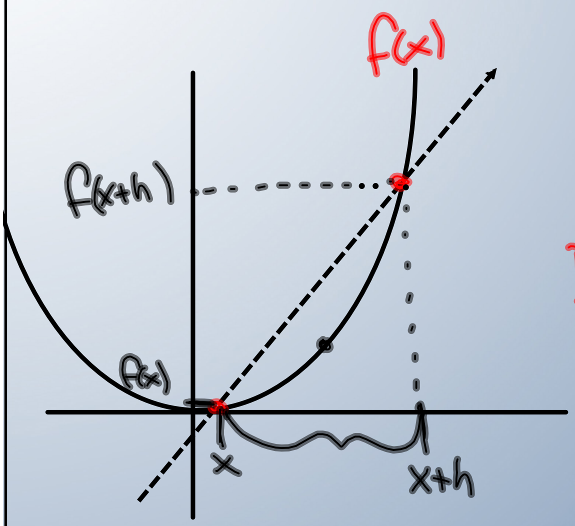
Difference Quotient:



$$\text{Slope} = \frac{\text{rise}}{\text{run}} = \frac{f(x+h)-f(x)}{(x+h)-x}$$

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

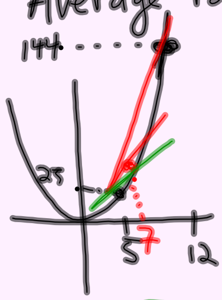
Derivative

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

Mar 7-12:28 PM

ex) $f(x) = x^2$

Average rate of change over



[5, 12]

$$m = \frac{144-25}{12-5}$$

$$= \frac{119}{7}$$

$$= 17$$

[5, 7]

$$m = \frac{49-25}{7-5}$$

$$= \frac{24}{2}$$

$$= 12$$

[5, 5.1]

$$m = \frac{26.01-25}{5.1-5}$$

$$= \frac{1.01}{.1}$$

$$= 10.1$$

Jan 6-12:39 PM

Find the derivative equation, $f'(x)$, for $f(x) = x^2$.

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

$$f'(x) = \lim_{h\to 0} \frac{f(x+h) - f(x)}{h}$$
$$= \lim_{h\to 0} \frac{(x+h)^2 - x^2}{h}$$
$$= \lim_{h\to 0} \frac{\cancel{x^2} + 2xh + h^2 \cancel{- x^2}}{h}$$
$$= \lim_{h\to 0} \frac{\cancel{h}(2x+h)}{\cancel{h}}$$
$$= 2x + 0$$
$$= \boxed{2x}$$

Jan 6-12:47 PM

$f(x) = x^3$ find $f'(x)$ using the definition of a derivative.

$f(x) = x^3$
$f(x+h) = (x+h)^3$

1
1 1
1 2 1
1 3 3 1

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

Jan 6-12:54 PM

$f(x) = x^a$

$f'(x) = a x^{a-1}$

$f(x) = bx^a$

$f'(x) = (ba)x^{a-1}$

Jan 6-1:00 PM

$f(x) = 3x^5 - 2x^3 + x^2 - 7x + 2$

$$\boxed{f'(x) = 15x^4 - 6x^2 + 2x - 7}$$

Jan 6-1:03 PM

$$f(x) = -2x + 5$$

$$f(x+h) = -2(x+h) + 5$$

$$= -2x - 2h + 5$$

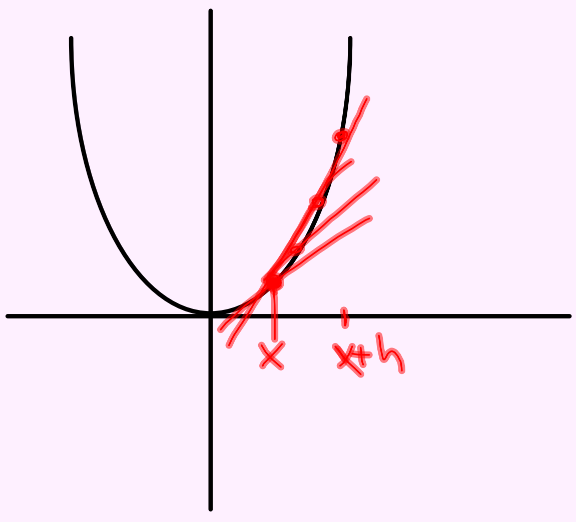
$$f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$$

$$= \lim_{h \to 0} \frac{-2x - 2h + 5 - (-2x + 5)}{h}$$

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

$$= -2$$

Jan 6-1:10 PM



Jan 5-1:17 PM