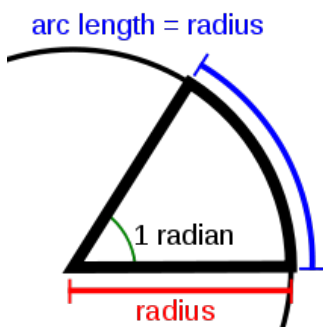
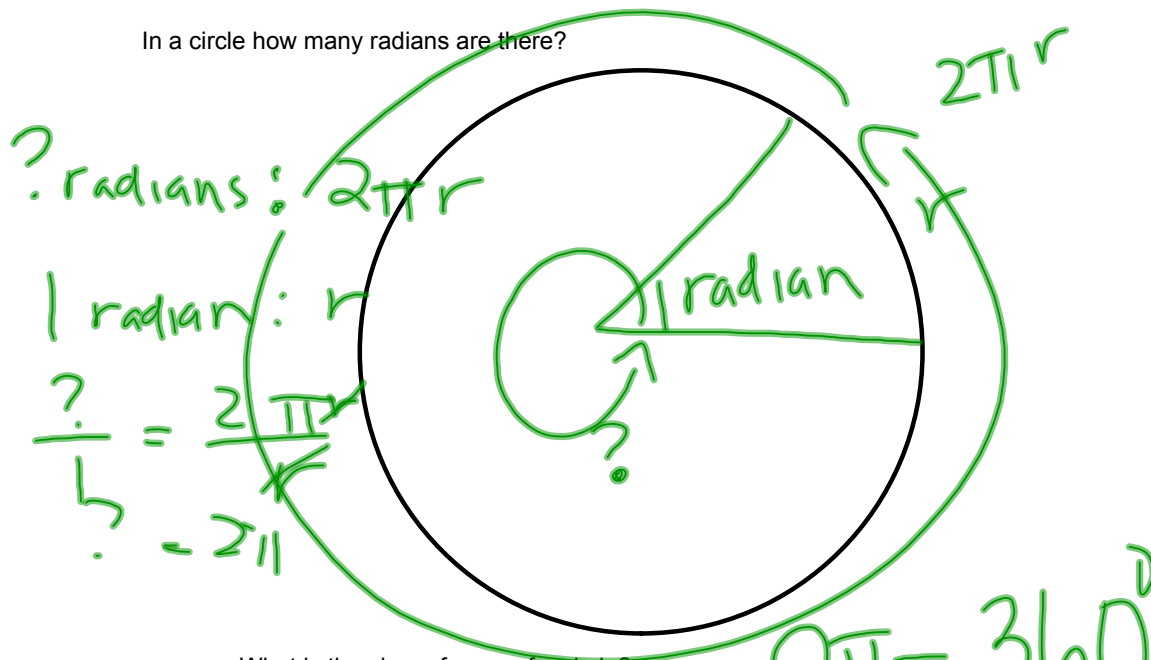


Radian Measure 6.1

What is a radian?



In a circle how many radians are there?



What is the circumference of a circle?

