3.1

3.1 The Derivative

Objectives:

- I can use the definition of a derivative to determine the derivative of a function

- I can graph the derivative of a function

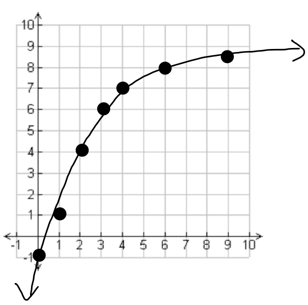
Review

What is the difference quotient theorem?

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

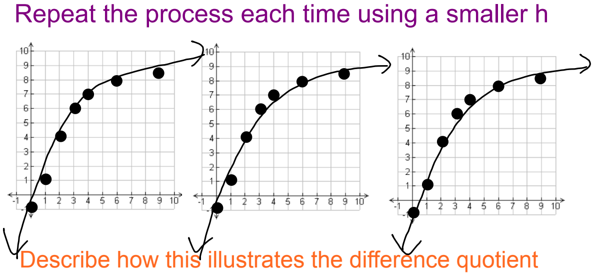
List at least 2 things that the difference quotient theorem tells us

Given the graph below, label f(x) and f(x+h) on the y-axis



Draw a graph of the secant line over [x, x+h] above and express the slope in terms of x and h

Repeat the process each time using a smaller h



Describe how this illustrates the difference quotient theorem

Find the instantaneous rate of change of $f(x) = x^2$ at $x = 3.5$

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Definition: When it exists, the difference quotient theorem is called the Derivative

Rule Sheet #24: $f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$

Notation: Different ways of writing the derivative (P. 101)

$f'(x)$ $\quad y'$ $\quad \frac{dy}{dx}$ $\quad \frac{d}{dx} f(x)$

Use the definition of the derivative to find the derivative of each function

$f(x) = x^2$

What is the significance of your answer? How are the process and result different from the warm up exercise?

Use the definition of the derivative to find the derivative of each function

$f(x) = 2x$

$y = \frac{1}{x}$

There are several definitions of the derivative. Explain or show why $f'(x) = \lim_{x \to a} \frac{f(x) - f(a)}{x - a}$ is a definition of the derivative.

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Use the second definition of the derivative to find y'

$y = x^4$

Why would the second definition be better than the first in this case?

Think of another function where using the second definition would be better? Try to think of one that is not a polynomial.

Why would the second definition of the derivative be better for your function?

Graph the derivative