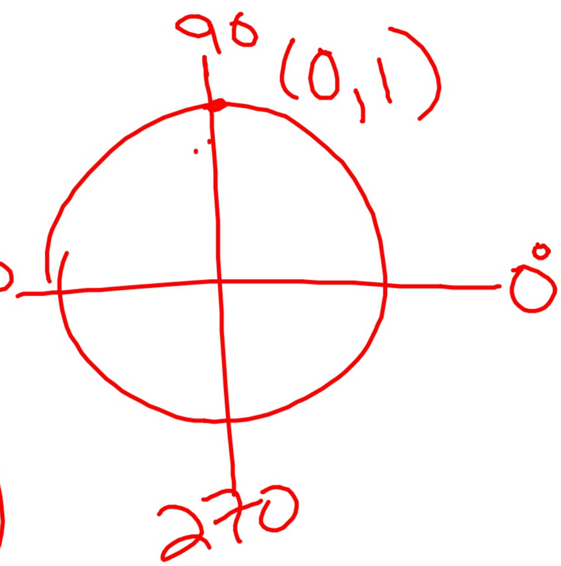
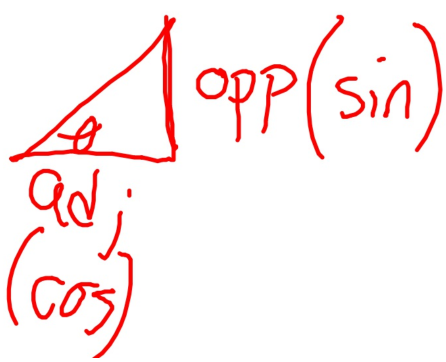
Welcome Back MYP Math 9!

	Assignment Effort Grade (Circle One)	Comments (What was interesting or challenging?)
Monday Date: 12/18 Topic: Unit Circle Review	0 1 2	
Tuesday Date: ______ Topic: ____________	0 1 2	
Wednesday Date: ______ Topic: ____________	0 1 2	
Thursday Date: ______ Topic: ____________	0 1 2	
Friday Date: ______ Topic: ____________	0 1 2	

$\boxed{\sin 90^\circ = 1}$

$(\cos\theta, \sin\theta)$





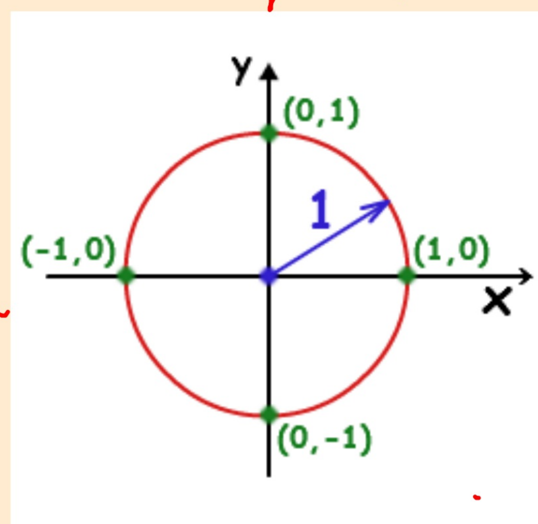
Warm-Up

r=1

Find the distance around this circle.

Circumference

C = 2π



http://images.tutorvista.com/cms/images/113/unit-circle.png

Class Plan:

1. Warm-up, homework ??

2. What is a radian?

- How do we convert between radians and degrees?

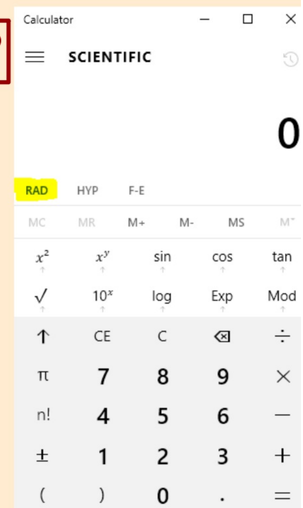
A Chapter 25 THE UNIT CIRCLE

3. Practice

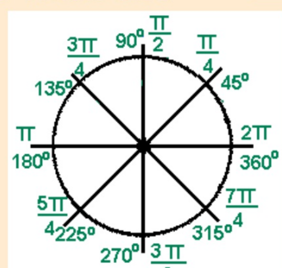
What is a "Radian"?

