$(e^x)' = e^x$ Taylor Series $\sin x, \cos x, e^x$

$$e^x = 1 + x + \frac{1}{2}x^2 + \frac{1}{6}x^3 + \frac{1}{24}x^4 + \frac{1}{120}x^5 + \ldots$$

$$(e^x)' = 0 + 1 + x + \frac{1}{2}x^2 + \frac{1}{6}x^3 + \ldots$$

$$\frac{d}{dx}e^x = e^x \checkmark$$

$$f(x) = \frac{3 - 5xe^x}{3x+2}$$

$$\left(\frac{f}{g}\right) = \frac{f'g - fg'}{g^2}$$

$$f'(x) = \frac{\underbrace{(3-5xe^x)'}_{}(3x+2) - (3+5xe^x)\underbrace{(3x+2)'}_{g \leftarrow 3}}{(3x+2)^2}$$

$$(3 - \underline{5xe^x})$$

$$0 - \left((5x)\underline{(e^x)'} + \underline{(5x)'}e^x \right)$$

$$-(5xe^x + 5e^x) = -5xe^x - 5e^x$$

$$\boxed{f'(x) = \frac{(-5xe^x - 5e^x)(3x+2) - 3(3+5xe^x)}{(3x+2)^2}}$$

$$f(x) = e^{x\sin(x)}$$

$$f'(x) = e^{x\sin(x)} \cdot \underbrace{\left(\frac{d}{dx}\, \underline{x}\,\underline{\sin x}\right)}$$

$$(x)'\sin x + x(\sin x)'$$

$$\underline{\sin x + x\cos x}$$

$$\boxed{f'(x) = e^{x\sin x}\left(\sin x + x\cos x\right)}$$

$$f(x) = \sqrt{x^2+3x-1}$$

$$f'(x) = \left(x^2+3x-1\right)^{1/2}$$

$$\boxed{= \frac{1}{2}\left(x^2+3x-1\right)^{-1/2}(2x+3)}$$

$$f'(x) = \frac{2x+3}{2\sqrt{x^2+3x-1}}$$

$$f(x) = \cos\left(\left(5x+3x^2\right)^{3/2}\right)$$

$$f'(x) = -\sin\left(\left(5x+3x^2\right)^{3/2}\right) \frac{d}{dx}\left(\left(5x+3x^2\right)^{3/2}\right)$$

$$\frac{3}{2}\left(5x+3x^2\right)^{1/2}\left(5+6x\right)$$

$$f'(x) = -\frac{3}{2}\left(5x+3x^2\right)^{1/2}\left(5+6x\right)\sin\left(\left(5x+3x^2\right)^{3/2}\right) \checkmark$$

What does it mean for a function to have a <u>horizontal</u> tangent line?

$f'(x) = 0$

$f''(x) = 2x - 4$

$f(x) = \frac{1}{3}x^3 - 2x^2 + 4x + 7$

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

$0 = x^2 - 4x + 4$

$= (x-2)(x-2)$

$\boxed{x = 2}$