

4. $f(x) = x^2 + 1$ (x , -3 , 10)

FINDING SLOPE OF TANGENT LINE AT A GIVEN POINT

① FIND DERIVATIVE

(a) FIND $f(x)$

$$f(x) = x^2 + 1$$

(b) FIND $f(x+h)$

$$\begin{aligned} f(x+h) &= (x+h)^2 + 1 \\ &= (x+h)(x+h) + 1 \\ &= x^2 + hx + hx + h^2 + 1 \\ &= x^2 + 2hx + h^2 + 1 \end{aligned}$$

③ PLUG $f(x)$ AND $f(x+h)$ INTO FORMULA AND FIND LIMIT

$$\begin{aligned} f'(x) &= \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h} \\ &= \lim_{h \rightarrow 0} \frac{x^2 + 2hx + h^2 + 1 - (x^2 + 1)}{h} \\ &= \lim_{h \rightarrow 0} \frac{x^2 + 2hx + h^2 + 1 - x^2 - 1}{h} \\ &= \lim_{h \rightarrow 0} \frac{2hx + h^2}{h} \\ &= \lim_{h \rightarrow 0} \frac{\cancel{h}(2x+h)}{\cancel{h}} \end{aligned}$$

$$\begin{aligned} f'(x) &= \lim_{h \rightarrow 0} 2x + h \\ f'(x) &= 2x + 0 \\ f'(x) &= 2x \end{aligned}$$

② CHANGE DERIVATIVE NOTATION TO m AND PLUG IN x PART OF POINT AND SIMPLIFY

$$\begin{aligned} f'(x) &= 2x \\ m &= 2(-3) \end{aligned}$$

$$m = -6$$