According to Wolfram MathWorld...

"The radian is a unit of angular measure defined such that an angle of one radian subtended from the center of a unit circle produces an arc with arc length 1."



Weisstein, Eric W. "Radian." From *MathWorld*--A Wolfram Web Resource. http://mathworld.wolfram.com/Radian.html



http://www.mathnstuff.com/math/spoken/here/2class/330/gif/45s.gif

Recall the circumference of a circle

The relationship between $\dfrac{C}{d}$ of a circle is known today as π.

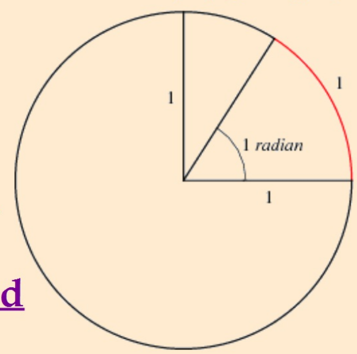
Ancients knew 3 was not accurate but they lacked the tools to process further.

The most common approximation of π by ancient Egyptians, Chinese, Greeks & many others was the ratio $\dfrac{22}{7}$.

$$\pi = \frac{C}{2r} \qquad 2\pi r = C$$

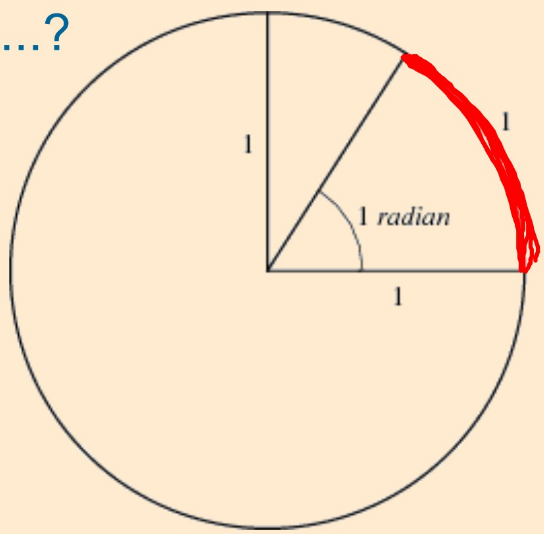
Let's unpack that definition...

http://mathworld.wolfram.com/images/eps-gif/Radian_700.gif



- "The radian is a unit of angular measure..."
  - Ok, so we measure angles w/ it. Cool.
- "...an angle of one radian **subtended** from the center of a unit circle..."
  - What does "subtended" mean? Basically it means the angle formed by connecting two lines to the end of the arc.
- "...produces an arc with arc length 1."
  - So basically 1 radian is the angle which makes an intercepted arc with a length of 1.

How many radians would it take to get around the unit circle...?



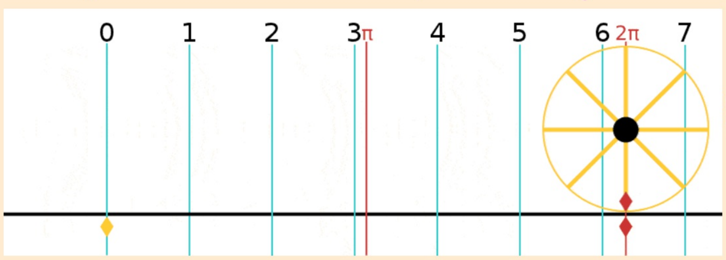
http://mathworld.wolfram.com/images/eps-gif/Radian_700.gif

This GIF is awesome...

https://upload.wikimedia.org/wikipedia/commons/4/4e/Circle_radians.gif http://www.reactiongifs.com/r/but-why.gif

"Ok, so I kinda get what radians are...but why...?"

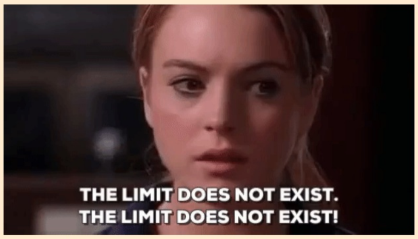
- Converting from angular to linear displacement is *super* easy.



https://upload.wikimedia.org/wikipedia/commons/6/67/2pi-unrolled.gif

Ex.: A wheel with a 1 foot radius turns 50 radians, then the wheel will have traveled 50 feet.

