$\lim_{x \to 4} (2x+5) = 13$

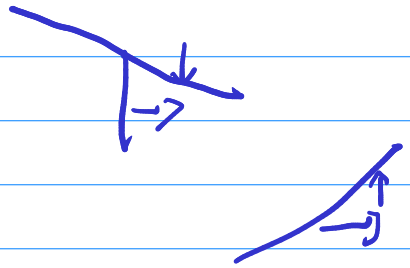
$2x+5 \leq (13+\varepsilon)$ $\quad 2x+5 \geq 13-\varepsilon$

$2x \leq 8+\varepsilon$ $\quad \delta \geq \frac{\varepsilon}{2}$

$x \leq 4+\frac{\varepsilon}{2}$

$\delta \leq \frac{\varepsilon}{2}$

$\lim_{x \to 3} x^2 - 3 = 6$



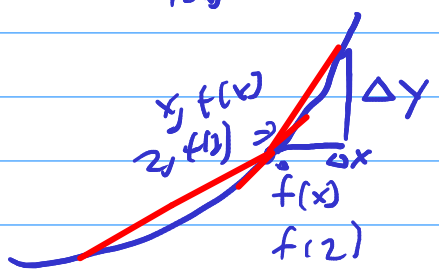
$6+\varepsilon = (x^2) - 3$

$9+\varepsilon = x^2$

$\sqrt{9+\varepsilon} = x$

$\delta \leq \varepsilon$ $\quad \sqrt{9+h}$ $\sqrt{9}+\sqrt{h}$ $\quad 9+h+2\sqrt{9}\sqrt{h}$

$f(x) = x^2$



$f(x+\Delta y)$

$(x+\Delta x, f(x+\Delta x))$

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

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

$\lim_{h \to 0}$

Slope of tangent line:

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

$f(x) = x^2$

$x = 2$

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

$$\lim_{h \to 0} \frac{x^2 + 2xh + h^2 - x^2}{h}$$

$$\lim_{h \to 0} \; 2x + h$$

$$2x$$

derivative of x^2 $= 2x$

$\dot{y}$ y'

$y = x^2$

$y' = 2x$

$f(x) = x^2$

$f'(x) = 2x$

$\frac{dy}{dx} = 2x$

$\frac{d}{dx} f(x) = 2x$

$y = 3x^2 + 1$

$$\lim_{h \to 0} \frac{3(x+h)^2 + 1 - (3x^2 + 1)}{h}$$

$$\frac{3(x^2 + 2xh + h^2) - 3x^2}{h}$$

$$\lim_{h \to 0} \frac{3x^2 + 6xh + h^2 - 3x^2}{h}$$

$$\lim_{h \to 0} \; 6x + h$$

$$6x$$

$\frac{d}{dx}\, af(x) + b$

$= a \frac{d}{dx} f(x)$

$x^3 + 5x^2 + 2x + 1$

$$\lim_{h \to 0} \frac{(x+h)^3 + 5(x+h)^2 + 2(x+h) + 1 - (x^3 + 5x^2 + 2x + 1)}{h}$$

$x^3 + 3x^2h + 3xh^2 + h^3 + 5x^2 + 10xh + 5h^2 + 2x + 2h + 1$

$\lim_{h \to 0} 3x^2 + 3xh + h^2 + 10x + 5h + 2$

$f(x) = x^3 + 5x^2 + 2x + 1$

$f'(x) = 3x^2 + 10x + 2$

$\frac{d}{dx} \quad 7x^8$

$56x^7$

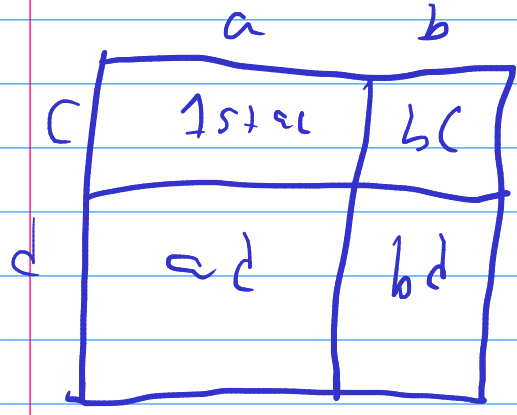
$\frac{d}{dx} x^{\frac{2}{3}} = \frac{2}{3} x^{-\frac{1}{3}}$

