

Review

Evaluate the trigonometric expression:

$$\sin(-120^\circ) = \frac{-\sqrt{3}}{2}$$

~~$\frac{-\sqrt{3}}{2}$~~

$$\sec 180^\circ = \frac{1}{-1} = -1$$

$$\cos 225^\circ = \frac{-1}{\sqrt{2}}$$

~~$\frac{-1}{\sqrt{2}}$~~

$$\csc 330^\circ = \frac{2}{-1} = -2$$

$$\tan(-270^\circ) = \text{undefined}$$

$$\cot 135^\circ = -1$$

Convert to degrees:

$$\frac{3\pi}{4} \cdot \frac{180^\circ}{\pi} = 135^\circ$$

$$\frac{4\pi}{3} \cdot \frac{180^\circ}{\pi} = 240^\circ$$

$$\frac{11\pi}{6} \cdot \frac{180^\circ}{\pi} = 330^\circ$$

$$-\frac{5\pi}{2} \cdot \frac{180^\circ}{\pi} = -450^\circ$$

Homework questions?

$$\frac{\pi}{2} = -\frac{3\pi}{2}$$

$$\pi = -\pi$$

$$0 \equiv 2\pi \equiv 20\pi$$

$$\frac{3\pi}{2} = -\frac{\pi}{2}$$

$$0 < \frac{\pi}{6} < \frac{\pi}{2}$$

$$\frac{\pi}{6}$$

Common angles:

(memorize!)

$$\frac{\pi}{6} = 30^\circ$$

$$\frac{\pi}{4} = 45^\circ$$

$$\frac{\pi}{3} = 60^\circ$$

Note:

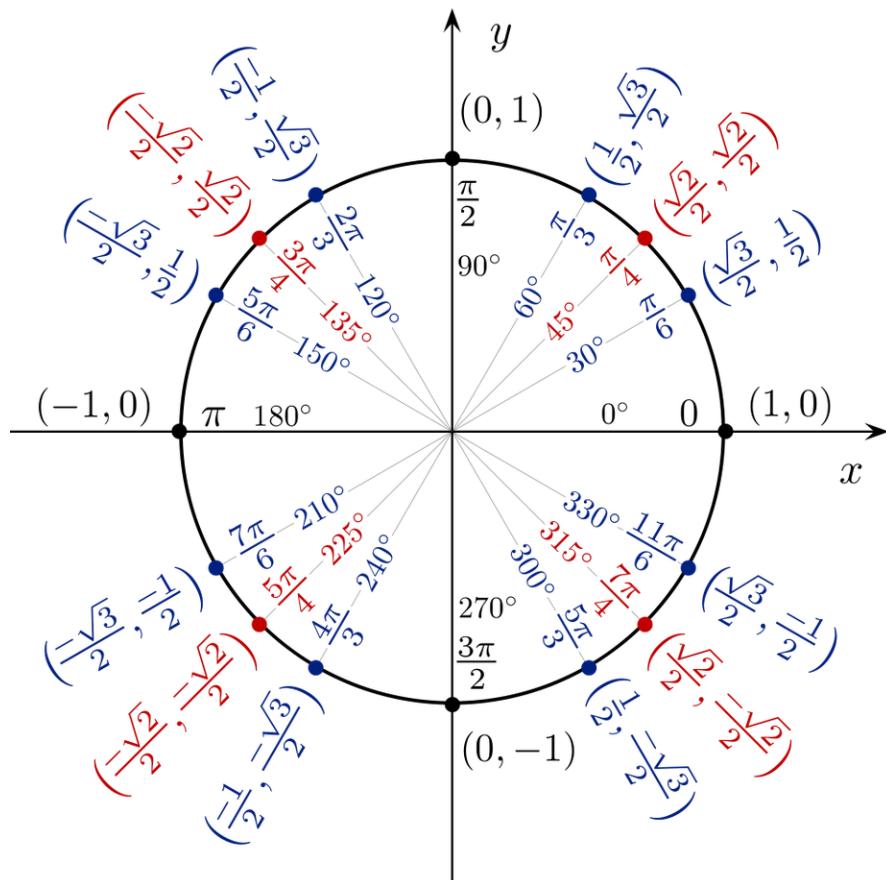
$$\frac{k\pi}{6} \rightarrow 30^\circ \text{ ref. } \angle$$

$$\frac{k\pi}{4} \rightarrow 45^\circ \text{ ref. } \angle$$

$$\frac{k\pi}{3} \rightarrow 60^\circ \text{ ref. } \angle$$

$$\frac{k\pi}{2} \rightarrow 90^\circ \text{ or } 270^\circ$$

$k\pi \rightarrow 0^\circ$ for k even;
 180° for k odd

Evaluate the trigonometric function of an angle given in radians

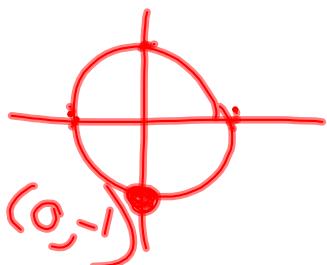
$$\cos \frac{11\pi}{6} = \boxed{\frac{\sqrt{3}}{2}}$$