- It "seems" a little less arbitrary and a bit more intuitive once you get the hang of it.
  - We know that the circumference of a circle is $2\pi r$, so the idea of there being 2π radians around a circle "kinda just makes sense".
  - Dividing up a circle into 360 parts is kinda arbitrary...
    - The 360° in a circle originated with ancient Babylonian astronomers. Babylon had a sexagesimal (base 60) number system!
- Calculus
  - Taking derivatives of trig functions with radians is way easier than with degrees.



https://media.giphy.com/media/l2YWF00ZX8wOs0p0s/giphy.gif

Disadvantages...?

You and our culture are already pretty used to degrees.

https://media.giphy.com/media/2P0sYfYfzxz2M/source.gif

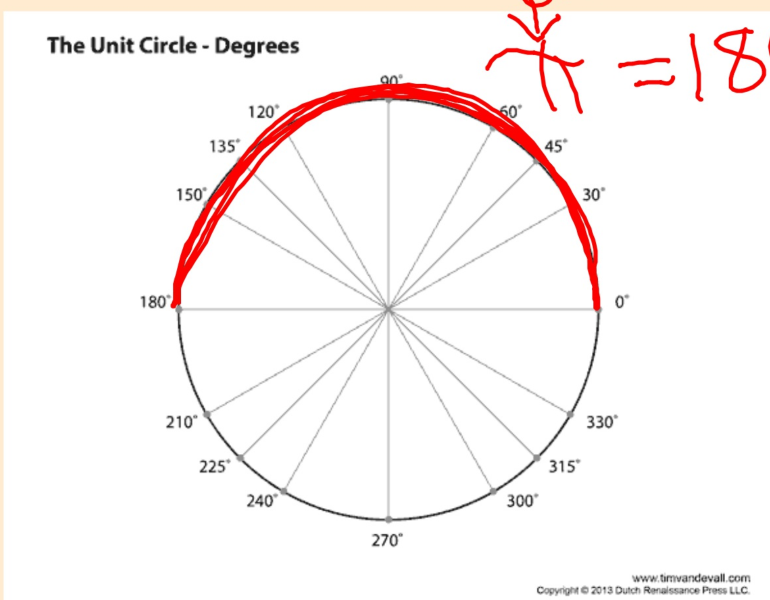
https://media.giphy.com/media/g65wOeFKB0ZpK/giphy.gif

https://media.giphy.com/media/lTobZfG2LMTJe/giphy.gif

Let's try to fill out the unit circle w/ radians.

angle measure

$\pi = 180^\circ$



http://w w w .timvandevall.com/w p-content/uploads/unit-circle-chart-degrees.png

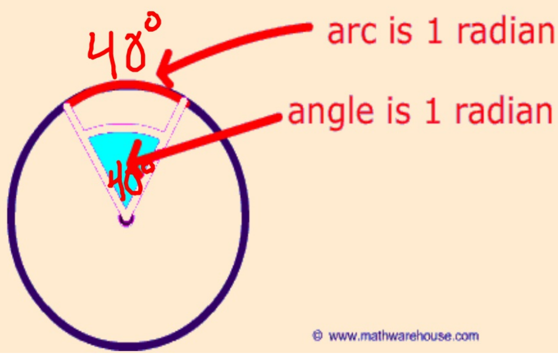
Try to come up with a formula to convert from degrees to radians, and vice versa.

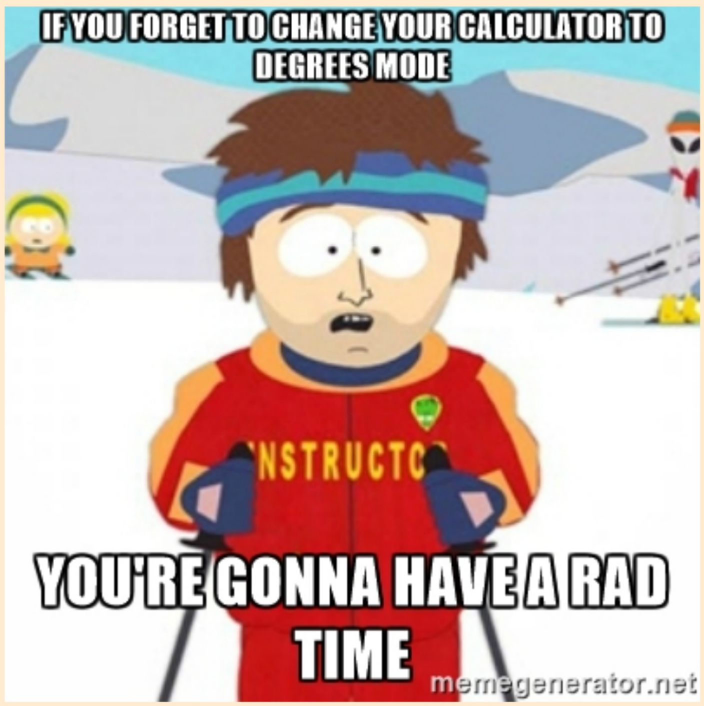
$$\frac{\text{radians}}{\pi} = \frac{\text{degrees}}{180}$$

