CCSS Algebra 4 Radians versus Degrees

1. a. What is the measure of a central angle that represents a full rotation?

   360°

   b. What fraction of a circle is represented by a Central Angle of 60° ?

   60° = 1/6 of circle

   c. What fraction of a circle is represented by a Central Angle of 225° ?

   225° = 5/8 of circle

   225÷45 / 360÷45 = 5/8

   d. Describe how the central angle can be used to represent a fraction of a circle.

   θ/360 = fraction of circle

2. Return to Kianna's Ferris wheel. To set the mechanics of the wheel up correctly, Anna will need to know the distance that riders travel as they move around the Ferris wheel. Recall that the model Anna built had a radius of 1 meter. What is the total distance a rider would travel in one rotation? (i.e., the circumference of the circle).

   $C = 2\cdot\pi\cdot r \rightarrow 2\pi$ b/c unit circle.

3. Determine the distance a rider traveled along the circumference of the Ferris wheel for each angle below:

   a. 90° $\pi/2$ b. 30° $\pi/6$ c. 270° $3\pi/2$ d. 240° $4\pi/3$

   e. 315° $7\pi/4$ f. -60° $\pi/3$

4. An alternative measurement for the rotation in a circle is called a RADIAN. Go to What is a Radian? Leaving r =1, move the slider under change angle.

   a. What does it appear one radian represents? How far around the circumference of the circle does one radian take you? If you are unsure go here.

   1 radian is the angle subtending an arc of length 1 radius

   b. How many radians is equivalent to one full rotation? If other words, 360° = $2\pi$ radians.

   c. Change r =2 and repeat parts (a) and (b).

   Still the angle that forms an arc of 1 radius.

   d. Why does the radius not affect the radian measure of the angle?

   Because the radian measure = # of radii traveled.

5. Convert each degree measure of an angle into RADIANS. Keep your answer in terms of π :

   a. 90° $\pi/2$ b. 30° $\pi/6$ c. 270° $3\pi/2$

   d. 240° $4\pi/3$ e. 315° $7\pi/4$ f. -60° $\pi/3$

   $\frac{\theta^\circ}{360} \cdot 2\pi$

   - Write a note for yourself about how to convert degrees to radians.

6. Convert each radian measure of an angle into degrees.

   a. $\frac{\pi}{4} = 45^\circ$ b. $\pi = 180^\circ$ c. $\frac{5\pi}{3} = 300^\circ$

   d. $-\frac{\pi}{6} = -30^\circ$ e. $\frac{7\pi}{4} = 315^\circ$ f. $5\pi = 900^\circ$

   $\frac{\theta}{2\pi} \cdot 360$

   - Write a note for yourself about how to convert radians to degrees.

7. Use the unit circle diagram and your knowledge of the trigonometric functions to complete the table below. Give your answers in exact form, as either rational numbers or radical expressions.

| $\theta$ | $cos(\theta)$ | $sin(\theta)$ |
|---|---|---|
| $\frac{\pi}{3}$ | $1/2$ | $\sqrt{3}/2$ |
| $\frac{3\pi}{4}$ | $-\sqrt{2}/2$ | $\sqrt{2}/2$ |
| $\frac{5\pi}{6}$ | $-\sqrt{3}/2$ | $1/2$ |
| $0$ | $1$ | $0$ |
| $-\frac{3\pi}{4}$ | $-\sqrt{2}/2$ | $-\sqrt{2}/2$ |
| $-\frac{7\pi}{6}$ | $-\sqrt{3}/2$ | $1/2$ |
| $-\frac{11\pi}{3}$ | $1/2$ | $\sqrt{3}/2$ |

8. Use the unit circle diagram and your knowledge of the sine and cosine functions to complete the table below. Select values of $\theta$ so that $0 \le \theta < 2\pi$.

| $\theta$ | $cos(\theta)$ | $sin(\theta)$ |
|---|---|---|
| $\pi/3$ or $5\pi/3$ | $\frac{1}{2}$ | $\sqrt{3}/2$ or $-\sqrt{3}/2$ |
| $5\pi/4$ or $7\pi/4$ | $\sqrt{2}/2$ or $-\sqrt{2}/2$ | $-\frac{\sqrt{2}}{2}$ |
| $3\pi/4$ | $-\frac{\sqrt{2}}{2}$ | $\frac{\sqrt{2}}{2}$ |
| $\pi$ | $-1$ | $0$ |
| $3\pi/2$ | $0$ | $-1$ |
| $7\pi/6$ or $11\pi/6$ | $\sqrt{3}/2$ or $-\sqrt{3}/2$ | $-\frac{1}{2}$ |

9 How many radians does the minute hand of a clock rotate through over 10 minutes? How many degrees?

10 minute = 1/6 of clock = $\pi/3$ radian or 60°

10. How many radians does the minute hand of a clock rotate through over half an hour? How many degrees?

$\pi$ rad 180°