Math 250 – Sect. 2.1: The Derivative

Think back to the Tangent Line Problem introduced in sect. 1.1.

Illustration:

The slope of the *secant line* on f between x and $x+\Delta x$:

This is the ______________________ rate of change for f on the interval $[x,\ x+\Delta x\ ]$.

The slope of the *tangent line* on f at x:

This is the ____________________________ rate of change for f at x.

*This is given a special name: the ________________________ of f .

Notation:

General form:	At a specific point $x = c$:

To find the instantaneous rate of change (____________________), we need to compute this limit, either in general, or at a specific x value.

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-example- Find the slope of the function $f(x) = 3x - 4$ at any point $(x, f(x))$

-example- a. Find the slope of the function $f(x) = x^2 - 2x$ at any point $(x, f(x))$

b. *Now, find the slope of the tangent line **at $x = 3$**

c. Write the EQUATION of the tangent line at that point.

d. Determine the value(s) of x for which the function would have a horizontal tangent line.

-example- Find the equation of the line tangent to the curve $f(x)=\dfrac{1}{x+2}$ when $x=1$.

SKETCH the graph and draw in the tangent line:

II. Differentiability. A function is said to be *differentiable* at a point $x=c$ if the derivative exists at that point. Since the derivative is defined as a limit, then both the right and left hand limits would have to be the SAME for the derivative to exist.

*A function is NOT differentiable at any point $x=c$ if:

1. It is not CONTINUOUS at that x value.

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

***NOTE: Differentiability implies continuity. The reverse is not true.**

2. The curve becomes VERTICAL at that x value.

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

*NDERIV feature on Calc:

3. The curve has a SHARP POINT at that x value.

-example- $f(x) = |x+1| + 2$

*A function is differentiable at a point if it has *local linearity*.