$$C = 2\pi r$$

1 radian = arc length  $r$   
 ? radians = arc length is  $2\pi r$

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

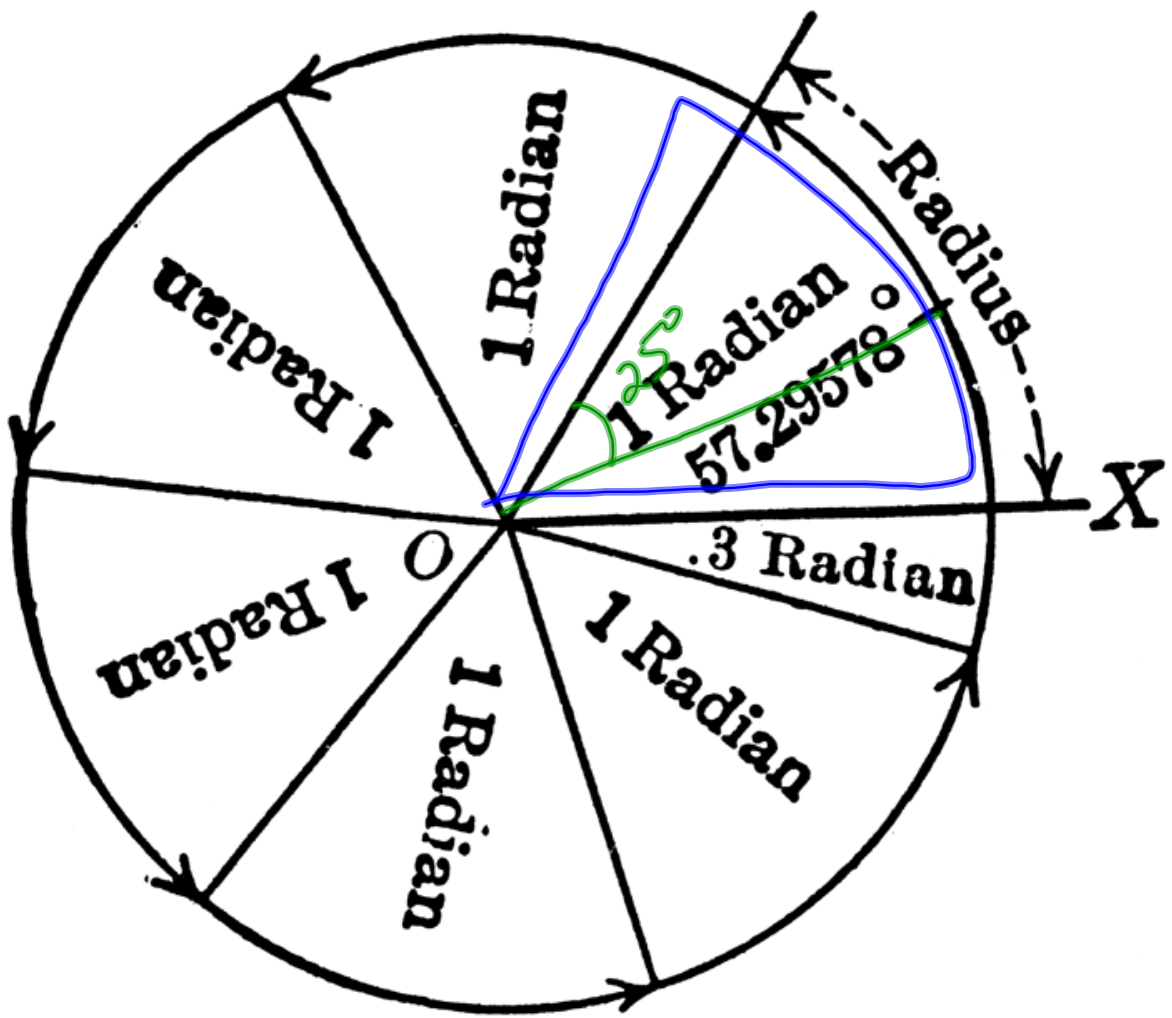
$$30^\circ = \frac{\pi}{6}$$

$$2\pi = 360^\circ$$

$$\pi = 180^\circ$$

$$\frac{\pi}{2} = 90^\circ$$

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



How many radians are there in half a circle?

$$2\pi = 360^\circ$$

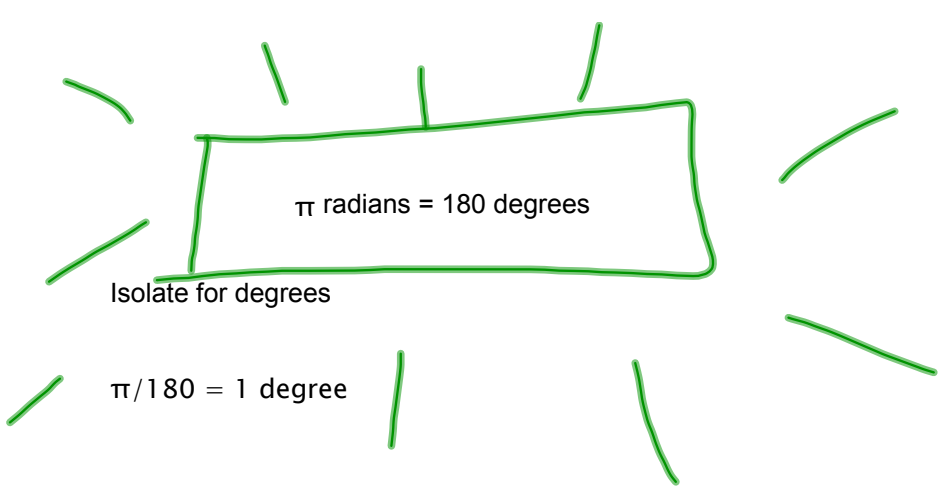
$$\pi = 180^\circ$$

How many degrees is 1 radian?

