M191 Lect #5 2-7-11

Last time we calculated the derivative of $f(x) = x^2$ algebraically. We now do it numerically

x	y	m_{tan} $y' = f'(x) = \frac{dy}{dx}$
-4	16	-6
-2	4	-4
0	0	0
2	4	4
4	16	8
6	36	10

For interior x values use symmetric $\frac{\text{rise}}{\text{run}}$.

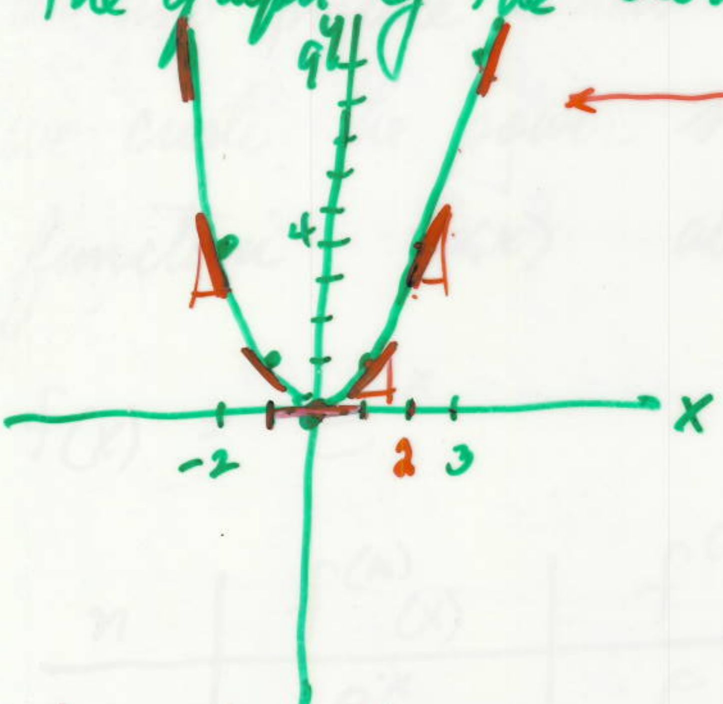
For edge values use what left

$$\frac{4-4}{-2-2} = 0 \qquad \frac{0-16}{0-4} = 4 \qquad \frac{4-36}{2-6} = \frac{-32}{-4} = 8$$

$$\frac{16-0}{-4-0} = -4 \qquad \frac{16-4}{-4-(-2)} = \frac{12}{-2} = -6 \qquad \frac{16-36}{4-6} = \frac{-20}{-2} = 10$$

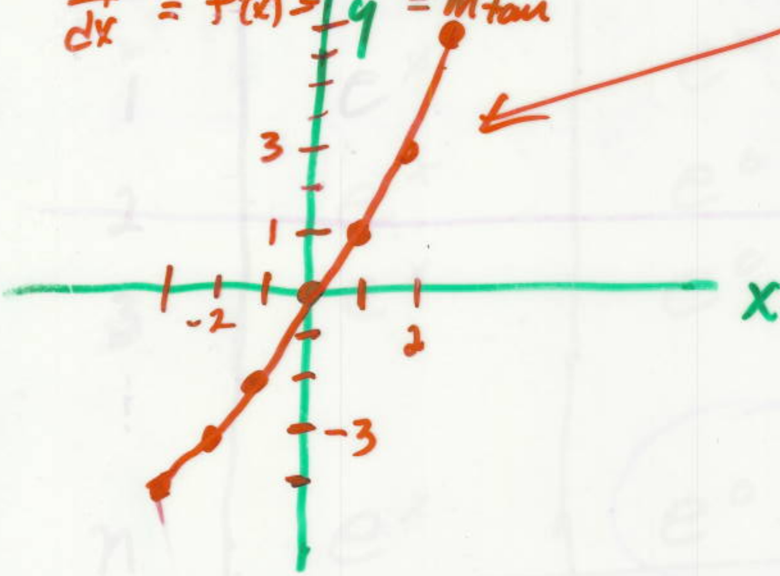
P 2

Let's do it graphically, let's find the graph of the derivative of $y = f(x) = x^2$



