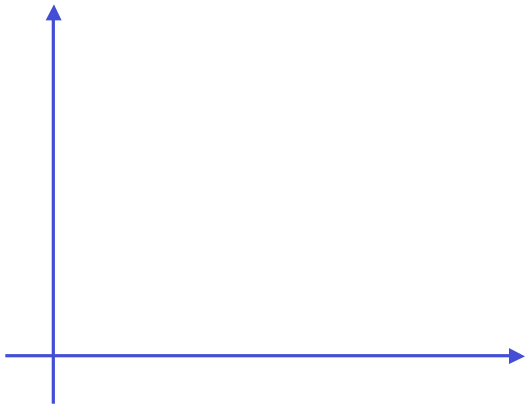
WARM UP EXERCISE

Find the absolute maximum/minimum for the following function on [0,10,000].

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



1

§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.**

2

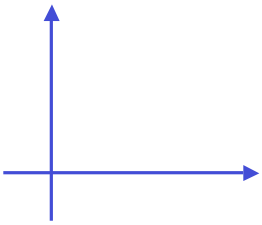
Absolute Maxima and Minima.

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,

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



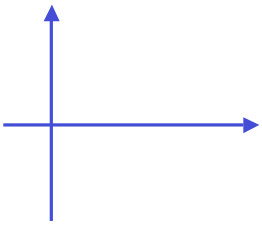
What do you notice about $f'(x)$ at the max/min?

3

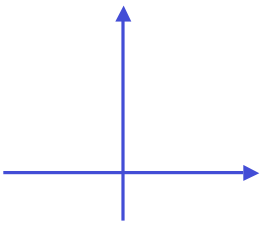
Absolute Maxima and Minima.

Find the absolute minimum and maximum value of:

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



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

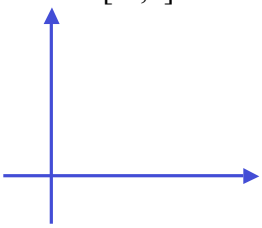


4

Absolute Maxima and Minima.

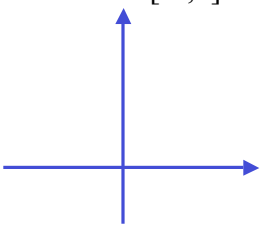
Find the absolute minimum and maximum value of *f(x)* on the interval [-1,1]:

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



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?

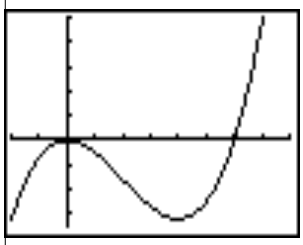
5

Extreme Value Theorem

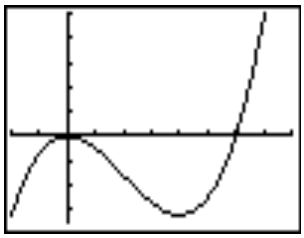
Theorem 1. Extreme Value Theorem.

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.

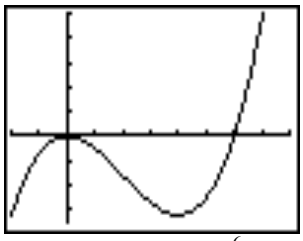
Find the absolute minimum and maximum value of *f(x)* on the intervals below: $f(x) = x^3 - 6x^2$



[-1,5]



[-1,7]



[1,4]

6

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.

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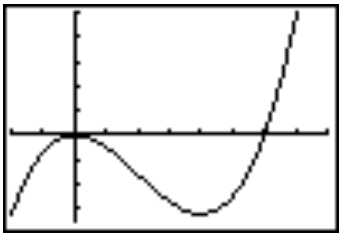
Example 2

Use algebra to find the absolute maximum and absolute minimum value on [-1, 7] of, $f(x) = x^3 - 6x^2$



8

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?

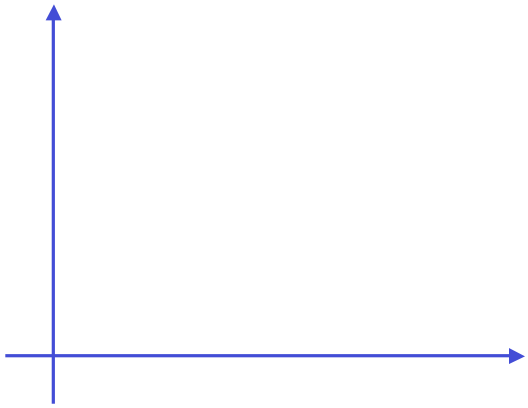
9

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 manufactureing 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?

10

Maximize Profit… work space



11

Maximize Profit… work space

12