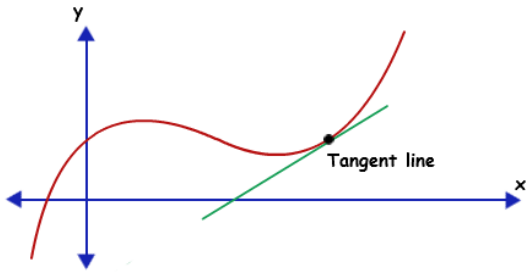
On Derivatives and Tangent Lines

(1) The derivative is an equation that allows us to find the slope of a tangent line at any point.



(2) To find the actual slope of a tangent line at a specific point, simply plug in an x-value into the derivative equation.

(3) To find the equation *of a specific tangent line* at some defined point:

a. First, find the slope of the tangent line, as in (2)
b. Then find the y-value that corresponds to the given x-value
c. Finally, plug this information into the general equation of a line (ie. y = mx + b)

Example

Original function:

$f(x) = 3x^2 - 5x + 7$

Derivative:

$f'(x) = 6x - 5$

To find the *slope* of the tangent line at, say, x = 2, simply plug 2 into the derivative:

$f'(2) = 6(2) - 5$

$f'(2) = 7$ (This means that the slope of the tangent line when x = 2 is 7)

To find the *equation* of the tangent line, first plug that same x-value into the original function:

$f(2) = 3(2)^2 - 5(2) + 7$

$f(2) = 9$ —> (2,9)

Then use that point, along with the slope, to find the equation of the tangent line:

In Slope-Intercept Form (y = mx + b) **or** **In Point-Slope Form ($y - y_1 = m(x - x_1)$)**

$9 = 7(2) + b$

$9 = 14 + b$

$b = -5$

$y = 7x - 5$

$y - 9 = 7(x - 2)$