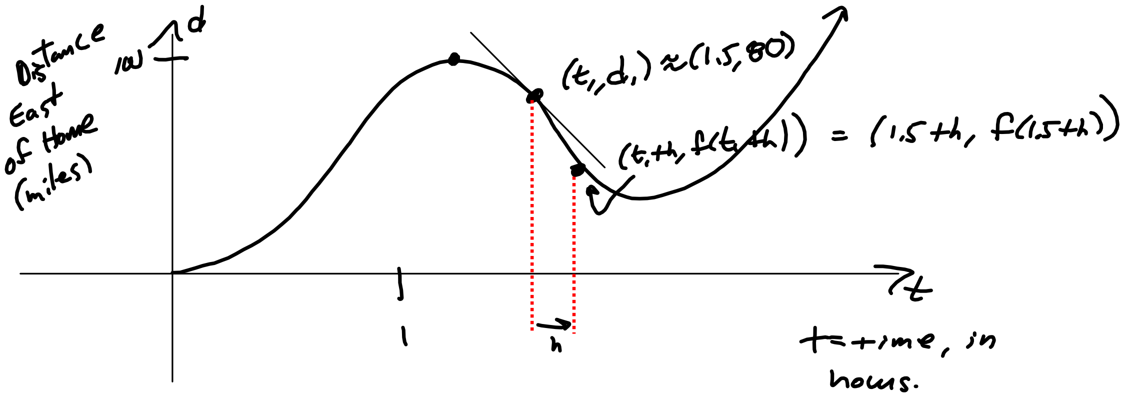
Anybody who hasn't taken Quiz 1 but wants to?



Let *d* = distance east of home (in miles) as a function of

***t* = time (in hours)**

Rate of speed. With direction, that makes it velocity.

2.1 Velocity at (t_1, d_1) is $\lim\limits_{t \to t_1} \frac{f(t) - f(t_1)}{t - t_1} = \lim\limits_{h \to 0} \frac{f(t_1+h) - f(t_1)}{h}$

$(t_1, d_1) = (1.5, 80)$

§2.1 $\lim\limits_{t \to 1.5} \frac{f(t) - f(1.5)}{t - 1.5} = \lim\limits_{h \to 0} \frac{f(1.5+h) - f(1.5)}{h} = m_{tan}$

Then the equation of the tangent line at (t_1, d_1) is

$y = L(t) = m_{tan}(t - t_1) + d_1$

$= m_{tan}(t - t_1) + f(t_1)$

approximates $f(t)$ for t close to t_1. (i.e., $|t - t_1|$ small)

§2.2 says compute $f'(t)$ in general, and then plug a bunch of different t-values into this derivative function.

$f'(t) = \lim\limits_{h \to 0} \frac{f(t+h) - f(t)}{h} = \lim\limits_{c \to t} \frac{f(c) - f(t)}{c - t} = f'(t)$

$f'(c) = \lim \frac{f(t) - f(c)}{t - c}$

$t \to c$

2.1 Consider the parabola $y = f(x) = x^2 - 6x$.

Find an equation of the tangent line to $f(x)$ @ $(x_1, y_1) = (4, -8)$

Find m_{tan}

write $y = L(x) = m_{tan}(x - x_1) + y_1$

at $x = 4$, $y = -8$,

$$m_{tan} = \lim_{h \to 0} \frac{f(4+h) - f(4)}{h} = \lim_{h \to 0} \frac{(4+h)^2 - 6(4+h) - (4^2 - 6(4))}{h}$$

$$= \lim_{h \to 0} \frac{16 + 8h + h^2 \boxed{-6(4)} - 6h - 4^2 \boxed{+6(4)}}{h}$$