Diagram: A right triangle with a hypotenuse of $\sqrt{3}$ and a vertical leg of 1. The angle between the horizontal leg and the hypotenuse is 30° . The horizontal leg is labeled 2 .

$$\sin 329\pi = \boxed{0}$$

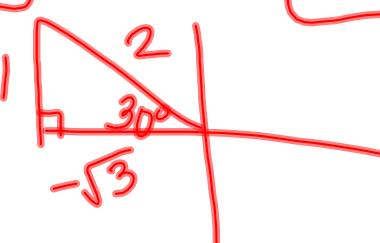
Diagram: A point on the unit circle in the third quadrant, corresponding to an angle of 329π radians.

$$\tan \frac{7\pi}{2} = \frac{1}{0} : \text{undef.}$$



$$\sec \frac{5\pi}{6} = \boxed{-\frac{2}{\sqrt{3}}}$$

Diagram: A right triangle in the second quadrant. The adjacent side is labeled 2 , the opposite side is labeled 1 , and the angle between the adjacent side and the hypotenuse is 30° . The hypotenuse is labeled $-\sqrt{3}$.



$$\cot \frac{3\pi}{4} = -1$$

$$\csc\left(-\frac{2\pi}{3}\right) = -\frac{2}{\sqrt{3}}$$

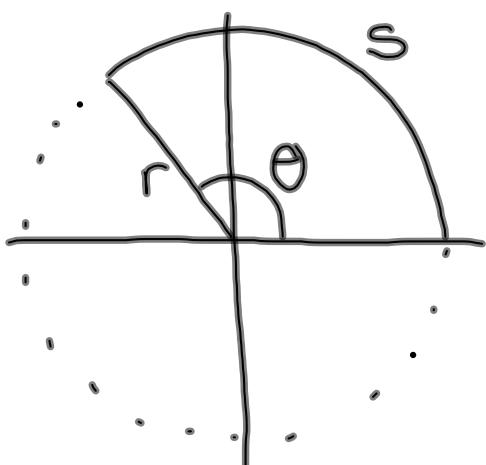
$$\sin \frac{4\pi}{3} = -\frac{\sqrt{3}}{2}$$

$$\sec \frac{7\pi}{4} = \sqrt{2}$$

$$\csc \frac{3\pi}{2} = -1$$

$$\tan \frac{7\pi}{6} = -\frac{1}{\sqrt{3}}$$

5.4 Arc Length & Angular Speed



Arc Length

r = radius or distance from the center of rotation
(in, cm, km, etc.)

s = arc length or distance traveled along the circumference of a circle
(in, cm, km, etc.)

θ = angle or amount of rotation
(deg, rad, revolutions, etc.)

$$s = r\theta$$

$$1. r = 5 \text{ in} ; \theta = 45^\circ ; s = ? \text{ in}$$

$$\begin{aligned} s &= r\theta \\ &= \frac{5 \text{ in}}{1} \cdot \frac{45^\circ}{1} \cdot \frac{\pi}{180^\circ} = \boxed{\frac{5\pi}{4} \text{ in}} \end{aligned}$$

$$2. s = 16 \text{ yards} ; \theta = 5 ; r = ? \text{ yards}$$

$$\begin{aligned} \cancel{s = r\theta} \\ r &= \frac{s}{\theta} = \boxed{\frac{16 \text{ yd}}{5}} \end{aligned}$$

3. Find the measure of a rotation in radians when a point 2 meters from the center of rotation travels 4 meters.

$$\theta = ? \text{ rad} ; r = 2 \text{ m} ; s = 4 \text{ m}$$

$$\begin{aligned} \cancel{s = r\theta} \\ \theta &= \frac{s}{r} = \frac{4 \text{ m}}{2 \text{ m}} = \boxed{2} \end{aligned}$$

Linear Speed

$$v = \frac{s}{t}$$


Angular Speed

$$\omega = \frac{\theta}{t}$$

 $\omega = \text{"omega"}$

Arc Length

$$s = r\theta$$


Relating Linear & Angular Speed

$$v = \frac{s}{t} = \frac{r\theta}{t} = r \cdot \frac{\theta}{t} = r\omega$$

$v = \frac{\text{linear distance}}{\text{time}} = \text{linear speed}$
 $\left(\frac{\text{km}}{\text{s}}, \frac{\text{mi}}{\text{h}}, \text{etc.} \right)$

$\omega = \frac{\text{amount of rotation}}{\text{time}} = \text{angular speed}$
 $\left(\frac{\text{rev}}{\text{min}}, \frac{\text{deg}}{\text{s}}, \text{etc.} \right)$

$v = r\omega$


Handout Problems:

1. A wheel with a 15 inch diameter rotates at a rate of 6 radians per second. What is the linear speed of a point on its rim in feet per minute?

$$r = \frac{15 \text{ in}}{2} ; \omega = \frac{6 \text{ rad}}{\text{s}} ; v = ? \text{ ft/min}$$

$$v = r\omega = \frac{15 \text{ in}}{2} \cdot \frac{6 \text{ rad}}{\text{s}} \cdot \frac{1 \text{ ft}}{12 \text{ in}} \cdot \frac{5}{\cancel{60 \text{ s}}} = \boxed{225 \text{ ft/min}}$$

Homework:

Evaluating trig functions of angles in radians:

5.5 #7-24 all (**super mega-important hw section!)