

**Double-Angle Formulas:**  $\sin(2u) = 2\sin(u)\cos(u)$ ,  $\cos(2u) = \cos^2(u) - \sin^2(u) = 2\cos^2(u) - 1 = 1 - 2\sin^2(u)$ ,

$\tan(2u) = \frac{2\tan(u)}{1 - \tan^2(u)} = \frac{\sin(2u)}{\cos(2u)}$ ! You have to determine the “±” deal by determining the quadrant in which  $\frac{u}{2}$  resides.

**Half-Angle Formulas:**  $\sin\left(\frac{u}{2}\right) = \pm\sqrt{\frac{1 - \cos(u)}{2}}$ ,  $\cos\left(\frac{u}{2}\right) = \pm\sqrt{\frac{1 + \cos(u)}{2}}$ ,  $\tan\left(\frac{u}{2}\right) = \frac{1 - \cos(u)}{\sin(u)} = \frac{\sin\left(\frac{u}{2}\right)}{\cos\left(\frac{u}{2}\right)}$ !!!

You have to determine the “±” by determining the quadrant in which  $\frac{u}{2}$  resides.

**Power-Reducing Formulas:**  $\sin^2(u) = \frac{1 - \cos(2u)}{2}$ ,  $\cos^2(u) = \frac{1 + \cos(2u)}{2}$ ,  $\tan^2(u) = \frac{1 - \cos(2u)}{1 + \cos(2u)} = \frac{\sin^2(u)}{\cos^2(u)}$

**Product-to-Sum Formulas**

$$\sin u \sin v = \frac{1}{2}[\cos(u - v) - \cos(u + v)]$$

$$\cos u \cos v = \frac{1}{2}[\cos(u - v) + \cos(u + v)]$$

$$\sin u \cos v = \frac{1}{2}[\sin(u + v) + \sin(u - v)]$$

**Sum-to-Product Formulas**

$$\sin u + \sin v = 2 \sin\left(\frac{u + v}{2}\right) \cos\left(\frac{u - v}{2}\right)$$

$$\cos u + \cos v = 2 \cos\left(\frac{u + v}{2}\right) \cos\left(\frac{u - v}{2}\right)$$

$$\cos u - \cos v = -2 \sin\left(\frac{u + v}{2}\right) \sin\left(\frac{u - v}{2}\right)$$

**Pythagorean Identities**

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

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

**Angle Sum Formulas**

$$\sin(u + v) = \sin(u)\cos(v) + \sin(v)\cos(u)$$

$$\cos(u + v) = \cos(u)\cos(v) - \sin(u)\sin(v)$$

Radians without  $\pi$

1.570796327

3.141592654  $\frac{\pi}{2}$  6.283185308  
4.712388981

**Law of Sines**  $\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$  **Law of Cosines**  $a^2 = b^2 + c^2 - 2bc \cos A$

**Heron's**  $Area = \sqrt{s(s-a)(s-b)(s-c)}$ , where  $s = \frac{a+b+c}{2}$ . **Magnitude**  $\vec{u} = \langle a, b \rangle \Rightarrow \|\vec{u}\| = \sqrt{a^2 + b^2}$

**Arc Length:**  $s = r\theta$ , **Area of a Sector:**  $A = \frac{1}{2}r^2\theta$