Example 6

Second Derivative

Get $f''(x)$ for $f(x) = x^2 + 2x$

$$f'(x) = \frac{d}{dx}[x^2 + 2x]$$

$$= 2x^{2-1} + 2 \cdot \frac{d}{dx}[x]$$

$$= 2x + 2 \cdot 1x^{1-1}$$

$$= 2x + 2$$

$$= \boxed{f'(x) = 2x + 2}$$

$$f''(x) = \frac{d}{dx}[2x + 2]$$

$$= 2 \cdot \frac{d}{dx}[x] + \frac{d}{dx}[2]$$

$$= 2 \cdot 1x^{1-1} + 0$$

$$= 2 \cdot 1x^0$$

$$= 2 \cdot 1$$

$$= 2$$

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

$$\boxed{f''(x) = 2}$$

$$\boxed{f''(x) = \frac{d^2}{dx^2}[x^2 + 2x] = \frac{d}{dx}[2x + 2] = 2}$$

Example 7

Get $f''(x)$ for $f(x) = x + \sin(x)$

$$f'(x) = \frac{d}{dx}[x + \sin(x)]$$

$$= \frac{d}{dx}[x] + \frac{d}{dx}[\sin(x)]$$

$$= 1x^{1-1} + \cos(x)$$

$$= 1x^0 + \cos(x)$$

$$= 1 + \cos(x)$$

$$\boxed{f'(x) = 1 + \cos(x)}$$

$$f''(x) = \frac{d}{dx}[1 + \cos(x)]$$

$$= \frac{d}{dx}[1] + \frac{d}{dx}[\cos(x)]$$

$$= 0 + (-\sin(x))$$

$$\boxed{f''(x) = -\sin(x)}$$

$$\boxed{f''(x) = \frac{d^2}{dx^2}[x + \sin(x)] = \frac{d}{dx}[1 + \cos(x)] = -\sin(x)}$$

SI #4

Get $f''(x)$ for $f(x) = \tan(x)$

$$f'(x) = \frac{d}{dx}[\tan(x)]$$

$$=$$

$$\boxed{f'(x) = \sec^2(x)}$$

$$f''(x) = \frac{d}{dx}[\sec^2(x)]$$

$$=$$

$$\frac{d}{dx}[(\sec(x))^2]$$

$$=$$

$$2\sec(x) \cdot \frac{d}{dx}[\sec(x)]$$

$$=$$

$$2\sec(x) \cdot \sec(x)\tan(x) \cdot 1$$

$$=$$

$$2\sec^2(x)\tan(x)$$

$$\boxed{f''(x) = 2\sec^2(x)\tan(x)}$$

Chain It

$f'(g(x))$ $\qquad$ $g'(x)$

$$= \qquad\qquad =$$

$$\frac{d}{dx}[\sec(x)] \cdot \frac{d}{dx}[x]$$

$$=$$

$$1x^{1-1}$$

$$=$$

$$1x^0$$

$$=$$

$$\sec(x)\tan(x) \cdot 1$$