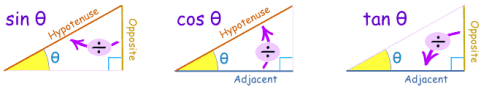
Algebra, Geometry, Trigonometry and Derivative Review

Algebra, Geometry & Trigonometry:



powers of x $(x^n)^2 = x^{2n}$ $(x^n)^m = x^{nm}$ $x^n x^m = x^{m+n}$ $\frac{x^{2n+3}}{x^{2n+1}} = x^{2n+3-(2n+1)} = x^2$ $x^{-1} = \frac{1}{x}$

ln $\ln(ab) = \ln a + \ln b$ $\ln(a^b) = b \ln a$ $\ln \frac{1}{a} = \ln 1 - \ln a = 0 - \ln a = -\ln a$

sin, cos & tan in a right triangle: $sohcahtoa : sin(\theta) = \frac{opp}{hyp}, cos(\theta) = \frac{adj}{hyp}, tan(\theta) = \frac{opp}{adj} = \frac{sin(\theta)}{cos(\theta)}$

csc, sec and cot, arc $csc(\theta) = \frac{1}{sin(\theta)}, sec(\theta) = \frac{1}{cos}, cot(\theta) = \frac{1}{tan} = \frac{cos(\theta)}{sin(\theta)}$. arc: function inverses.

Pythagorean Thm: $sin^2(x) + cos^2(x) = 1$. **Others:** $tan^2(x) + 1 = sec^2(x), cot^2(x) + 1 = csc^2(x)$

sin Sums: $sin(x + y) = sin(x)cos(y) + cos(x)sin(y)$. **Double angle:** $sin(2\theta) = 2sin(\theta)cos(\theta)$

cos Sums: $cos(x+y) = cos(x)cos(y) - sin(x)sin(y)$. **Double:** $cos(2\theta) = 2cos^2(\theta) - 1 = 1 - 2sin^2(\theta)$

Half Angle for sin: $sin^2(x) = \frac{1}{2} - \frac{1}{2}cos(2x)$, **Half Angle for cos:** $cos^2(x) = \frac{1}{2} + \frac{1}{2}cos(2x)$

Odd/Even: Sine is odd, $sin(-x) = -sin(x)$; Cosine is even, $cos(-x) = cos(x)$

Area & Volume: circle πr^2. rectangle $l \times w$. cylinder surface $2\pi rh$. cylinder volume $\pi r^2 h$.

Derivatives of Specific Functions:

Polynomial: $\frac{d}{dx}(x^n) = nx^{n-1}$

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

Exponential, Base e: $\frac{d}{dx}(e^x) = e^x$

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

Logarithmic, Base e: $\frac{d}{dx}(ln(x)) = \frac{1}{x}$

Sine: $\frac{d}{dx}(sin(x)) = cos(x)$

Cosine: $\frac{d}{dx}(cos(x)) = -sin(x)$

Tangent: $\frac{d}{dx}(tan(x)) = sec^2(x)$

Cotangent: $\frac{d}{dx}(cot(x)) = -csc^2(x)$

Arcsine: $\frac{d}{dx}(arcsin(x)) = \frac{1}{\sqrt{1-x^2}}$

Arccosine: $\frac{d}{dx}(arccos(x)) = \frac{-1}{\sqrt{1-x^2}}$

Arctangent: $\frac{d}{dx}(arctan(x)) = \frac{1}{1+x^2}$

Hyperbolic Sine: $\frac{d}{dx}(sinh(x)) = cosh(x)$

Hyperbolic Cosine: $\frac{d}{dx}(cosh(x)) = sinh(x)$

Derivative Rules for Function Arithmetic:

Arithmetic Combination	*Derivative*
Constant multiple: $cf(x)$	$cf'(x)$
Addition: $f(x) + g(x)$	$f'(x) + g'(x)$
Multiplication: $f(x) \cdot g(x)$	$f(x) \cdot g'(x) + g(x) \cdot f'(x)$ (product rule)
Division: $\frac{f(x)}{g(x)}$	$\frac{g(x) \cdot f'(x) - f(x) \cdot g'(x)}{(g(x))^2}$ (quotient rule)
Composition of functions: $f(g(x))$	$f'(g(x)) \cdot g'(x)$ (chain rule)