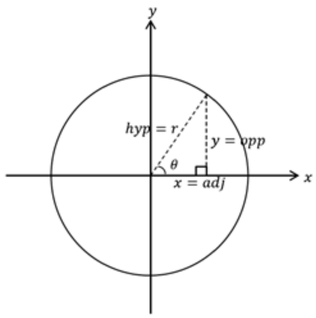
Trigonometric Basic Identities

UVU Math Lab

HINT: In many cases, we can use the **Reciprocal Identities** to rewrite expressions as functions of sine & cosine in order to more easily simplify, solve, or to reduce the amount of material to memorize (So, memorize the green information only.).

Definition of Trigonometric Functions:
Given a right triangle, where $0 < \theta < 90°$,



SOH $\quad \sin\theta = \frac{opp}{hyp} = \frac{y}{r}$ $\qquad \csc\theta = \frac{1}{\sin\theta} = \frac{hyp}{opp} = \frac{r}{y}$

CAH $\quad \cos\theta = \frac{adj}{hyp} = \frac{x}{r}$ $\qquad \sec\theta = \frac{1}{\cos\theta} = \frac{hyp}{adj} = \frac{r}{x}$

TOA $\quad \tan\theta = \frac{\sin\theta}{\cos\theta} = \frac{opp}{adj} = \frac{y}{x}$ $\qquad \cot\theta = \frac{\cos\theta}{\sin\theta} = \frac{adj}{opp} = \frac{x}{y}$

where, $r = \sqrt{x^2 + y^2}$

Reciprocal Identities:

$$\sin\theta = \frac{1}{\csc\theta} \qquad \csc\theta = \frac{1}{\sin\theta}$$

$$\cos\theta = \frac{1}{\sec\theta} \qquad \sec\theta = \frac{1}{\cos\theta}$$

$$\tan\theta = \frac{1}{\cot\theta} \qquad \cot\theta = \frac{1}{\tan\theta}$$

Pythagorean Identities:

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

$$\frac{\sin^2\theta}{\sin^2\theta} + \frac{\cos^2\theta}{\sin^2\theta} = \frac{1}{\sin^2\theta} \qquad \frac{\sin^2\theta}{\cos^2\theta} + \frac{\cos^2\theta}{\cos^2\theta} = \frac{1}{\cos^2\theta}$$

$$1 + \cot^2\theta = \csc^2\theta \qquad \tan^2\theta + 1 = \sec^2\theta$$

Even & Odd Trig Functions:

$$\sin(-\theta) = -\sin\theta \text{ (odd)} \qquad \cos(-\theta) = \cos\theta \text{ (even)}$$

$$\csc(-\theta) = \frac{1}{\sin(-\theta)} = \frac{1}{-\sin\theta} = -\csc\theta \text{ (odd)}$$

$$\sec(-\theta) = \frac{1}{\cos(-\theta)} = \frac{1}{\cos\theta} = \sec\theta \text{ (even)}$$

$$\tan(-\theta) = \frac{\sin(-\theta)}{\cos(-\theta)} = \frac{-\sin\theta}{\cos\theta} = -\tan\theta \text{ (odd)}$$

$$\cot(-\theta) = \frac{\cos(-\theta)}{\sin(-\theta)} = \frac{\cos\theta}{-\sin\theta} = -\cot\theta \text{ (odd)}$$

Co-function Formulas:

$$\sin\left(\frac{\pi}{2} - \theta\right) = \cos\theta \quad \csc\left(\frac{\pi}{2} - \theta\right) = \sec\theta$$

$$\cos\left(\frac{\pi}{2} - \theta\right) = \sin\theta \quad \sec\left(\frac{\pi}{2} - \theta\right) = \csc\theta$$

$$\tan\left(\frac{\pi}{2} - \theta\right) = \cot\theta \quad \cot\left(\frac{\pi}{2} - \theta\right) = \tan\theta$$

See why this is true on Table of Trig Values.

