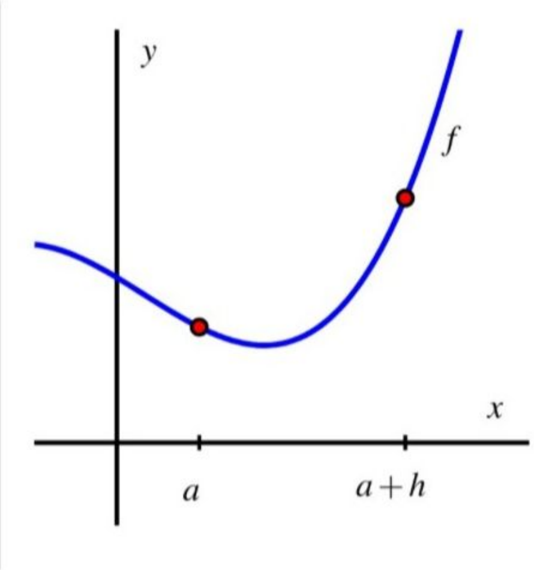
MTH 201 -- Calculus
Module 2A: The derivative of a function at a point

September 14-15, 2020

Agenda for today

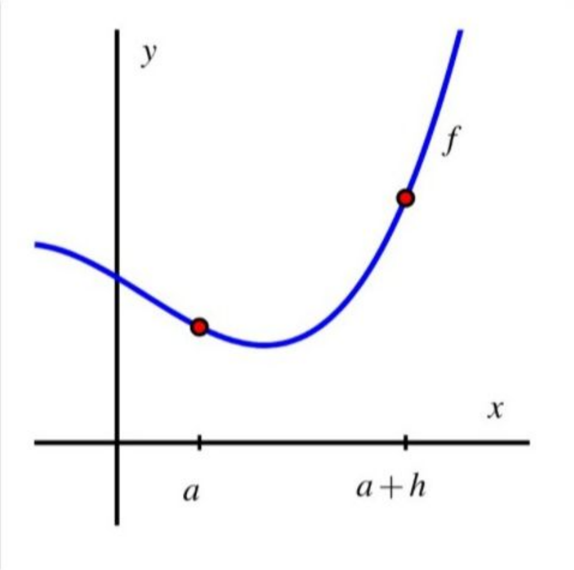
- Polling activity over Daily Preparation
- Q&A time
- The definition of the derivative, and a couple of computations
- Activity: Using limits to find derivatives
- Bonus activity: Applying the concept to velocities
- Quick (ungraded) quiz
- Feedback time

The slope of the line that connects the two red points in this graph is



- 1
- $f(a+h)$
- $f(a+h)-f(a)$
- $\frac{f(a+h)}{h}$
- $\frac{f(a+h)-f(a)}{h}$

The slope of the line that connects the two red points in this graph is the same thing as