$$\begin{array}{l} 2\pi \text{ radians} = 360 \text{ degrees} \\ 1 \text{ radian} = ? \text{ degrees} \end{array}$$

$$\frac{2\pi}{1} = \frac{360}{x}$$

$$\begin{array}{l} \frac{2\pi x}{2\pi} = \frac{360}{2\pi} \\ x = 57.29^\circ \end{array}$$

A hand-drawn diagram consisting of a central rectangular box with a slightly irregular border. Inside the box, the text " $\pi$  radians = 180 degrees" is written. Surrounding the box are several short, curved green lines radiating outwards, resembling a starburst or a signal. Below the box, the text "Isolate for degrees" is written. Further down, the equation " $\pi/180 = 1 \text{ degree}$ " is shown. At the bottom, the text "Isolate for radians" is written, followed by the equation " $1 \text{ radian} = 180/\pi$ ".

$\pi$  radians = 180 degrees

Isolate for degrees

$$\pi/180 = 1 \text{ degree}$$

Isolate for radians

$$1 \text{ radian} = 180/\pi$$

$\pi$  radians = 180 degrees.

Example 1: Convert the angle to radians

a) 25 degrees

b) 190 degrees

$$25 \text{ degrees} = ? \text{ radians}$$

$$180 \text{ degrees} = \pi \text{ radians}$$

$$\frac{25}{180} = \frac{x}{\pi}$$
$$\pi \times \frac{25}{180} = x$$

$$0.44 \text{ radians} = 25 \text{ degrees} = \frac{?}{\pi}$$

To convert from degrees to radians, multiply by  $\pi/180$

$$190 \text{ degrees} = ? \text{ radians}$$
$$180 \text{ degrees} = \pi \text{ radians}$$
$$\frac{190}{180} = \frac{?}{\pi}$$
$$\pi \times \frac{190}{180} = ?$$
$$3.22 = ?$$

