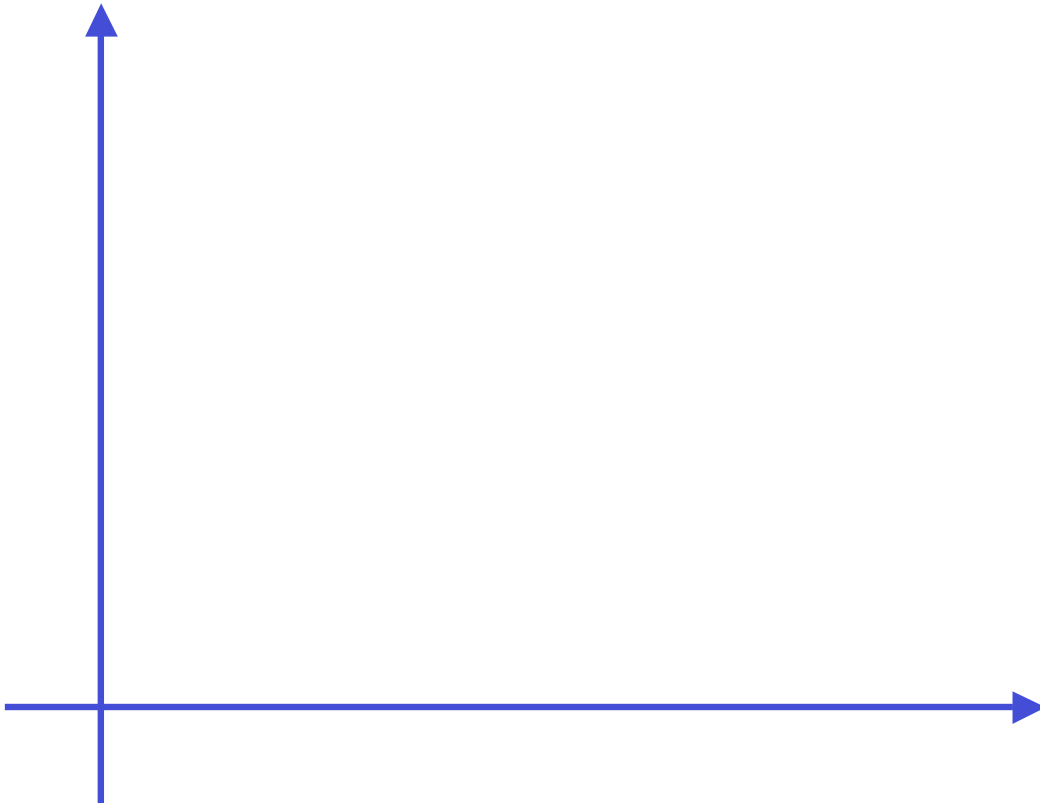
The price demand equation for these pencils is $p = 10 - .001x$.

Suppose further that the total annual cost of manufacturing x mechanical pencils is $C(x) = 5000 + 2x$.

What is the company's maximum profit?

What should the company charge for each pencil and how many pencils should be produced?

Maximize Profit... work space



Maximize Profit... work space
