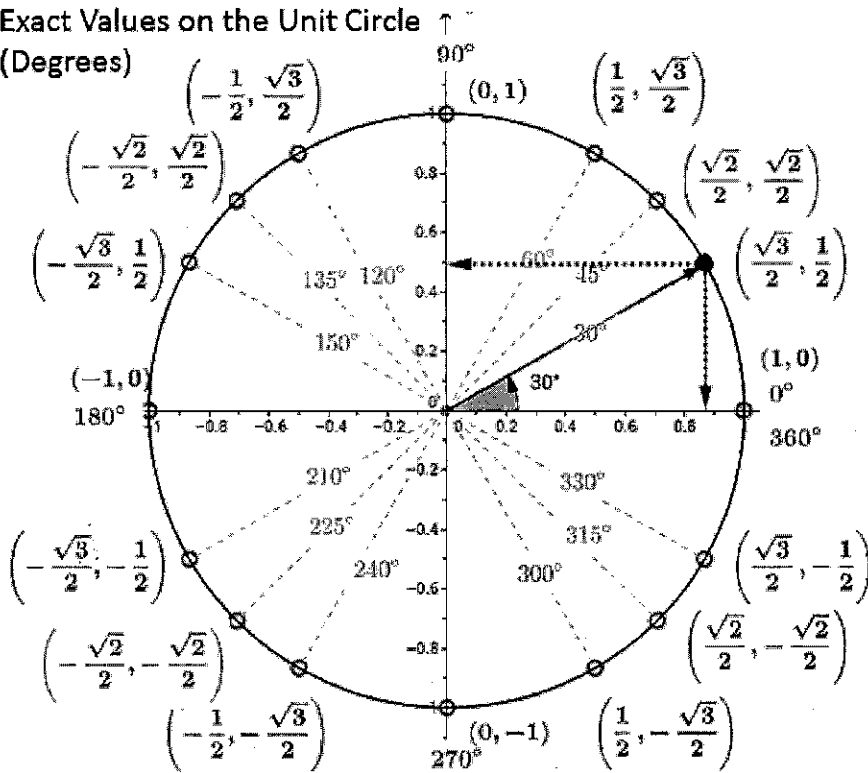


Recall from Anna's Ferris Wheel problem and the Clock problem that the coordinate points on a circle can be found using  $y = \sin \theta = \frac{\text{opposite leg}}{\text{hypotenuse}}$  and  $x = \cos \theta = \frac{\text{adjacent leg}}{\text{hypotenuse}}$ . Where  $\theta$  is the rotation from the x-axis.

**Exact Values on the Unit Circle**  
(Degrees)



The cosine of an angle is the x-coordinate of the point on the unit circle.

$$\cos 30^\circ = \frac{\sqrt{3}}{2}$$

The sine of an angle is the y-coordinate of the point on the unit circle.

$$\sin 30^\circ = \frac{1}{2}$$

Use the image of the unit circle above to answer all the problems below.

1. Explain why each of the following are true:

a.  $\sin(45^\circ) = \sin(135^\circ)$

They are at the same height.

b.  $\cos(120^\circ) = \cos(240^\circ)$ .

They are at the same x value

c.  $\sin(-30^\circ) = \sin(210^\circ)$

$$-30^\circ = 330^\circ$$

$330^\circ$  &  $210^\circ$  have the same y.

d.  $\cos(180^\circ) = \cos(540^\circ)$

$$540^\circ = 360^\circ + 180^\circ = 180^\circ$$

They are the same location

2. Solve each equation for  $\theta$ :

a.  $\sin(\theta) = \sin(42^\circ)$  where  $0 \leq \theta \leq 90$

$42^\circ = 360 + 42 = 60$

$\theta = 60$

b.  $\cos(\theta) = \cos(75^\circ)$  where  $0 \leq \theta \leq 90$

$75^\circ = 360 + 75 = 30$

$\theta = 30$

c.  $\sin(\theta) = \sin(30^\circ)$  where  $180 \leq \theta \leq 270$

300 is at the same

height as 240.

$\theta = 240^\circ$

2. Find  $\cos(-30^\circ)$  and  $\sin(-30^\circ)$ . Identify the measure of the reference angle (the 1st quadrant angle that shares the same absolute value of cosine and sine).

$\cos(-30^\circ) = \sqrt{3}/2$

$\sin(-30^\circ) = -1/2$

$\theta = 30^\circ$

3. Find  $\cos(-135^\circ)$  and  $\sin(-135^\circ)$ . Identify the measure of the reference angle.

$\cos(-135^\circ) = -\sqrt{2}/2$

$\sin(-135^\circ) = -\sqrt{2}/2$

$\theta = 45^\circ$

4. Find  $\cos(1680^\circ)$  and  $\sin(1680^\circ)$ . Identify the measure of the reference angle.

$1680^\circ = 360 + 360 + 360 + 360 + 360 + 240$

$\cos(240^\circ) = -1/2$

$\sin(240^\circ) = -\sqrt{3}/2$

$\theta = 60^\circ$

5. Find  $\cos(2115^\circ)$  and  $\sin(2115^\circ)$ . Identify the measure of the reference angle.

$2115 = 360 + 360 + 360 + 360 + 360 + 315$

1800

$\cos(315^\circ) = \sqrt{2}/2$

$\sin(315^\circ) = -\sqrt{2}/2$

$\theta = 45^\circ$

6. Find  $\cos(720.030^\circ)$  and  $\sin(720.030^\circ)$ . Identify the measure of the reference angle.

$720.030 = 360.02000 + 30$

$\cos 30 = \sqrt{3}/2$

$\sin 30 = 1/2$

$\theta = 30$