Trigonometric Unit Circle

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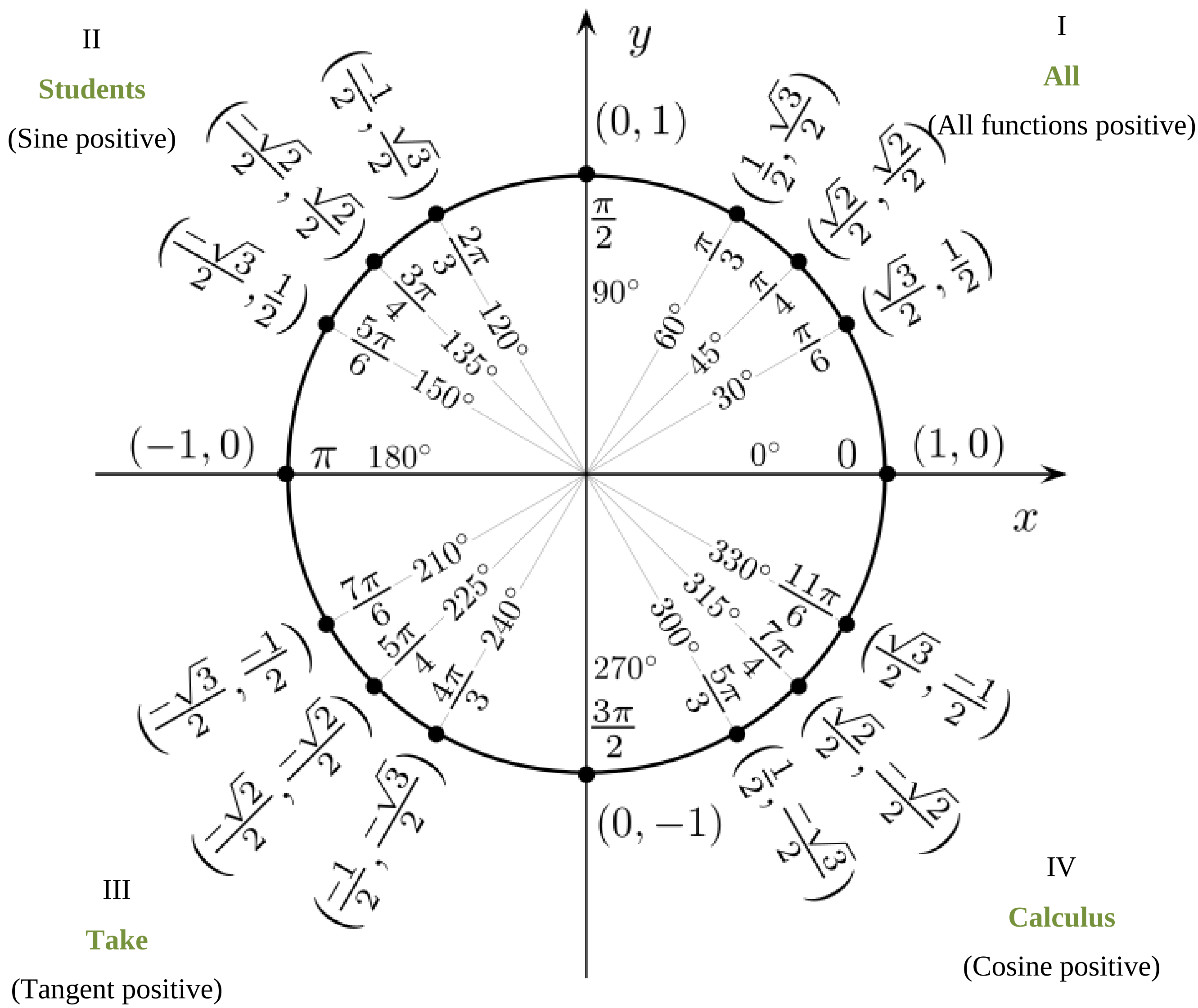

Table of Trigonometric Values of Common Angles of the Unit Circle:						
Angle in Degrees / Radians	**$\sin\theta$**	**$\cos\theta$**	$\csc\theta = \frac{1}{\sin\theta}$	$\sec\theta = \frac{1}{\cos\theta}$	$\tan\theta = \frac{\sin\theta}{\cos\theta}$	$\cot\theta = \frac{\cos\theta}{\sin\theta}$
30° / $\pi/6$	$\sqrt{1}/2$	$\sqrt{3}/2$	$\frac{1}{\sqrt{1}/2} = 2$	$\frac{1}{\sqrt{3}/2} = \frac{2\sqrt{3}}{3}$	$\frac{\sqrt{1}/2}{\sqrt{3}/2} = \frac{\sqrt{3}}{3}$	$\frac{\sqrt{3}/2}{\sqrt{1}/2} = \sqrt{3}$
45° / $\pi/4$	$\sqrt{2}/2$	$\sqrt{2}/2$	$\frac{1}{\sqrt{2}/2} = \sqrt{2}$	$\frac{1}{\sqrt{2}/2} = \sqrt{2}$	$\frac{\sqrt{2}/2}{\sqrt{2}/2} = 1$	$\frac{\sqrt{2}/2}{\sqrt{2}/2} = 1$
60° / $\pi/3$	$\sqrt{3}/2$	$\sqrt{1}/2$	$\frac{1}{\sqrt{3}/2} = \frac{2\sqrt{3}}{3}$	$\frac{1}{\sqrt{1}/2} = 2$	$\frac{\sqrt{3}/2}{\sqrt{1}/2} = \sqrt{3}$	$\frac{\sqrt{1}/2}{\sqrt{3}/2} = \frac{\sqrt{3}}{3}$