

$$m=3$$

Example: Find $f'(x)$, for $f(x) = 3x + 5$

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

$$f'(x) = 3$$

$$= \lim_{h \rightarrow 0} \frac{\cancel{3x} + 3h + \cancel{5} - \cancel{3x} - \cancel{5}}{h} = \lim_{h \rightarrow 0} \frac{3h}{h}$$

$$= \lim_{h \rightarrow 0} 3 = \boxed{3}$$

Example: Find $f'(x)$, for $f(x) = x^2$

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

$$f'(x) = 2x$$

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

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

$$= \lim_{h \rightarrow 0} 2x + h$$

$$= 2x$$

Example: slope of $(1, f(1)) = (1, 1)$ equation:

$$(1, 1) \quad m=2 \quad y=mx+b$$

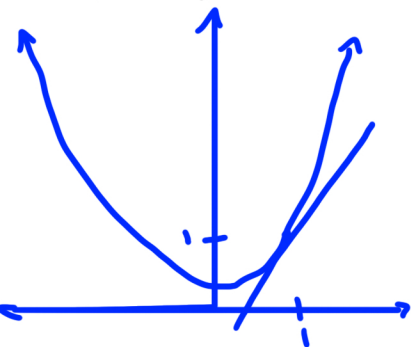
$$f'(x) = 2 \quad y = 2x + b$$

$$1 = 2(1) + b$$

$$-2 = -2$$

$$-1 = b$$

$$y = 2x - 1$$



Find $S'(x)$, for $S(x) = x^2 + 6x - 10$

$$\begin{aligned} S'(x) &= \frac{S(x+h) - S(x)}{h} = \lim_{h \rightarrow 0} \frac{((x+h)^2 + 6(x+h) - 10) - (x^2 + 6x - 10)}{h} \\ &= \lim_{h \rightarrow 0} \frac{x^2 + 2xh + h^2 + 6x + 6h - 10 - x^2 - 6x + 10}{h} \\ &= \lim_{h \rightarrow 0} 2x + h + 6 \\ &= 2x + 6 \end{aligned}$$

$$\text{slope } (1, S(1)) = (1, -3)$$

$$\begin{aligned} &= 2(1) + 6 \\ &= 8 \end{aligned}$$

Equation

$$m = 8 \quad (1, -3)$$

$$y = mx + b$$

$$y = 8x + b$$

$$-3 = 8x + b$$

$$-11 = b$$

$$\boxed{y = 8x - 11}$$