AB Flash Cards

You need to be able to quickly evaluate sin, cos, tan, csc, sec, or cot of the following angles (or any multiple of these angles):

$0, \frac{\pi}{6}, \frac{\pi}{4}, \frac{\pi}{3}, \frac{\pi}{2} ....and...0, 30°, 45°, 60°, 90°...$

Properties of $y = \ln x$

1. The domain of $y = \ln x$ is the set of all positive numbers, $x > 0$.
2. The range of $y = \ln x$ is the set of all real numbers, $-\infty < y < \infty$.
3. $y = \ln x$ is continuous and increasing everywhere on its domain.
4. $\ln(ab) = \ln a + \ln b$.
5. $\ln\left(\frac{a}{b}\right) = \ln a - \ln b$.
6. $\ln a^r = r \ln a$.
7. $y = \ln x < 0$ if $0 < x < 1$.
8. $\lim_{x \to +\infty} \ln x = +\infty$ and $\lim_{x \to 0^+} \ln x = -\infty$.
9. $\log_a x = \frac{\ln x}{\ln a}$

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

Definition of Derivative

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

Alternate Definition of Derivative
Derivative at a point

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

$$\lim_{h \to 0} \frac{\cos h - 1}{h} = 0$$

$$\frac{d}{dx} \sin x = \cos x$$

$$\frac{d}{dx} \cos x = -\sin x$$

$$\frac{d}{dx} \tan x = \sec^2 x$$

$$\frac{d}{dx} \cot x = -\csc^2 x$$

$$\frac{d}{dx} \sec x = \sec x \tan x$$

$$\frac{d}{dx} \csc x = -\csc x \cot x$$

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

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

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

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

$$\frac{d}{dx} \sec^{-1} x = \frac{1}{|x|\sqrt{x^2-1}}$$

$$\frac{d}{dx} \csc^{-1} x = \frac{-1}{|x|\sqrt{x^2-1}}$$

$$\int \frac{dx}{a^2+x^2} = \frac{1}{a} Arc\tan\left(\frac{x}{a}\right) + C$$

$$\int \frac{dx}{\sqrt{a^2-x^2}} = Arc\sin\left(\frac{x}{a}\right) + C$$

$$\int \frac{dx}{x\sqrt{x^2-a^2}} = \frac{1}{a} Arc\sec\frac{|x|}{a} + C = \frac{1}{a} Arc\cos\left|\frac{a}{x}\right| + C$$

$$\lim_{h \to 0} \frac{e^h - 1}{h} = 1$$

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

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

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

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

Power Rule

$$\frac{d}{dx}x^n = nx^{n-1}$$

Product Rule

$$\frac{d}{dx}(uv) = u'v + uv'$$

Quotient Rule

$$\frac{d}{dx}\frac{u}{v} = \frac{u'v - uv'}{v^2}$$

Chain Rule

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

<u>Mean Value Theorem:</u>

If $f(x)$ is continuous at every point of the closed interval $[a,b]$ and differentiable at every point (a,b) then there is one point c in (a,b) at which

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

<u>Intermediate Value Theorem:</u>

If $f(x)$ is continuous on $[a,b]$, then $f(x)$ takes on every (y) value between $f(a)$ and $f(b)$.

<u>Extreme Value Theorem:</u>

If $f(x)$ is continuous on $[a,b]$, then $f(x)$ has both an absolute max and absolute min on that interval.

<u>Average Value</u>

If f is integrable on $[a,b]$, its **average value** on $[a,b]$ is $\frac{1}{b-a}\int_a^b f(x)dx$

<u>The Fundamental Theorem of Calculus, Part 1</u>

If f is continuous on $[a,b]$, then the function $F(x) = \int_a^x f(t)dt$ has a derivative at every point x in $[a,b]$, and $\frac{dF}{dx} = \frac{d}{dx}\int_a^x f(t)dt = f(x)$

<u>The Fundamental Theorem of Calculus, Part 2 (Integral Evaluation Theorem)</u>

If f is continuous at every point $[a,b]$, and if F is any antiderivitive of f on $[a,b]$, then

$$\int_a^b f(x)dx = F(b) - F(a)$$

<u>Y changes at a rate proportional to the amount present.</u>

$$\frac{dy}{dt} = ky$$

$$y = Ae^{kt}$$

<u>Derivative of Inverses</u>

If $g(x)$ is the inverse of $f(x)$ and $f(a) = b$ then

$$g'(b) = \frac{1}{f'(a)}$$

<u>The Fundamental Theorem in Fogle Language</u>

Given a velocity $v(t)$ and a position at a given time… ex: when t = 8, the position is 4. Find the position at 2 seconds.