Essential derivatives *Math 111*

- $\frac{d}{dx}\, c = 0$ for each constant c
- $\frac{d}{dx}\, x^\alpha = \alpha\, x^{\alpha-1}$ for every real number α
- $\frac{d}{dx}\, e^x = e^x$
- $\frac{d}{dx}\, \ln\, x = \frac{1}{x}$
- $\frac{d}{dx}\, \cos x = -\sin x$
- $\frac{d}{dx}\, \sin x = \cos x$
- $\frac{d}{dx}\, \tan x = \sec^2 x$
- $\frac{d}{dx}\, \cot x = -\csc^2 x$
- $\frac{d}{dx}\, \sec x = \sec x \tan x$
- $\frac{d}{dx}\, \csc x = -\csc x \cot x$

- $\frac{d}{dx}\, b^x = b^x \ln\, b$ for all positive constants b
- $\frac{d}{dx}\, \arccos x = -\frac{1}{\sqrt{1-x^2}}$
- $\frac{d}{dx}\, \arcsin x = \frac{1}{\sqrt{1-x^2}}$
- $\frac{d}{dx}\, \arctan x = \frac{1}{1+x^2}$

- *linearity:* $(f+g)' = f' + g'$ and $(cf)' = c(f')$ for each constant c
- *product or Leibniz rule:* $(fg)' = f'\, g + f\, g'$
- *quotient rule:* $\left(\frac{f}{g}\right)' = \frac{f'\, g - f\, g'}{g^2}$
- *chain rule:* $(f \circ g)'(x) = f'(g(x))g'(x)$