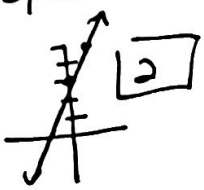
Assignment
P. 846 (16-22e
30-34e, 44, 46)

12.3 The Tangent Line Problem

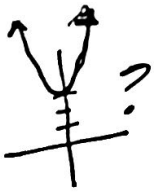
What is the slope?

$y = 2x + 3$



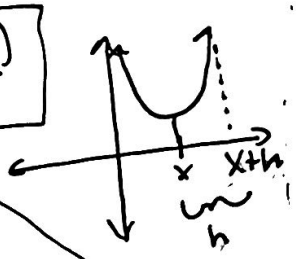
What is the slope?

$y = 2x^2 + 3$



Using the limit process or definition of derivative to find the slope.

$$\lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$$



$x+h-x = h$

$f(x+h)$ → means put $(x+h)$ in for x in your equation

$f(x)$ → means your equation

$f(x) = y = 2x + 3$

$$\lim_{h \to 0} \frac{2((x+h)) + 3 - (2x+3)}{h}$$

$$\lim_{h \to 0} \frac{2x + 2h + 3 - 2x - 3}{h}$$

$$\lim_{h \to 0} \frac{2h}{h} = \lim_{h \to 0} 2 = \boxed{2}$$

No h to put zero into

$f(x) = y = 2x^2 + 3$

$$\lim_{h \to 0} \frac{2(x+h)^2 + 3 - (2x^2 + 3)}{h}$$

$$\lim_{h \to 0} \frac{2(x+h)(x+h) + 3 - 2x^2 - 3}{h}$$

$$\lim_{h \to 0} \frac{2(x^2 + 2xh + h^2) - 2x^2}{h}$$

$$\lim_{h \to 0} \frac{2x^2 + 4xh + 2h^2 - 2x^2}{h}$$

$$\lim_{h \to 0} \frac{4xh + 2h^2}{h}$$ reduce an h out

$$\lim_{h \to 0} 4x + 2h = \boxed{4x}$$

$\boxed{4x}$ is the equation for the slope. If you want the slope at a certain point you have to plug in the point.

Different Notations for Derivative (slope)

$f'(x)$ $\quad$ y'

m $\quad$ rate of change

$\frac{dy}{dx}$ $\quad$ $\frac{d}{dx}$(equation here)

$D_x[y]$

* Find the slope at a given point

(20) $g(x) = \frac{1}{x-4}$ $\quad$ $(3,-1)$

$$\lim_{h\to 0}\left(\frac{\frac{1}{(x+h)-4}-\frac{1}{x-4}}{h}\right)\frac{(x+h-4)(x-4)}{(x+h-4)(x-4)}$$

← mult by common denominator $(x+h-4)(x-4)$

$$\lim_{h\to 0}\frac{(x-4)-(x+h-4)}{h(x+h-4)(x-4)}$$

← on top the denom. cancelled

← on bottom just write them together

$$\lim_{h\to 0}\frac{\cancel{x}-4-\cancel{x}-h+4}{h(x+h-4)(x-4)}$$

$$\lim_{h\to 0}\frac{-\cancel{h}}{\cancel{h}(x+h-4)(x-4)} = \lim_{h\to 0}\frac{-1}{(x+h-4)(x-4)} = \frac{-1}{(x-4)(x-4)}$$

$$= \boxed{\frac{-1}{2(x-4)}}$$

At $(3,-1)$ $\quad \frac{-1}{2(3-4)} = \frac{-1}{-2} = \boxed{\frac{1}{2}}$

So $\frac{1}{2}$ is the slope at point $(3,-1)$

(43) $f(x) = x^2 - 1 \quad (2, 3)$

(a) Find the slope

$$\lim_{h \to 0} \frac{(x+h)^2 - 1 - (x^2 - 1)}{h}$$

$$\lim_{h \to 0} \frac{x^2 + 2xh + h^2 - 1 - x^2 + 1}{h}$$

$$\lim_{h \to 0} \frac{2xh + h^2}{h}$$

$$\lim_{h \to 0} 2x + h = 2x \quad @(2, 3) \quad 2(2) = \boxed{4}$$

Slope $(m) = 4$

(b) Tangent line (line that touches at that point and goes on)

$y = mx + b$

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

$y = 4(x - 2) + 3$

$y = 4x - 8 + 3$

$\boxed{y = 4x - 5}$

(c) Graph