The instantaneous rate of change in f(x) at x = a+h

The instantaneous rate of change in f(x) at x = a

The average rate of change in f(x) from x = a to x = a+h

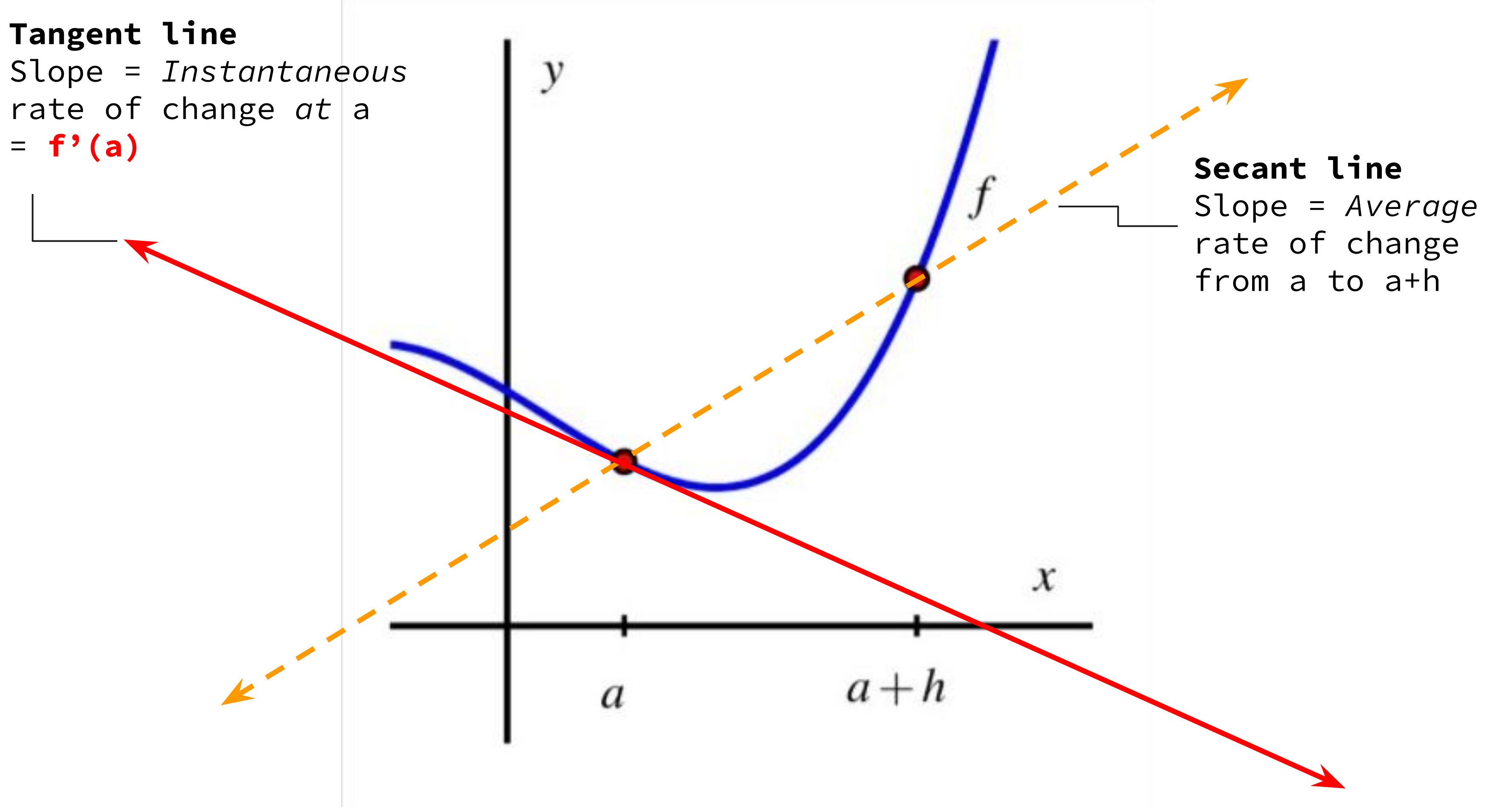
The average rate of change in f(x) from x = 0 to x = a

To 0

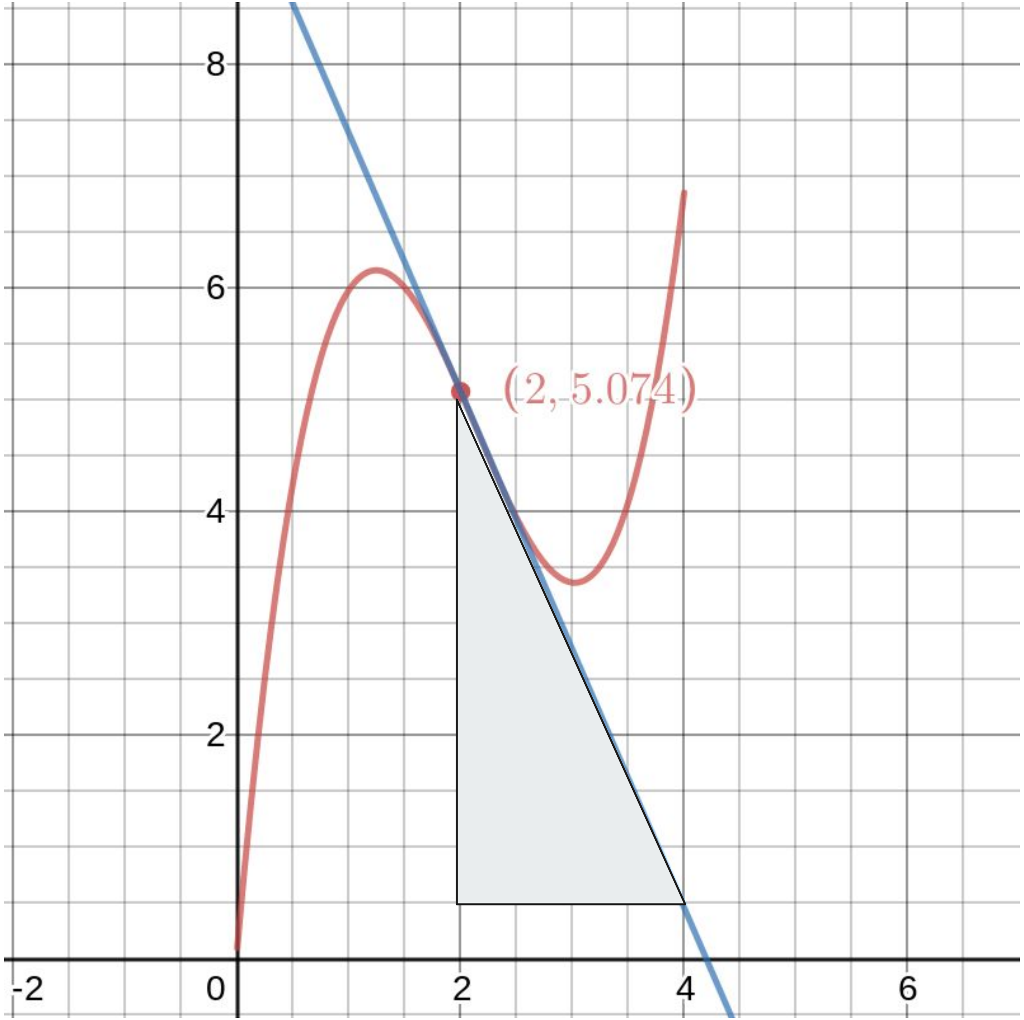
The derivative of a function at a point

The derivative of a function f(x) at a point x=a is:

