differentiation (derivatives) always about $\frac{dy}{dx}$, the instantaneous rate of change of output ("y") with respect to input ("x")

#5 p. 170

$\frac{d}{dx}\left(\sin^{-1}x\right)=\frac{1}{\sqrt{1-x^2}}$

inside $\sqrt{\ }$
t^{-4}
mult by t^4
balance this by mult. by t^2 in numerator

$$y=\sin^{-1}\left(\frac{3}{t^2}\right)$$

$$y=\sin^{-1}\left(3t^{-2}\right)$$

$$\frac{dy}{dx}=\frac{1}{\sqrt{1-9t^{-4}}}\cdot -6t^{-3}$$

$$=\frac{t^2}{\sqrt{t^4-9}}\cdot\frac{-6}{t^3}$$

$$=\frac{-6}{t\sqrt{t^4-9}}$$

$$\#7 \quad y = x\sin^{-1}x + \sqrt{1-x^2}$$

$u = x \quad u' = 1$

$v = \sin^{-1}x \quad v' = \frac{1}{\sqrt{1-x^2}}$

$\frac{d}{dx}\left[(1-x^2)^{1/2}\right]$

$u'v + uv'$

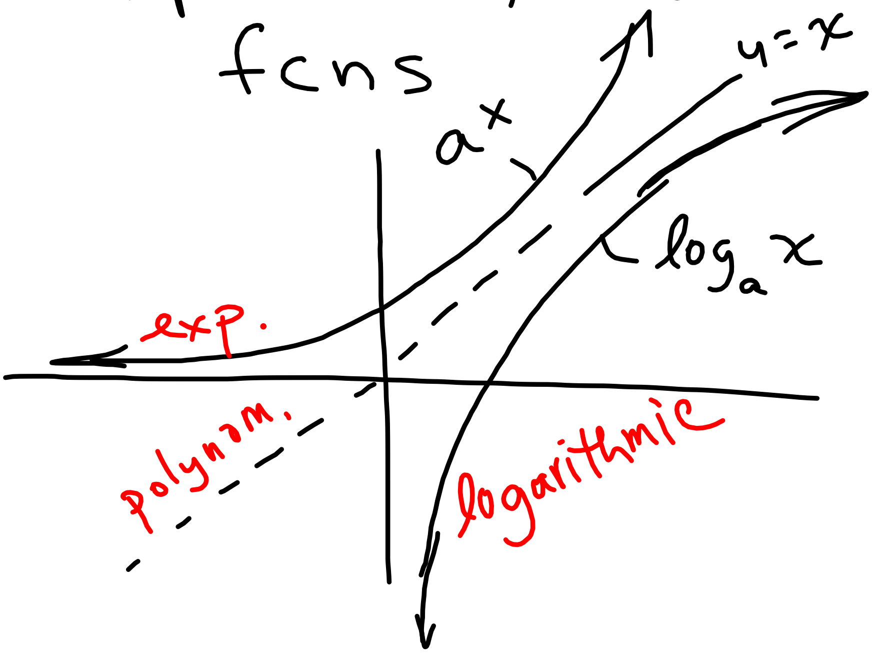
$= \sin^{-1}x + x\frac{1}{\sqrt{1-x^2}} + \frac{1}{2}(1-x^2)^{-1/2}(-2x)$

$\frac{dy}{dx} = \sin^{-1}x + \cancel{\frac{x}{\sqrt{1-x^2}}} \quad \cancel{\frac{x}{\sqrt{1-x^2}}}$

$= \sin^{-1}x$

$$(3t^{-2})^2 = 3^2 \cdot (t^{-2})^2 = 9t^{-4}$$

Topic: derivatives of exponential, logarithmic fcns



Rules

$$\frac{d}{dx}(a^x) = a^x \cdot \ln a$$

special case: $\frac{d}{dx}(e^x) = e^x$

$$\frac{d}{dx}(\log_a x) = \frac{1}{x \cdot \ln a}$$

special case: $\frac{d}{dx}(\ln x) = \frac{1}{x}$

Quick Review:

1. $\log_5 8$ in terms of ln

change of base: $\dfrac{\log_a 8}{\log_a 5}$

so: $\dfrac{\ln 8}{\ln 5}$

to graph $\log_3 x$?

graph $\dfrac{\ln(x)}{\ln(3)}$

2. 7^x as power of e?

$7 = a^{\log_a(7)} = \log_a(a^7)$

$\boxed{1.}$ $\boxed{2.}$

$7 = e^{\ln 7}$

$\Rightarrow 7^x = (e^{\ln 7})^x = e^{x \ln 7}$

3. $\ln(e^{\tan x}) = \tan x$

in general: f invertible*

$$f^{-1}(f(x)) = f(f^{-1}(x)) = x$$

f has an inverse which is also a fcn.