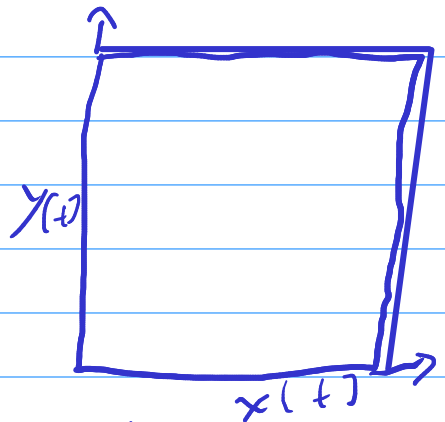
$\frac{d}{dx} ax^b = ab x^{b-1}$

$(x^2 - 1)(2x + 3) \qquad 2x \qquad 2$

$2x^3 + 3x^2 - 2x - 3$

$6x^2 + 6x - 2$





$\frac{d}{dt} t^2$

$\frac{d}{dt} y(t) \cdot x(t)$

$\left(\frac{d}{dt} y(t)\right) \cdot x(t)$

$\frac{d}{dt} (f(x) g(x))$

$= f'(x) g(x) + g'(x) f(x)$

$\left(\frac{d}{dt} x(t)\right) \cdot y(t)$

Power: $\frac{d}{dx} ax^b = ab x^{b-1}$

Product: $f'(x)g(x) + g'(x)f(x)$

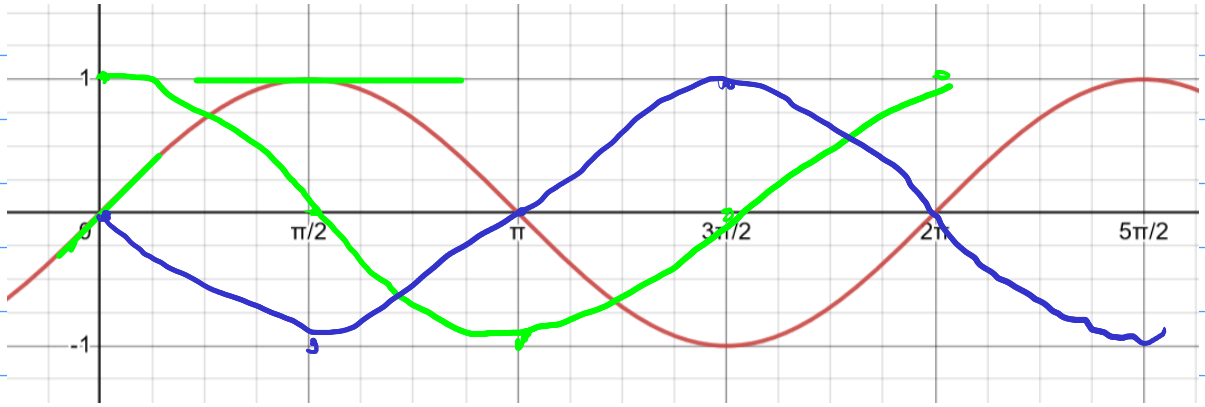
$(x^2-1)(2x+3)$ $\quad 2x \quad 2$

$2x(2x+3) + 2(x^2-1)$

$4x^2 + 6x + 2x^2 - 2$

$6x^2 + 6x - 2$

$\sin(x) \to \cos(x) \to -\sin(x) \to -\cos(x)$



$(4x^2+3x-6)\cdot\sin(x)$

$8x+3 \qquad \cos(x)$

$(8x+3)\sin(x) + (4x^2+3x-6)\cos(x)$