$$= \lim_{h \to 0} \frac{2h + h^2}{h} = \lim_{h \to 0} (2 + h) = 2 = m_{tan}$$

$$\Longrightarrow y = m_{tan}(x - x_1) + \underbrace{y_1}_{f(x_1)}$$

$$\boxed{y = 2(x-4) - 8}$$

Same question for $x_1 = 3. \Longrightarrow y_1 = f(x_1) = 3^2 - 6(3) = -9$

$(x_1, y_1) = (x_1, f(x_1)) = (3, -9)$

$$m_{tan} = \lim_{h\to 0} \frac{f(3+h) - f(3)}{h} = \lim_{h\to 0} \frac{(3+h)^2 - 6(3+h) - (3^2 - 6(3))}{h}$$

$$= \lim_{h\to 0} \frac{9 + 6h + h^2 - 18 - 6h - 9 + 18}{h} = \lim_{h\to 0} \frac{0h}{h} = \lim_{h\to 0} 0 = 0$$

$m_{tan} = 0 \Longrightarrow$

$y = m_{tan}(x - x_1) + y_1$

$= 0(x-3) - 9$ i.e.,

$$\boxed{y = -9}$$

§2.2 Says: Find $f'(x)$, in general

$$\lim_{h\to 0} \frac{f(x+h) - f(x)}{h} = \lim_{h\to 0} \frac{(x+h)^2 - 6(x+h) - (x^2 - 6x)}{h}$$

$$= \lim_{h\to 0} \frac{\cancel{x^2} + 2xh + h^2 \cancel{-6x} - 6h \cancel{-x^2} \cancel{+6x}}{h} = \lim_{h\to 0} \frac{2xh - 6h + h^2}{h}$$

$$= \lim_{h\to 0} \frac{2x - 6 + h}{1} = \boxed{2x - 6 = f'(x)}$$

Now the 1st question

Tan line @ $x_1 = 4, y_1 = -8$ is

$y = m_{tan}(x - x_1) + y_1 = f'(4)(x-4) + f(4)$

$= 2(x-4) - 8$

$f'(4) = 2(4) - 6 = 2$

@ $x_1 = 3, y_1 = -9$

$y = f'(3)(x-3) + f(3)$

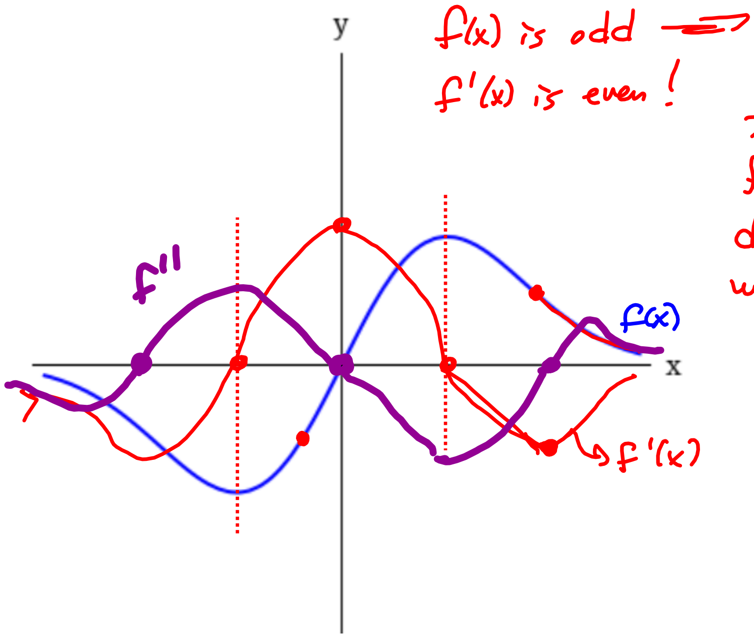
$= (2(3)-6)(x-3) - 9$

$= 0(x-3) - 9$

$= -9 = y$ = tan line.

2.2 The Derivative as a Function.

Use the given graph of $f(x)$ to sketch the graph of f'.



$f'(x)$ = slope function = derivative of f with respect to x.