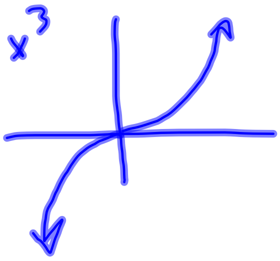
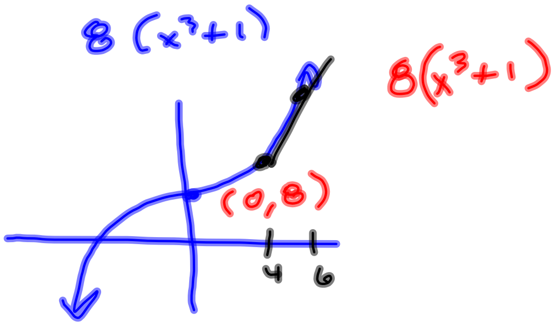
Find the average rate of change of the function over the given intervals.

$f(x) = 8x^3 + 8$; **a)** $[4,6]$, **b)** $[-5,5]$





m_{avg} on $[4,6]$ is $\dfrac{f(6)-f(4)}{6-4}$

$= \dfrac{8(6^3+1) - 8(4^3+1)}{6-4} = \dfrac{8[217-65]}{2}$

$= 4[152] = \boxed{608 = m_{avg}}$

what's the equation of the line thru $(6, f(6))$ and $(4, f(4))$

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

Slope between (x, y) & (x_1, y_1)?

$$m = \frac{y - y_1}{x - x_1} = \frac{y_2 - y_1}{x_2 - x_1} = m$$

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

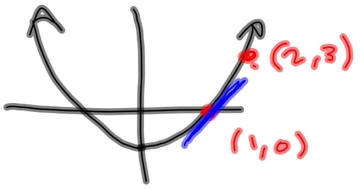
$$\boxed{y = m(x - x_1) + y_1}$$ Use THIS

$$\boxed{y = m(x - x_1) + f(x_1)}$$

* Find the avg slope of $f(x) = x^2 - 1$ on $[1, 2]$
* what's the instantaneous slope of $f(x)$ at $x = 1$?

$$m_{avg} = \frac{f(2) - f(1)}{2-1} = \frac{(2^2-1) - (1^2-1)}{1}$$

$$= \frac{3-0}{1} = 3 = m_{avg}$$



$$\frac{f(1+h) - f(1)}{h} = \frac{(1+h)^2 - 1 - (1^2-1)}{h}$$

$$= \frac{1 + 2h + h^2 - 1 - 0}{h} = \frac{2h+h^2}{h}$$

$$= \frac{\cancel{h}(2+h)}{\cancel{h}} = 2 + h \xrightarrow{h \to 0} \boxed{2 = m_{tan}}$$

In general:

$$\frac{f(x+h) - f(x)}{h} = \frac{(x+h)^2 - 1 - (x^2-1)}{h}$$

$$= \frac{x^2 + 2xh + h^2 - 1 - x^2 + 1}{h}$$

$$= \frac{2xh + h^2}{h} = \frac{h(2x+h)}{h} = 2x + h \xrightarrow{h \to 0} 2x$$

$$= \boxed{f'(x) = 2x}$$

and @ $x = 1$
$f'(1) = 2(1) = 2$

$f(x) = x^2 \longrightarrow 2x = f'(x)$