7.2 CHEAT SHEET

$D_x \sin u = (\cos u)\frac{du}{dx}$ $\int \sin u\, du = -\cos u + C$

$D_x \cos u = (-\sin u)\frac{du}{dx}$ $\int \cos u\, du = \sin u + C$

$D_x \tan u = (\sec^2 u)\frac{du}{dx}$ $\int \tan u\, du = \ln|\sec u| + c$

$D_x \cot u = (-\csc^2 u)\frac{du}{dx}$ $\int \cot u\, du = \ln|\sin u| + c$

$D_x \sec u = ((\sec u)\tan u)\frac{du}{dx}$ $\int \sec u\, du = \ln|\sec u + \tan u| +$

$D_x \csc u = ((-\csc u)\cot u))\frac{du}{dx}$ $\int \csc u\, du = \ln|\csc u - \cot u| + c$

$\int \sin^2 u\, du = \frac{1}{2}u - \frac{1}{4}\sin 2u + C$

$\int \cos^2 u\, du = \frac{1}{2}u + \frac{1}{4}\sin 2u + C$

$\int \tan^2 u\, du = \tan u - u + C$

$\int \cot^2 u\, du = -\cot u - u + C$

$\int \sec^2 u\, du = \tan u + C$

$\int \csc^2 u\, du = -\cot u + C$

$\int \sec u \tan u\, du = \sec u + C$

$\int \csc u \cot u\, du = -\csc u + C$

$D_x\, e^u = e^u \frac{du}{dx}$

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

$D_x \sin u = +\cos u \frac{du}{dx}$

$D_x \cos u = -\sin u \frac{du}{dx}$

$D_x \tan u = \sec^2 u \frac{du}{dx}$

$D_x \sec u = \sec u \tan u \frac{du}{dx}$

$D_x \csc u = -\csc u \cot u \frac{du}{dx}$

$D_x \cot u = -\csc^2 u \frac{du}{dx}$

$\int e^u dx = e^u + C$

$\int \frac{1}{u} du = \ln|u| + C$

$\int \sin u\, du = -\cos u + C$

$\int \cos u\, du = \sin u + C$

$\int \tan u\, du = -\ln|\cos u| + C$

$\int \tan^n u\, du = \frac{\tan^{n-1} u}{n-1} - \int \tan^{n-2} u\, du$

$\int \tan^2 u\, du = \tan u - u + C$

$\int \sec u\, du = \ln|\sec u + \tan u| + C$

$\int \sec^n u\, du = \frac{\sec^{n-2} u \tan u}{n-1} + \frac{n-2}{n-1}\int \sec^{n-2} u\, du$

$\int \sec^2 u\, du = \tan u + C$

$\int \csc^2 u\, du = -\cot u + C$

$\int \sec u \tan u\, du = \sec u + C$

$\int \csc u \cot u\, du = -\csc u + C$

$D_x \sin^{-1} u = \frac{1}{\sqrt{1-u^2}}\frac{du}{dx}$ $\qquad \int \frac{du}{\sqrt{1-u^2}} = \sin^{-1} u + C$

$D_x \cos^{-1} u = \frac{-1}{\sqrt{1-u^2}}\frac{du}{dx}$

$D_x \tan^{-1} u = \frac{1}{1+u^2}\frac{du}{dx}$ $\qquad \int \frac{du}{1+u^2} = \tan^{-1} u + C$

$D_x \cot^{-1} u = \frac{-1}{1+u^2}\frac{du}{dx}$

$D_x \sec^{-1} u = \frac{1}{|u|\sqrt{u^2-1}}\frac{du}{dx}$ $\qquad \int \frac{du}{u\sqrt{u^2-1}} = \sec^{-1}|u| + C$

$D_x \csc^{-1} u = \frac{-1}{|u|\sqrt{u^2-1}}\frac{du}{dx}$

$f(t) = A\cos kt + B\sin kt$

$A = x_0$ $\qquad C = \text{amplitude} = \sqrt{A^2+B^2}$

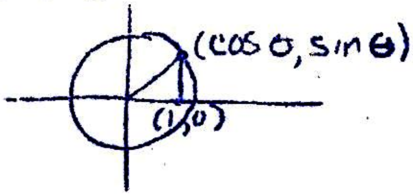
$B = \frac{v_0}{k}$ $\qquad \alpha = \frac{1}{k}\tan^{-1}\left(\frac{-A}{B}\right)$ = phase shift

period $= \frac{2\pi}{k}$ $\qquad$ frequency $= \frac{1}{\text{period}}$

$D_x \ln u = \frac{1}{u}\frac{du}{dx}$ $\qquad D e^u = e^u \frac{du}{dx}$

CIRCULAR FUNCTIONS

$x^2+y^2=1$



$a^2-u^2 \quad u=a\sin\theta \quad 1-\sin^2\theta=\cos^2\theta$

$a^2+u^2 \quad u=a\tan\theta \quad 1+\tan^2\theta=\sec^2\theta$

$u^2-a^2 \quad u=a\sec\theta \quad \sec^2\theta-1=\tan^2\theta$

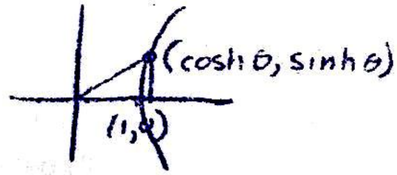
$u=\tan\frac{\theta}{2}$

$\sin\theta=\frac{2u}{1+u^2} \quad \cos\theta=\frac{1-u^2}{1+u^2}$

$\theta=2\tan^{-1}u$

$d\theta=\frac{2du}{1+u^2}$

HYPERBOLIC FUNCTIONS



$x^2-y^2=1$

$\sinh x=\frac{e^x-e^{-x}}{2} \quad \operatorname{csch} x=\frac{2}{e^x-e^{-x}}$

$\cosh x=\frac{e^x+e^{-x}}{2} \quad \operatorname{sech} x=\frac{2}{e^x+e^{-x}}$

$\tanh x=\frac{e^x-e^{-x}}{e^x+e^{-x}} \quad \coth x=\frac{e^x+e^{-x}}{e^x-e^{-x}}$

