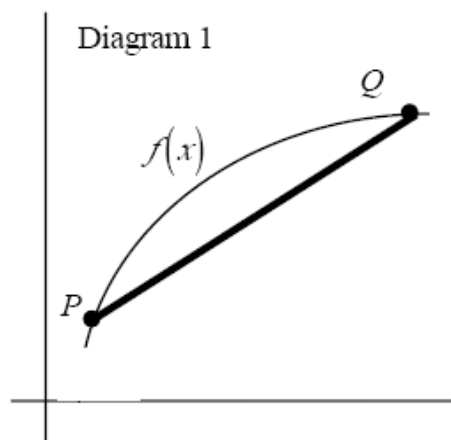
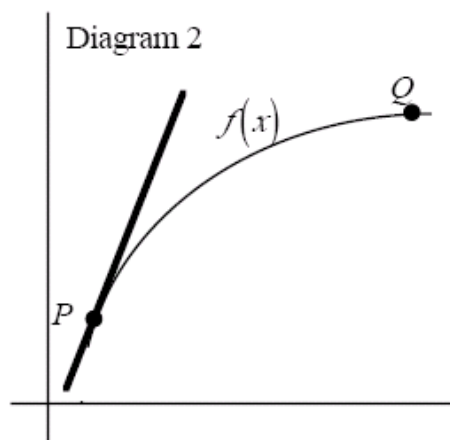


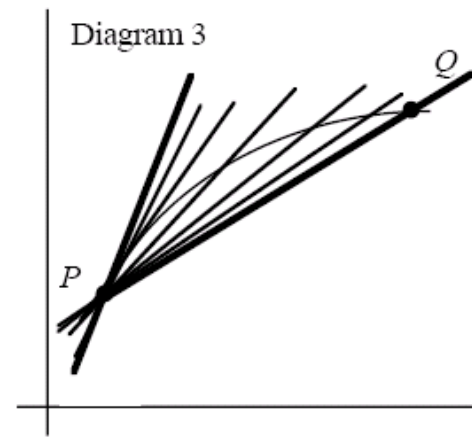
Section 2.4 - 3.2:
Definition of the Derivative



A line is drawn between points P and Q. That line is called the _____ line through P and Q.



A line is drawn through P that touches $f(x)$ in one and only one point. that line is called the _____ line at P.



We draw the secant line through PQ. However, point Q starts to move along the curve $f(x)$ towards P. So the secant line also moves. As Q gets real close to P, what is happening to the secant line?

Let's try an example. Suppose $f(x) = x^2$. Let us try and find the slope of the secant line between $x = 1$ and a value of x closer and closer to 1. Complete the chart and then answer the questions.

P (1, 1) Q ($x, f(x)$)

x	2	1.5	1.1	1.05	1.01	1.001	1.0001	1
$f(x)$								
Rise								
Run								
m_{sec}								

Why can't you find the tangent line slope between $x = 1$ and $x = 1$?

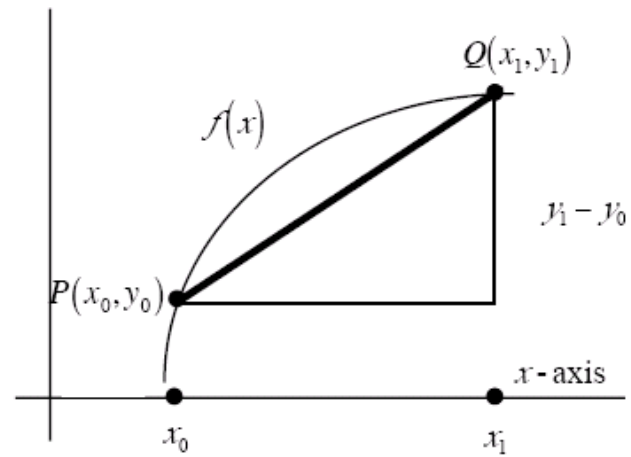
Secant lines use how many points?

Tangent lines use how many points?

What is your best guess for the slope of the tangent line at $x = 1$?

Let's develop a formula for the slope of the tangent line so that we don't have to calculate secant line slopes each time.

$$m_{\text{sec}} = \frac{\text{rise}}{\text{run}} = \frac{y_1 - y_0}{x_1 - x_0}$$



Limit Definition of the Derivative:

$$f'(x) =$$



When you see "derivative" you think _____.

Notations for derivative: _____

Differentiate $f(x) = x^2 + 1$ using the definition of the derivative. Then find the slope of the tangent line at $(0, 1)$ and $(-1, 2)$. Do these make sense in terms of the graph of $f(x)$? Write the equation of the tangent and normal lines at each point.

Definition of the Derivative at a point, $x = c$.

$$f'(c) =$$



Find the slope of the curve $f(x) = \frac{1}{x+1}$ at the point $x = 2$. Then write the equation of the tangent and normal lines.

Set up the following using the limit definitions of the derivative.

$$f(x) = 5x + 2; f'(x)$$

$$f(x) = x^2 + 4x - 1; f'(-1)$$

$$f(x) = \frac{5}{x-3}; f'(x)$$

$$f(x) = \frac{x-2}{x+1}; f'(3)$$

$$f(x) = \sqrt{3x+1}; f'(x)$$

$$f(x) = 2e^{x+1} - 5; f'(-1)$$

Identify what each limit represents.

$$\lim_{h \rightarrow 0} \frac{\sqrt{x+h} - \sqrt{x}}{h}$$

$$\lim_{\Delta x \rightarrow 0} \frac{[3(x + \Delta x)^2 + 2(x + \Delta x) - 1] - [3x^2 + 2x - 1]}{\Delta x}$$

$$\lim_{x \rightarrow 2} \frac{e^x - e^2}{x - 2}$$

$$\lim_{x \rightarrow -3} \frac{[6x - 9] + 27}{x + 3}$$

Remember: A function is *not differentiable* at c if:

1.

2.

3.

4.