- The instantaneous rate of change in f(x) at x = a
- The slope of the tangent line to the graph of f(x) at x = a
- The instantaneous velocity of an object whose position is given by f(x), at time x = a



Tangent line
Slope = *Instantaneous* rate of change *at* a
= f'(a)
y
f
x
a
a+h
Secant line
Slope = *Average* rate of change from a to a+h



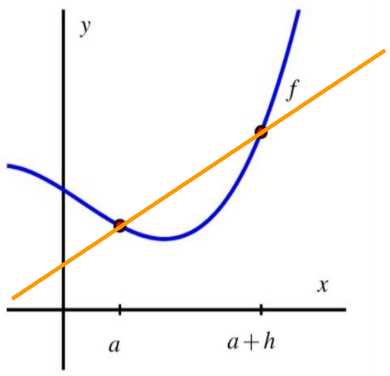
g(2) = 5.074

BUT:
g'(2) is **negative**

At x=2, the function g(x) is positive but changing at a negative rate (i.e. decreasing)

g'(2) ≈ (0.5−5.074)/(4−2) = −2.287

That's an **estimate**
Can we get the value *exactly?*



Secant line slope/average rate:

$$\frac{f(a+h)-f(a)}{h}$$

To get a better approximation to the instantaneous rate:
ZOOM IN AND RECALCULATE

This means let “h” approach zero.

$$\boxed{f'(a)=\lim_{h\to 0}\frac{f(a+h)-f(a)}{h}}$$

Activities

https://jamboard.google.com/d/1aQ4WEllrFbAPTIm31GwvK72Ir-8qbqh-avZKMY3sZ7E/edit?usp=sharing

(Posted in chat and on Campuswire)

The derivative $f'(a)$ tells you

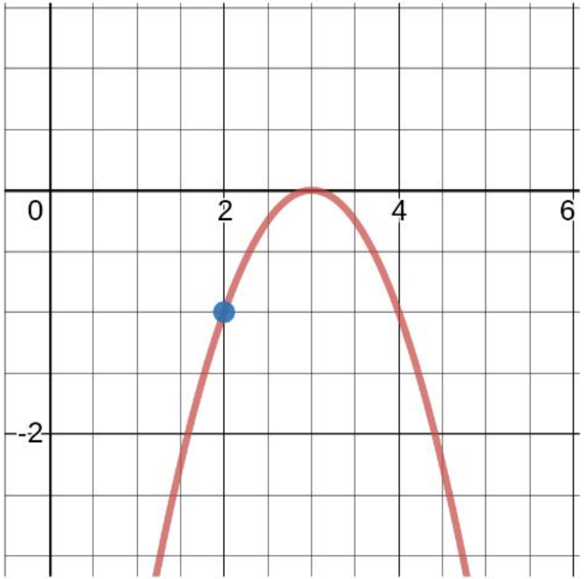
The instantaneous rate of change in f(x) at x = a

The slope of the tangent line touching the graph of f(x) at x = a

The slope of the secant line connecting x = 0 and x = a on the graph of f(x)

Both (a) and (b)

Here's the graph of a function g(x) and the point on its graph at x = 2. Which of the following are true statements? Select ALL that apply.



- $g(2)$ is positive
- $g(2)$ is negative
- $g'(2)$ is positive
- $g'(2)$ is negative

Arthur says the derivative of a function $f(x)$ at $x = 2$ is found by computing the fraction $\frac{f(a+h)-f(a)}{h}$. What, if anything, is wrong with Arthur's statement? Select ALL that apply.

- He's missing $\lim_{h\to 0}$
- He's missing $\lim_{h\to 2}$
- He's missing $\lim_{a\to 2}$
- The h on the bottom should be a 2
- Both of the a's should be 2's
- Nothing -- Arthur's statement is correct

To 0

Feedback:
http://gvsu.edu/s/1rx

Add sticky notes for comments, ideas, and questions.

Next:

- **Followup Activities to complete**: Find them on Blackboard > MODULES > Module 2 > Module 2A Followup.
- **Daily Prep for Module 2B**
- **Checkpoint 1** will be assigned Wednesday 9/16. See announcements + Campuswire for information. **Will include Learning Targets F.2 and L.1**.

See the Calendar for all due dates.