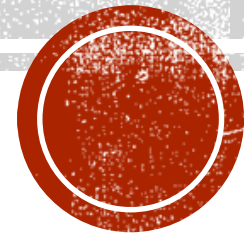


TANGENT LINES

Keeper 14

Honors Calculus



SLOPE OF THE TANGENT LINE

$$m_{tan} = \lim_{x \rightarrow a} \frac{f(x) - f(a)}{x - a}$$

This formula represents the **INSTANTANEOUS** rate of change

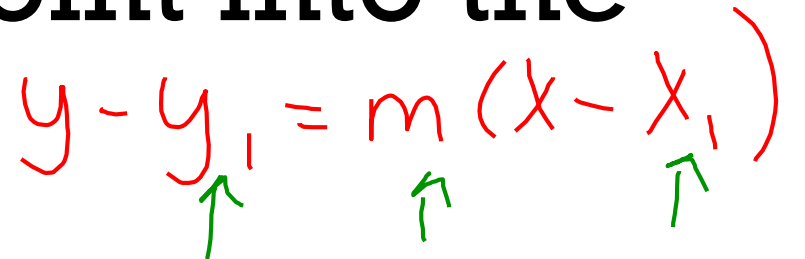


TANGENT EQUATIONS

To find the **equation of the tangent line**:

-find the slope of the tangent line
(find the derivative)

-input the slope and the point into the
point-slope form of a line

$$y - y_1 = m(x - x_1)$$




FIND THE EQUATION OF THE TANGENT LINE

1. $f(x) = x^2 + 2x$ find the $f'(3)$

$$f(3) = 3^2 + 2(3) = 15$$

$$f'(x) = \lim_{h \rightarrow 0}$$

$$\frac{(x+h)^2 + 2(x+h) - (x^2 + 2x)}{h}$$

$$\frac{\cancel{x^2} + 2xh + h^2 + \cancel{2x} + 2h - \cancel{x^2} - \cancel{2x}}{h}$$

$$\lim_{h \rightarrow 0} \frac{2x + h + 2}{1}$$

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

$$f'(3) = 2(3) + 2 = 8$$

$$m = 8 \quad \text{pt } (3, 15)$$

$x_1 \quad y_1$

$$y - y_1 = m(x - x_1)$$

$$y - 15 = 8(x - 3)$$

$$y - 15 = 8x - 24$$

$$y = 8x - 9$$

FIND THE EQUATION OF THE TANGENT LINE

2. $f(x) = \sqrt{x}$

find the $f'(3)$

$(3, \sqrt{3})$
 x_1 y_1

$$f'(x) = \lim_{h \rightarrow 0} \frac{(\sqrt{x+h} - \sqrt{x}) (\sqrt{x+h} + \sqrt{x})}{h (\sqrt{x+h} + \sqrt{x})}$$

$$m = \frac{1}{2\sqrt{3}}$$

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

$$f'(x) = \frac{1}{2\sqrt{x}}$$

$$f'(3) = \frac{1}{2\sqrt{3}}$$

$$y - \sqrt{3} = \frac{1}{2\sqrt{3}} (x - 3)$$



FIND THE EQUATION OF THE TANGENT LINE

3. $f(x) = 4x - 3x^2$ $(x^2 + 2xh + h^2)$ at $(2, -4)$

$$f'(x) = \lim_{h \rightarrow 0} \frac{4(x+h) - 3(x+h)^2 - (4x - 3x^2)}{h}$$

$$\frac{\cancel{4x} + 4h - \cancel{3x^2} - 6xh - 3h^2 - \cancel{4x} + \cancel{3x^2}}{h}$$

$$\lim_{h \rightarrow 0} \frac{\cancel{h}(4 - 6x - 3\cancel{h})}{h}$$

$$f'(x) = 4 - 6x \quad f'(2) = -8$$

$$m = -8$$

$$(2, -4)$$

$$x_1, y_1$$

$$y + 4 = -8(x - 2)$$

$$y + 4 = -8x + 16$$

$$y = -8x + 12$$