$$\pi \text{ radians} = 180^\circ \text{ degrees}$$

Example 2: Convert the radian measure to degrees

a)  $3\pi/4$

b) 1.25 radians

$$\frac{3\pi}{4} \text{ radians} = x \text{ degrees}$$

$$\frac{\pi}{\pi} \text{ radians} = 180^\circ \text{ degrees}$$

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

To convert from radians to degrees, multiply by  $180/\pi$

$$\frac{\cancel{3\pi}}{\cancel{4\pi}} = \frac{x}{180}$$

$$\frac{3}{4} = \frac{x}{180}$$

$$180 \times \frac{3}{4} = x$$

$$135^\circ = x$$

$$\pi \text{ radians} = 180^\circ \text{ degrees}$$

Example 2: Convert the radian measure to degrees

a)  $3\pi/4$

b) 1.25 radians

$$71.6^\circ \quad 1.25 \text{ r} = x^\circ$$

$$\pi \text{ r} = 180^\circ$$

$$\frac{1.25}{\pi} = \frac{x}{180}$$

$$\frac{180 \cdot 1.25}{\pi} = x$$

$$71.62^\circ = x$$

To convert from radians to degrees, multiply by  $180/\pi$

$$\frac{180 \times \frac{3}{4}}{\pi} = \frac{x}{180}$$

$$135^\circ = x$$

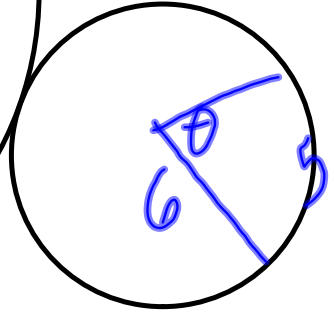
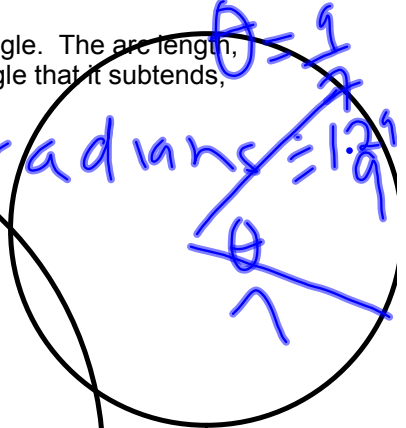
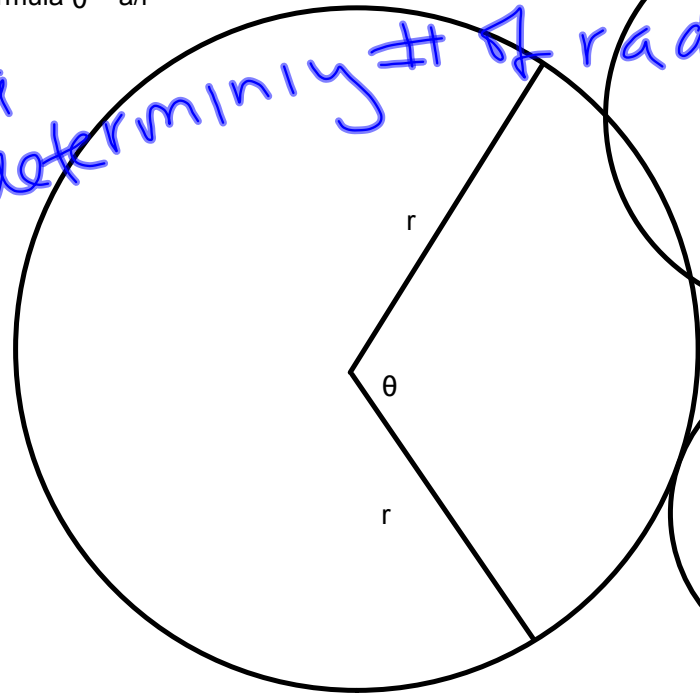
To convert from degrees to radians, multiply by  $\pi/180$   
To convert from radians to degrees, multiply by  $180/\pi$



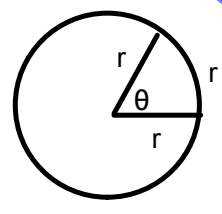
The radian is an alternative way to represent the size of an angle. The arc length,  $a$ , of a circle is proportional to its radius,  $r$ , and the central angle that it subtends,  $\theta$ , by the formula  $\theta = a/r$

Formula for determining # of radians

$$\theta = \frac{a}{r}$$



$$\theta = \frac{r}{r} = 1$$



$$\theta = \frac{5}{6} = 0.83$$

Example 4: The Ferris Wheel at Niagara Falls has a diameter of 150 m and completes one rotation in 6 minutes.

a) Determine the angular velocity,  $\omega$ , in radians per second. (notice radians per second NOT per minute) → (360 seconds)

b) How far has a rider travelled at 4 minutes into the ride?

Complete  
→  $2\pi$  radians in 6 minutes  
 $2\pi$  radians in 360 seconds

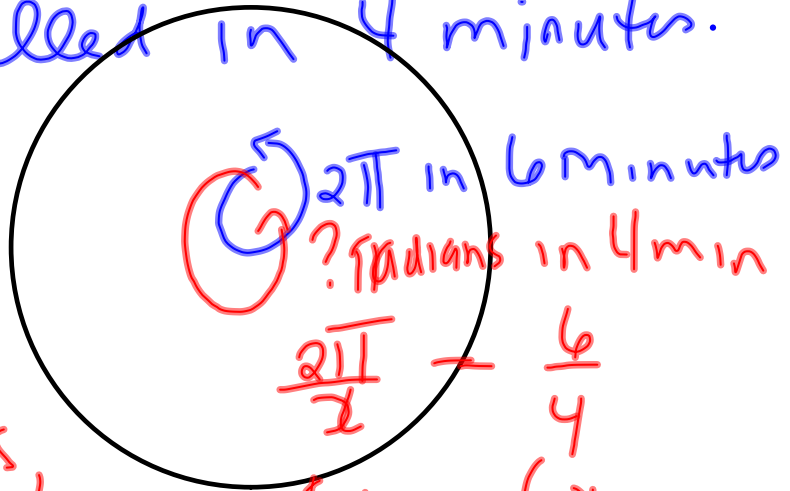
$$\omega = \frac{2\pi}{360} \quad \text{r/s}$$

