Notation

The terms θ, x, y are all expressed in degrees.

Formulas

Pythagorean Identities

$$\sin^2(\theta) + \cos^2(\theta) = 1.$$
$$\tan^2(\theta) + 1 = \sec^2(\theta).$$
$$\cot^2(\theta) + 1 = \csc^2(\theta).$$

Odd/Even Functions

$$\sin(\theta) = -\sin(-\theta).$$
$$\cos(\theta) = \cos(-\theta).$$
$$\tan(\theta) = -\tan(-\theta).$$

Cofunction Identities

$$\sin(\theta) = \cos(90 - \theta), \text{ and } \cos(\theta) = \sin(90 - \theta).$$
$$\tan(\theta) = \cot(90 - \theta), \text{ and } \cot(\theta) = \tan(90 - \theta).$$

Periodicity Identities

$$\sin(\theta) = \sin(\theta + 360x)$$
$$\cos(\theta) = \cos(\theta + 360x)$$
$$\tan(\theta) = \tan(\theta + 180x)$$

Sum/Difference Identities

$$\cos(x + y) = \cos(x)\cos(y) - \sin(x)\sin(y).$$
$$\cos(x - y) = \cos(x)\cos(y) + \sin(x)\sin(y).$$
$$\sin(x + y) = \sin(x)\cos(y) + \sin(y)\cos(x).$$
$$\sin(x - y) = \sin(x)\cos(y) - \sin(y)\cos(x).$$
$$\tan(x + y) = \frac{\tan(x)+\tan(y)}{1-\tan(x)\cdot\tan(y)}.$$
$$\tan(x - y) = \frac{\tan(x)-\tan(y)}{1+\tan(x)\cdot\tan(y)}.$$
$$\cot(x + y) = \frac{\cot(x)\cdot\cot(y)-1}{\cot(x)+\cot(y)}.$$
$$\cot(x - y) = \frac{\cot(x)\cdot\cot(y)+1}{\cot(y)-\cot(x)}.$$

Double Angle Identities

$$\sin(2x) = 2\sin(x)\cos(x).$$

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

Half Angle Identities

$$\sin(\tfrac{x}{2}) = \pm\sqrt{\frac{1-\cos(x)}{2}}.$$
$$\cos(\tfrac{x}{2}) = \pm\sqrt{\frac{1+\cos(x)}{2}}.$$
$$\tan(\tfrac{x}{2}) = \pm\sqrt{\frac{1-\cos(x)}{1+\cos(x)}} = \frac{\sin(x)}{1+\cos(x)} = \frac{1-\cos(x)}{\sin(x)}.$$

Sum to Product Identities

$$\sin(x) + \sin(y) = 2\sin(\tfrac{x+y}{2})\cos(\tfrac{x-y}{2}).$$
$$\sin(x) - \sin(y) = 2\sin(\tfrac{x-y}{2})\cos(\tfrac{x+y}{2}).$$
$$\cos(x) + \cos(y) = 2\cos(\tfrac{x+y}{2})\cos(\tfrac{x-y}{2}).$$
$$\cos(x) - \cos(y) = -2\sin(\tfrac{x+y}{2})\sin(\tfrac{x-y}{2}).$$
$$\tan(x) + \tan(y) = \frac{\sin(x+y)}{\cos(x)\cos(y)}.$$
$$\tan(x) - \tan(y) = \frac{\sin(x-y)}{\cos(x)\cos(y)}.$$

Product to Sum Identities

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

Mollweide's Formulas

Consider $\triangle ABC$ with $\overline{BC}, \overline{AC}, \overline{AB}$ expressed as $a, b, c,$ respectively. Then,

$$\frac{a+b}{c} = \frac{\cos(\frac{A-B}{2})}{\sin(C)},$$
and $$\frac{a-b}{c} = \frac{\sin(\frac{A-B}{2})}{\cos(C)}.$$