Differential Calculus
MTH 62-140
Laws/Theorems/Definitions About Derivatives

1. Definition of Derivative:

   (a) Derivative at a number a:

   $$f'(a) = \lim_{h \to 0} \frac{f(a+h) - f(a)}{h}$$

   (b) Derivative at a number a:

   $$f'(a) = \lim_{x \to a} \frac{f(x) - f(a)}{x - a}$$

   (c) Derivative function:

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

2. Derivatives

   (a) $(x^n)' = nx^{n-1}$

   (b) $(e^x)' = e^x$

   (c) $(\ln(x))' = \dfrac{1}{x}$

   (d) $(\log_b(x))' = \dfrac{1}{x \ln b}$

   (e) $(\sin(x))' = \cos(x)$

   (f) $(\cos(x))' = \sin(x)$

   (g) $(\tan(x))' = \sec^2(x)$

   (h) $(\csc(x))' = -\csc(x)\cot(x)$

   (i) $(\sec(x))' = \sec(x)\tan(x)$

   (j) $(\cot(x))' = -\csc^2(x)$

   (k) $\left(\sin^{-1}(x)\right)' = \dfrac{1}{\sqrt{1-x^2}}$

(l) $\left(\cos^{-1}(x)\right)' = -\dfrac{1}{\sqrt{1-x^2}}$

(m) $\left(\tan^{-1}(x)\right)' = \dfrac{1}{1+x^2}$

(n) $\left(\csc^{-1}(x)\right)' = -\dfrac{1}{x\sqrt{x^2-1}}$

(o) $\left(\sec^{-1}(x)\right)' = \dfrac{1}{x\sqrt{x^2-1}}$

(p) $\left(\cot^{-1}(x)\right)' = -\dfrac{1}{1+x^2}$