Try to come up with a formula to convert from degrees to radians, and vice versa.

notes

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





https://cdn.meme.am/cache/instances/folder281/23412281.jpg

Convert from degrees to radians:

1) 90^o

2) 30^o

3) 60^o

4) 45^o

5) 135^o

6) 270^o

7) 315^o

8) 330^o

9) 210^o

10) 840^o

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

Convert from degrees to radians:

1) 90° $\frac{90}{180} = \frac{r}{\pi}$ $\frac{90\pi}{180} = \frac{r(180)}{180}$ $\boxed{r = \frac{\pi}{2}}$

2) 30° $\frac{30}{180} = \frac{r}{\pi}$ $r(180) = 30\pi$

$r = \frac{30\pi}{180} = \boxed{\frac{\pi}{6}}$

3) 60° $\frac{60}{180} = \frac{r}{\pi}$ $60\pi = r(180)$ $\boxed{r = \frac{\pi}{3}}$

4) 45° $\frac{45}{180} = \frac{r}{\pi}$ $\frac{45\pi}{180} = \frac{180r}{180}$ $\boxed{r = \frac{\pi}{4}}$

5) 135° $\frac{135}{180} = \frac{r}{\pi}$ $\frac{135\pi}{180} = r = \frac{3\pi}{4}$

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

Convert from degrees to radians:

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

6) 270° $\frac{270}{180} = \frac{r}{\pi}$ $270\pi = r(180)$ $\boxed{r = \frac{3\pi}{2}}$

7) 315° $\frac{315}{180} = \frac{r}{\pi}$ $315\pi = 180r$ $\boxed{r = \frac{7\pi}{4}}$

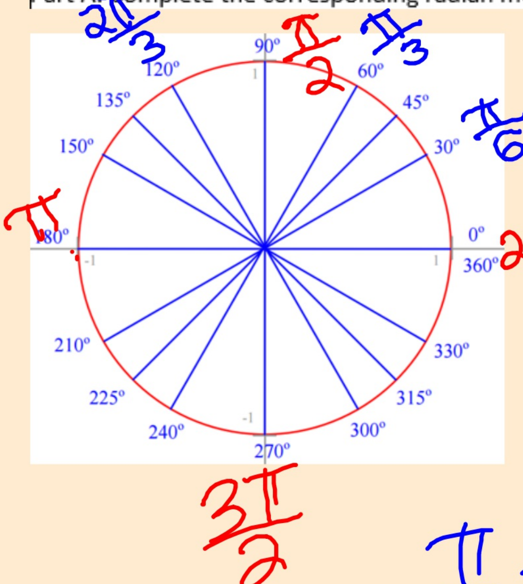
8) 330° $\frac{330}{180} = \frac{r}{\pi}$ $180r = 330\pi$ $r = \frac{330\pi}{180} = \boxed{\frac{11\pi}{6}}$

9) 210° $\frac{210}{180} = \frac{r}{\pi}$ $\frac{210\pi}{180} = \frac{180r}{180}$ $\boxed{r = \frac{7\pi}{6}}$

10) 840° $\frac{840}{180} = \frac{r}{\pi}$ $r = \frac{840\pi}{180}$ $r = \boxed{\frac{14\pi}{3}}$

Radian Exercises

Part A: Complete the corresponding radian measures for each given degree measure.