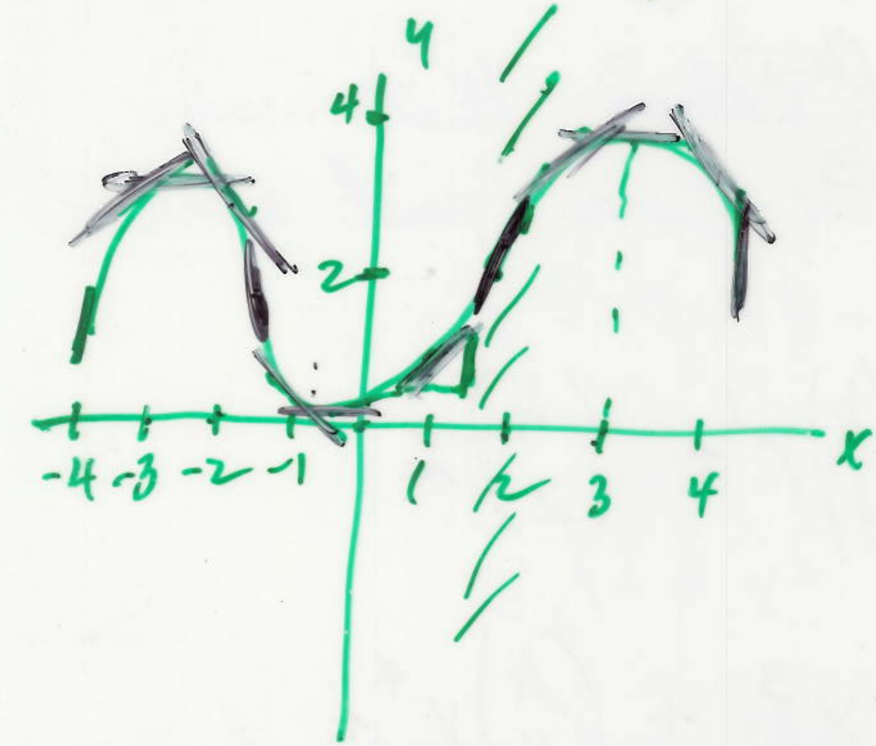
The slopes up here are the heights down here

$\frac{dy}{dx} = f'(x) \rightarrow y' = m_{tan}$



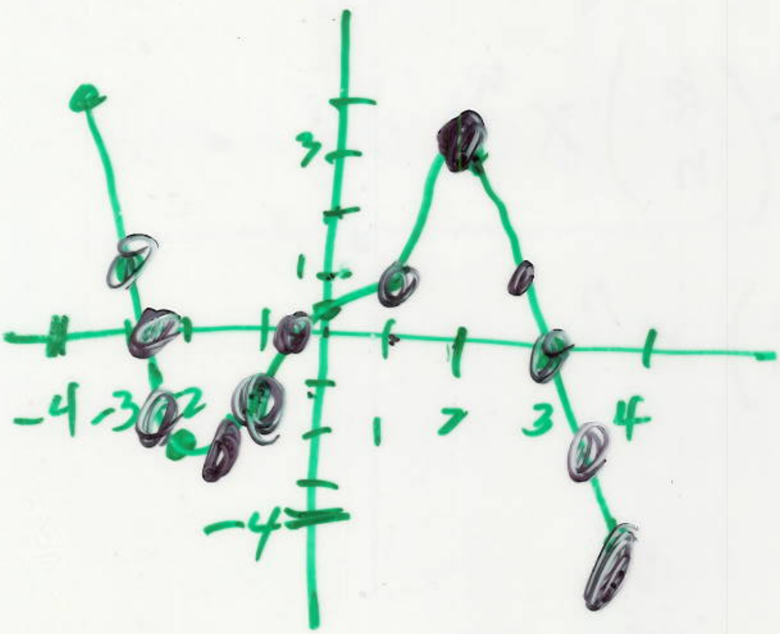
So for this fcn

$y = f(x)$

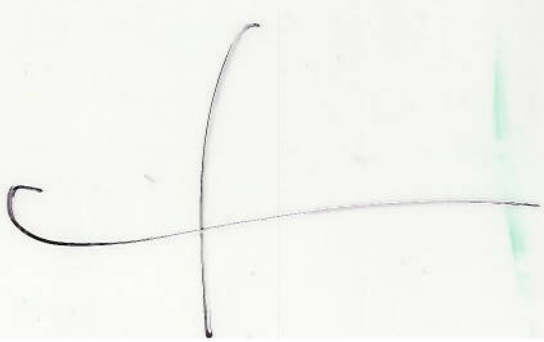


the slope of
this one
up here

is



the height of
this one



$$f(x) = x^3 + 5x - 7$$

Find the derivative (m_{tan}) using the definition

x	y
$x+h$	$(x+h)^3 + 5(x+h) - 7$
x	$x^3 + 5x - 7$

$$f'(x) = \lim_{h \to 0} \frac{(x+h)^3 + 5(x+h) - 7 - (x^3 + 5x - 7)}{h}$$

$$= \lim_{h \to 0} \frac{\cancel{x^3} + 3x^2h + 3xh^2 + h^3 + \cancel{5x} + 5h \cancel{-7} - \cancel{x^3} - \cancel{5x} + \cancel{7}}{h}$$

$$= \lim_{h \to 0} \frac{3x^2h + 3xh^2 + h^3 + 5h}{h}$$

$$= \lim_{h \to 0} \frac{\cancel{h}(3x^2 + 3xh + h^2 + 5)}{\cancel{h}}$$

$$= 3x^2 + 5$$

p5

$(x+h)^3 = (x+h)^2(x+h)^1$

$= (x^2+2xh+h^2)(x+h)$

$= x^3 + hx^2 + 2x^2h + 2xh^2 + h^2x + h^3$

$$\boxed{= 1x^3 + 3x^2h + 3xh^2 + 1h^3}$$

1

1 1

1 2 1

1 3 3 1

1 4 6 4 1

$1x^5 + 5x^4h + 10x^3h^2 + 10x^2h^3 + 5xh^4 + 1h^5$

1 6 15 20 15 6 1

1 7 21 35 35 21 7 1