$$= \frac{\pi}{180} \quad \text{r/s}$$

Example 4: The Ferris Wheel at Niagara Falls has a diameter of 150 m and completes one rotation in 6 minutes.  $\rightarrow$  (360 seconds)

- a) Determine the angular velocity,  $\omega$ , in radians per second. (notice radians per second NOT per minute)
- b) How far has a rider travelled at 4 minutes into the ride?

How far has a rider travelled in 4 minutes?



You travel  $\frac{4\pi}{3}$  radians, how many metres have you travelled?

$$\frac{2\pi}{2} = \frac{6}{4}$$

$$\frac{8\pi}{8} = 2$$

$$\frac{4\pi}{3} = x$$

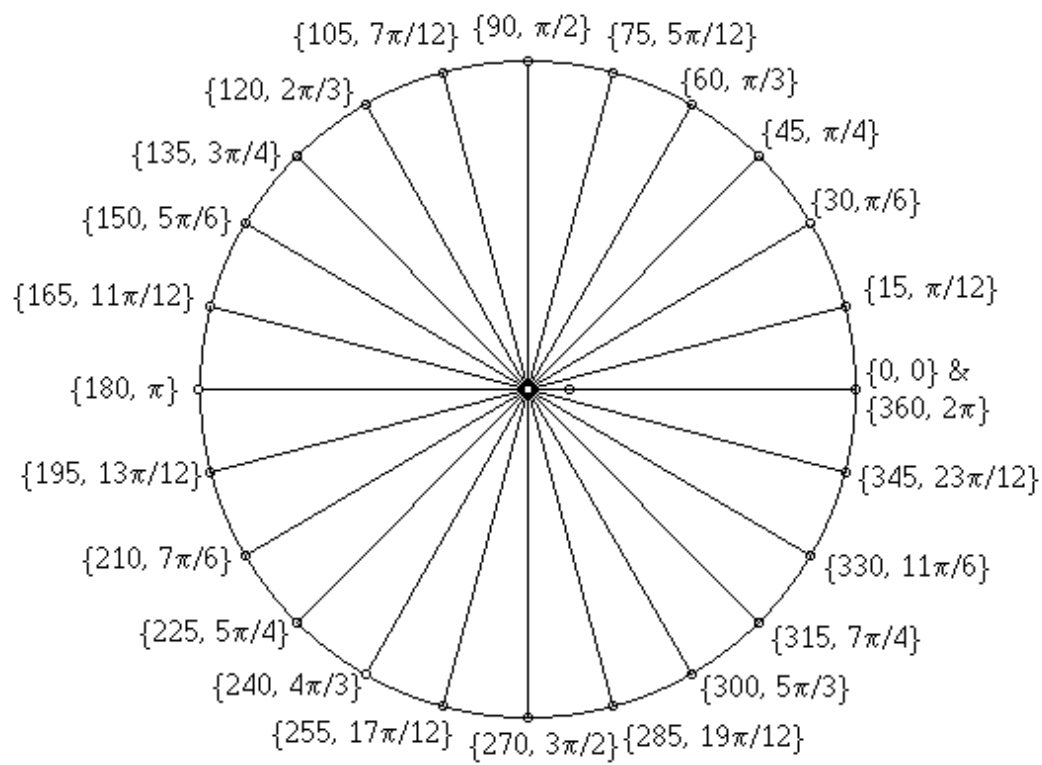
$$\theta = \frac{a}{r}$$

$$\frac{4\pi}{3} = \frac{a}{r}$$

$$\frac{4\pi}{3} = \frac{a}{75}$$

$$\frac{75 \times 4\pi}{3} = a$$

$$314.16 = a$$



Homework: 5-13

6.1