Closing *Thurs*: 4.1(1) and 4.1(2)
Exam 1 is next **Tuesday**!
covers 3.1-3.6, 3.9-3.10, 10.2, 4.1

4.1: Critical Points and Absolute Max/Min

Given $y = f(x)$.
The first questions we always ask:

1. What is the domain?
   (What inputs are allowed?)

2. What are the "critical numbers"?
   A **critical number** is a number $x = a$
   that is <u>in the domain</u> and either
   (a) $f'(a) = 0$, or
   (b) $f'(a)$ does not exist.

Entry Task:

$$f(x) = 4x + \frac{1}{x}$$

a) What is the domain?
b) What are the critical numbers?

Example (from homework):

$$y = x^3 + 3x^2 - 72x$$

a) What is the domain?

b) What are the critical numbers?

Example:

$$g(x) = 3x - x^{1/3}$$

a) What is the domain?

b) What are the critical numbers?

Absolute Max/Min

The **absolute max** (or **global** max) is the highest *y*-value on the interval.

The **absolute min** (or **global** min) is the lowest *y*-value on the interval.

Procedure to find absolute max/min:

1. Find critical numbers.
2. Plug endpoints and critical numbers into the function.

<u>Big, key, awesome observation</u>:

(*Extreme Value Theorem*)

The absolute max/min always occur at critical numbers or endpoints!

Example (like HW):

Find the abs. max and min of $f(x) = x^3 + 3x^2$ on $[-1,2]$.

Small Note:
The **value** of a function, $y = f(x)$, is the output y-value. A question asking for the absolute max of a function is asking for the **y-value**. (The x-value is the location where the max *occurs*)

Example:
Find the abs. max and min of $f(x) = x\ln(x)$ on $[1, e]$.

Example:

Find the abs. max and min of

$f(x) = x\sqrt{1-x}$ on $[-1,1]$.