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

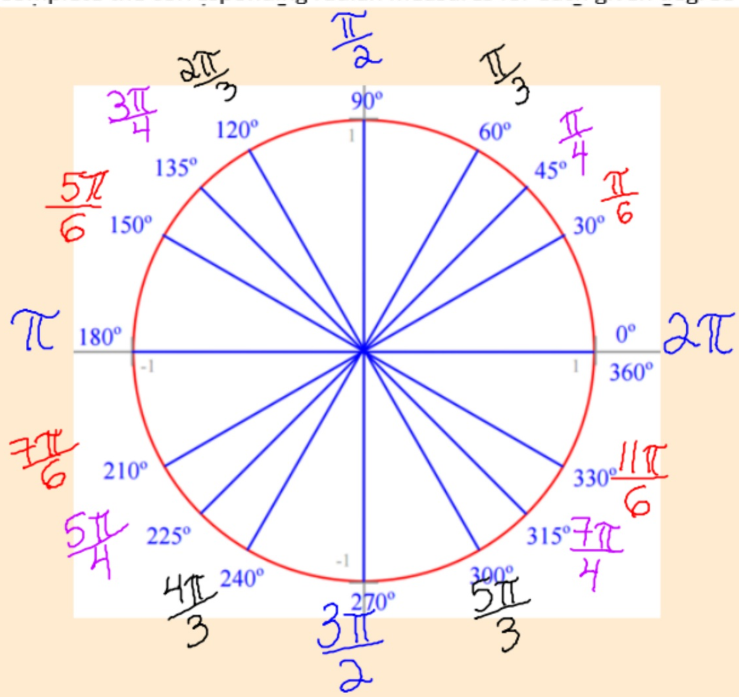
$\frac{\cancel{180}x}{\cancel{180}} = \frac{30\pi}{180}$

$$\frac{30}{180} = \frac{x}{\pi}$$

$$\frac{\pi}{6} = \frac{30\pi}{180} = x$$

The Unit Circle - Radians and Degrees

Part A: Complete the corresponding radian measures for each given degree measure.



Radian Exercises

1) $\cos(\frac{\pi}{4}) =$ $\boxed{\frac{\sqrt{2}}{2}}$

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

$$x\cancel{\pi} = 180\left(\frac{\cancel{\pi}}{4}\right)$$

$$x = \frac{180}{4} = 45^\circ$$

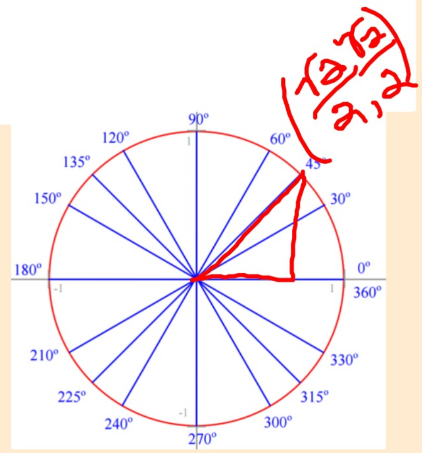
2) $\sin(\frac{\pi}{6}) =$

1

$\frac{\sqrt{2}}{2}$

$\frac{\sqrt{2}}{2}$

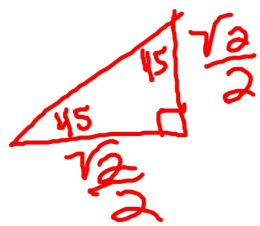
3) $\cos(\frac{4\pi}{3})$



Radian Exercises

1) $\cos\left(\frac{\pi}{4}\right) = \boxed{\frac{\sqrt{2}}{2}}$

$$\frac{\frac{\pi}{4}}{\pi} = \frac{x}{180} \qquad \pi x = \frac{180\pi}{4} \qquad x = 45^\circ$$

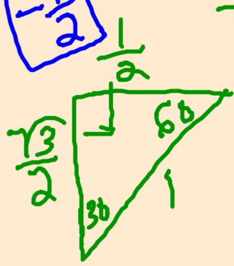


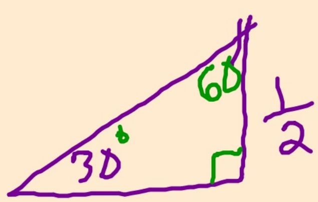
2) $\sin\left(\frac{\pi}{6}\right) = \boxed{\frac{1}{2}}$