$\sinh^{-1}x=\ln(x+\sqrt{x^2+1}) \quad \forall x$

$\cosh^{-1}x=\ln(x+\sqrt{x^2-1}) \quad \forall x\geq 1$

$\tanh^{-1}x=\frac{1}{2}\ln\left(\frac{1+x}{1-x}\right) \quad \forall |x|<1$

$\coth^{-1}x=\frac{1}{2}\ln\left(\frac{x+1}{x-1}\right) \quad \forall |x|>1$

$\operatorname{sech}^{-1}x=\ln\left(\frac{1+\sqrt{1-x^2}}{x}\right)$ if $0<x\leq 1$

$\operatorname{csch}^{-1}x=\ln\left(\frac{1}{x}+\frac{\sqrt{1+x^2}}{|x|}\right) \forall x\neq 0$

$\cos^2x+\sin^2x=1$

$1+\tan^2x=\sec^2x$

$\cot^2x+1=\csc^2x$

$\sin(x+y)=\sin x\cos y+\cos x\sin y$

$\cos(x+y)=\cos x\cos y-\sin x\sin y$

$\sin 2x=2\sin x\cos x$

$\cos 2x=\cos^2x-\sin^2x$

$\cos^2x=\frac{1}{2}(1+\cos 2x)$

$\sin^2x=\frac{1}{2}(1-\cos 2x)$

$\cosh^2x-\sinh^2x=1$

$1-\tanh^2x=\operatorname{sech}^2x$

$\coth^2x-1=\operatorname{csch}^2x$

$\sinh(x+y)=\sinh x\cosh y+\cosh x\sinh y$

$\cosh(x+y)=\cosh x\cosh y+\sinh x\sinh y$

$\sinh 2x=2\sinh x\cosh x$

$\cosh 2x=\cosh^2x+\sinh^2x$

$\cosh^2x=\frac{1}{2}(\cosh 2x+1)$

$\sinh^2x=\frac{1}{2}(\cosh 2x-1)$

$D_x \sinh u = \cosh u \dfrac{du}{dx}$ $\qquad \int \sinh u \, du = \cosh u + C$

$D_x \cosh u = \sinh u \dfrac{du}{dx}$ $\qquad \int \cosh u \, du = \sinh u + C$

$D_x \tanh u = \operatorname{sech}^2 u \dfrac{du}{dx}$ $\qquad \int \operatorname{sech}^2 u \, du = \tanh u + C$

$D_x \coth u = -\operatorname{csch}^2 u \dfrac{du}{dx}$ $\qquad \int \operatorname{csch}^2 u \, du = -\coth u + C$

$D_x \operatorname{sech} u = -\operatorname{sech} u \tanh u \dfrac{du}{dx}$ $\qquad \int \operatorname{sech} u \tanh u \, du = -\operatorname{sech} u + C$

$D_x \operatorname{csch} u = -\operatorname{csch} u \coth u \dfrac{du}{dx}$ $\qquad \int \operatorname{csch} u \coth u \, du = -\operatorname{csch} u + C$

$D_x \sinh^{-1} u = \dfrac{1}{\sqrt{u^2+1}} \dfrac{du}{dx}$ $\qquad \int \dfrac{du}{\sqrt{u^2+1}} = \sinh^{-1} u + C$

$D_x \cosh^{-1} u = \dfrac{1}{\sqrt{u^2-1}} \dfrac{du}{dx}$ $\qquad \int \dfrac{du}{\sqrt{u^2-1}} = \cosh^{-1} u + C$

$D_x \tanh^{-1} u = \dfrac{1}{1 \cancel{+} u^2} \dfrac{du}{dx}$ $\qquad \int \dfrac{du}{1-u^2} = \tanh^{-1} u + C \quad \forall |u| < 1$

$\qquad = \dfrac{1}{2} \ln \left| \dfrac{1+u}{1-u} \right| + C$

MINUS $\qquad = \coth^{-1} u + C \quad \forall |u| > 1$

$D_x \coth^{-1} u = \dfrac{1}{1-u^2} \dfrac{du}{dx}$

$D_x \operatorname{sech}^{-1} u = \dfrac{-1}{u\sqrt{1-u^2}} \dfrac{du}{dx}$ $\qquad \int \dfrac{du}{u\sqrt{1-u^2}} = -\operatorname{sech}^{-1} |u| + C$

$D_x \operatorname{csch}^{-1} u = \dfrac{-1}{u\sqrt{1+u^2}} \dfrac{du}{dx}$ $\qquad \int \dfrac{du}{u\sqrt{1+u^2}} = -\operatorname{csch}^{-1} |u| + C$