

* These are not comprehensive, just a starting point, add to it what you like *

Midterm notes

Limits Involving ∞

- ① If degree of num. $>$ degree of denom. no horizontal asym.
- ② degree num = degree of den. $y = \frac{\text{leading coeff of num}}{\text{leading coeff of denom.}}$
- ③ degree num $<$ degree of denom. $y = 0$

Guidelines to splitting limits

- Never:
- ① $0 \cdot \infty$
 - ② $dne \cdot dne$

$dne \cdot$ a limit that does exist $= dne$

$0 \cdot dne = 0$
 \uparrow but is bounded

after

$$\lim_{x \rightarrow 0} \frac{\sin x}{x} = 1$$

$$\lim_{x \rightarrow \infty} \frac{\sin x}{x} = 0$$

|||||

$$\lim_{x \rightarrow 0} \frac{\tan x}{x} = 1$$

$$\lim_{x \rightarrow \infty} \frac{\tan x}{x} dne$$

after

$$\lim_{x \rightarrow 0} \frac{\cos x}{x} dne$$

$$\lim_{x \rightarrow \infty} \frac{\cos x}{x} = 0$$

$$\lim_{h \rightarrow 0} \frac{f(x_0+h) - f(x_0)}{h} = f'(x_0)$$

$$\begin{aligned} \frac{d}{dx} [\sin x] &= \cos x \\ \frac{d}{dx} [\cos x] &= -\sin x \\ \frac{d}{dx} [\tan x] &= \sec^2 x \end{aligned}$$

$$\begin{aligned} \frac{d}{dx} [\csc x] &= -\cot x \csc x \\ \frac{d}{dx} [\sec x] &= \tan x \sec x \\ \frac{d}{dx} [\cot x] &= -\csc^2 x \end{aligned}$$

with respect to x
 n Deriv $(y, x, x) \rightarrow$ at every x
 find derivative of

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

$$\frac{d}{dx} \ln x = \frac{1}{x}$$

$$\frac{d}{dx} e^u = e^u \frac{du}{dx}$$

$$\frac{d}{dx} \ln u = \frac{1}{u} \frac{du}{dx}$$

$$\frac{d}{dx} a^u = a^u \ln a \frac{du}{dx}$$

$$\frac{d}{dx} \log_a u = \frac{1}{u \ln a} \cdot \frac{du}{dx}$$

* If f and g are inverses, then $g'(y) = \frac{1}{f'(x)}$

$$\frac{d}{dx} [\sin^{-1} u] = \frac{1}{\sqrt{1-u^2}} \frac{du}{dx}$$

$$\frac{d}{dx} [\cos^{-1} u] = -\frac{1}{\sqrt{1-u^2}} \frac{du}{dx}$$

$$\frac{d}{dx} [\tan^{-1} u] = \frac{1}{u^2+1} \frac{du}{dx}$$

MVT

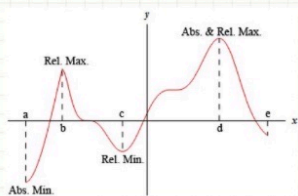
continuous on $[a, b]$

differentiable on (a, b)

$$f'(c) = \frac{f(b) - f(a)}{b - a}$$

Extreme Value Theorem (Candidate Test)

The **extreme value theorem** states that if a real-valued function f is continuous in the closed and bounded interval $[a, b]$, then f must attain both a maximum and a minimum on that interval.



* absolute mins/maxes can occur at endpoints or relative mins/maxes

Intermediate Value Theorem (IVT)

- f is continuous on $[a, b]$
- N is a number between $f(a)$ and $f(b)$
 - i.e. $f(a) \leq N \leq f(b)$ or $f(b) \leq N \leq f(a)$
- then there exists at least one c in $[a, b]$ s.t. $f(c) = N$