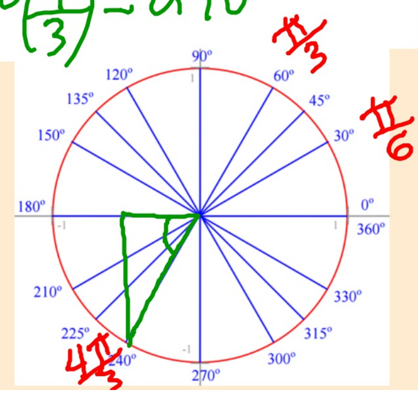
$$\frac{\frac{\pi}{6}}{\pi} = \frac{x}{180} \qquad x = \frac{180}{6} = 30^\circ$$

3) $\cos\left(\frac{4\pi}{3}\right)$ $\boxed{-\frac{1}{2}}$

$$\frac{\frac{4\pi}{3}}{\pi} = \frac{x}{180} \qquad x = 180\left(\frac{4}{3}\right) = 240^\circ$$





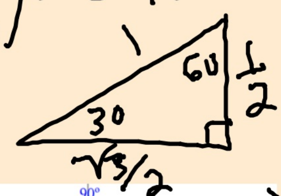


Radian Exercises

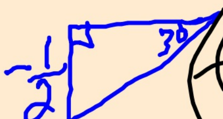
$-\frac{1}{2}$

4) $\sin\left(\frac{7\pi}{6}\right) =$ $\dfrac{\frac{7\pi}{6}}{\pi} = \dfrac{x}{180}$ $\quad x = 180\left(\frac{7}{6}\right) = 210^\circ$

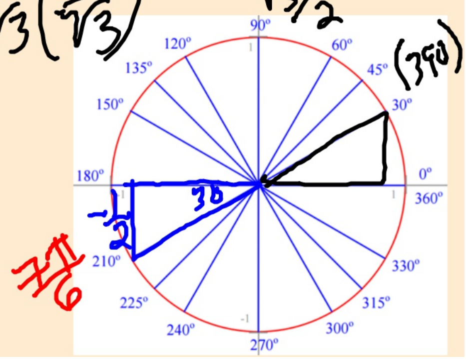
5) $\tan\left(\frac{13\pi}{6}\right) =$ $\dfrac{\frac{13\pi}{6}}{\pi} = \dfrac{x}{180}$ $\quad x = 180\left(\frac{13}{6}\right) = 390^\circ$



$$\tan(30) = \frac{\frac{1}{2}}{\frac{\sqrt{3}}{2}} = \frac{1}{\sqrt{3}}\left(\frac{\sqrt{3}}{\sqrt{3}}\right)$$



$$\boxed{\tan(30) = \frac{\sqrt{3}}{3}}$$



Radian Exercises

4) $\sin\left(\frac{7\pi}{6}\right) =$

5) $\tan\left(\frac{13\pi}{6}\right) =$

$$2\pi = \frac{12\pi}{6}$$

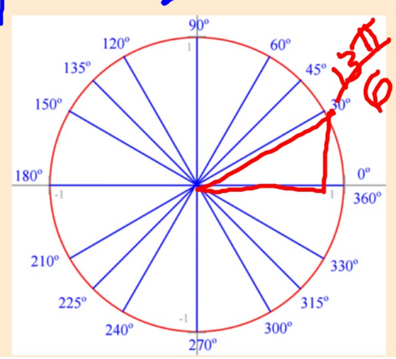
$$\frac{13\pi}{6} = 2\pi + \frac{\pi}{6}$$

$$\boxed{\frac{13\pi}{6} = 390^\circ}$$

$$\frac{\frac{1}{2}}{\frac{\sqrt{3}}{2}} \quad \frac{opp}{adj}$$

1, 60, 30, $\frac{1}{2}$, $\frac{\sqrt{3}}{2}$

$$\boxed{\frac{\sqrt{3}}{3}}$$



Radian Exercises

6) $\tan\left(\frac{\pi}{4}\right) =$

$$\frac{\frac{\pi}{4}}{\pi} = \frac{x}{180} \qquad x = \frac{180}{4} = 45^\circ$$

$$\tan\left(\frac{\pi}{4}\right) = \frac{\frac{\sqrt{2}}{2}}{\frac{\sqrt{2}}{2}} = \boxed{1}$$