Miscellaneous Identities

$$\tan x = \frac{\sin x}{\cos x} \qquad \cot x = \frac{\cos x}{\sin x}$$

$$\sec x = \frac{1}{\cos x} \qquad \csc x = \frac{1}{\sin x}$$

$$\sin x = \frac{1}{\csc x} \qquad \cos x = \frac{1}{\sec x}$$

$$\tan x = \frac{1}{\cot x}$$

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

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

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

$$\sin\frac{1}{2}x = \pm\sqrt{\frac{1-\cos x}{2}} \Rightarrow 1 - \cos x = 2\sin^2\frac{1}{2}x$$

$$\cos\frac{1}{2}x = \pm\sqrt{\frac{1+\cos x}{2}} \Rightarrow 1 + \cos x = 2\cos^2\frac{1}{2}x$$

$$\tan\frac{1}{2}x = \pm\sqrt{\frac{1-\cos x}{1+\cos x}}$$

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

$$\cos(x \pm y) = \cos x\cos y \mp \sin x\sin y$$

$$\tan(x \pm y) = \frac{\tan x \pm \tan y}{1 \mp \tan x\tan y}$$

$$\sin(x+y) + \sin(x-y) = 2\sin x\cos y$$

$$\sin(x+y) - \sin(x-y) = 2\cos x\sin y$$

$$\cos(x+y) + \cos(x-y) = 2\cos x\cos y$$

$$\cos(x+y) - \cos(x-y) = -2\sin x\sin y$$

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

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

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

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

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

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

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

$$\text{arc}\,\sin x + \text{arc}\,\cos x = \frac{1}{2}\pi$$

$$\sinh x = \frac{1}{2}e^x - \frac{1}{2}e^{-x} \qquad \cosh x = \frac{1}{2}e^x + \frac{1}{2}e^{-x}$$

$$\tanh x = \frac{e^x - e^{-x}}{e^x + e^{-x}} = \frac{\sinh x}{\cosh x}$$

$$\text{ctn h}\, x = \frac{1}{\tanh x} \qquad \text{sech}\, x = \frac{1}{\cosh x} \qquad \text{csch}\, x = \frac{1}{\sinh x}$$

$$\sinh(x+y) = \frac{1}{2}e^{x+y} - \frac{1}{2}e^{-x-y}$$

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

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

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

$$\text{ctn h}^2 x - 1 = \text{sech}^2 x$$

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

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

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

$$\cosh^{-1} x = \ln(x \pm \sqrt{x^2-1})$$

$$\tanh^{-1} x = \frac{1}{2}\ln\frac{1+x}{1-x}$$