

Objective: Describe angles using radian and degree measures

Wednesday 4/1

Radian and Degree Measure

- Convert between degrees and radians
- Find coterminal angles in degrees and radians

Objective: Describe angles using radian and degree measures

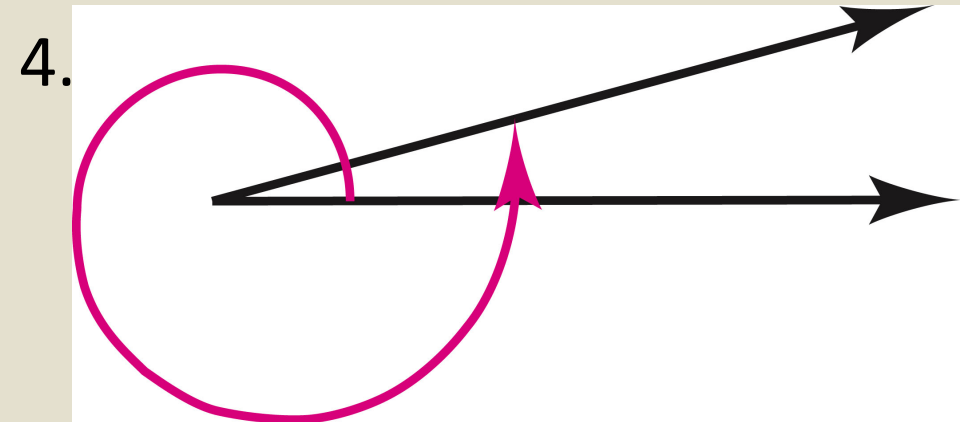
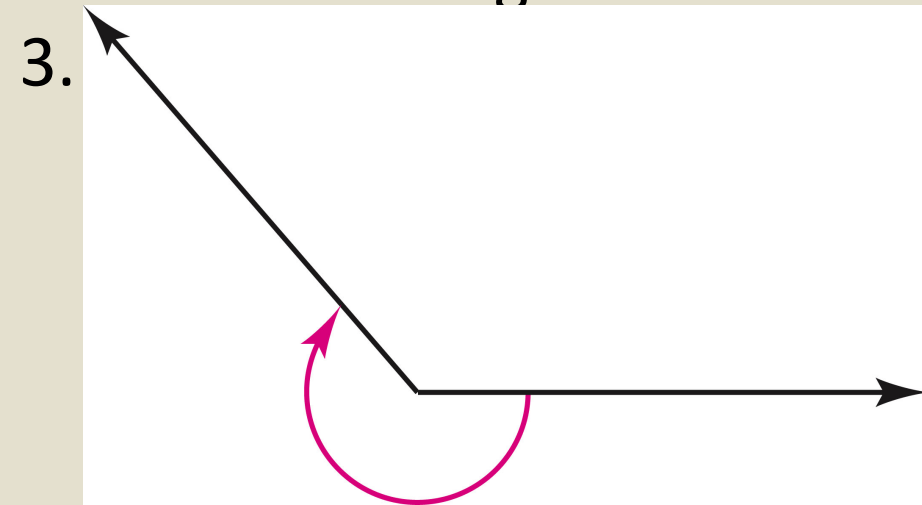
Warmup

Determine which quadrant in which the angle lies

1. $\frac{-5\pi}{6}$

2. 3

Estimate the angle to the nearest one-half radian



Objective: Describe angles using radian and degree measures

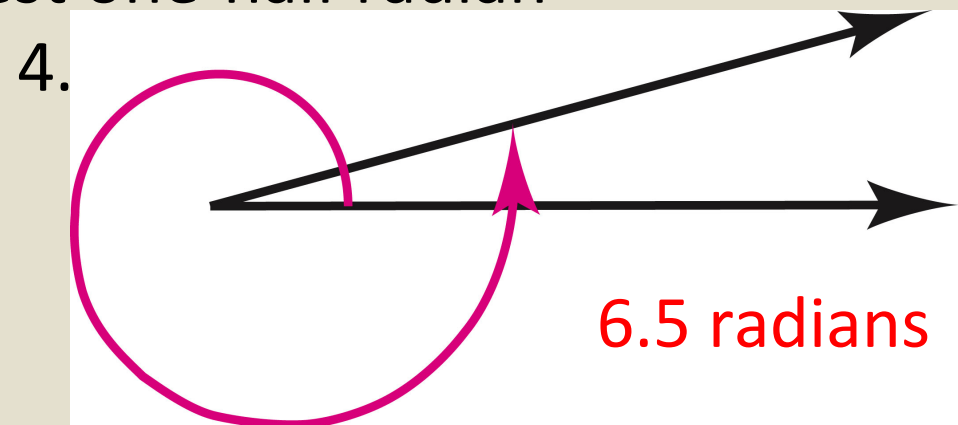
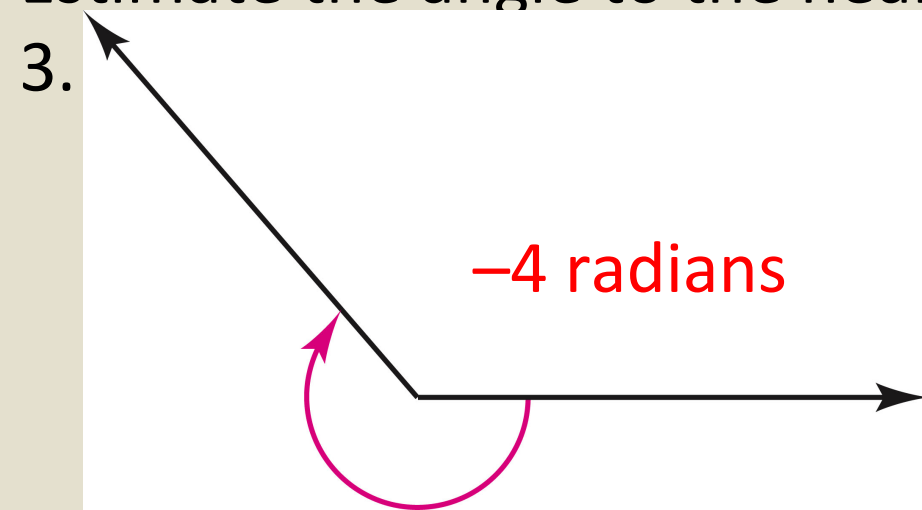
Warmup

Determine which quadrant in which the angle lies

1. $\frac{-5\pi}{6}$ Quadrant III

2. 3 Quadrant II

Estimate the angle to the nearest one-half radian



Objective: Describe angles using radian and degree measures

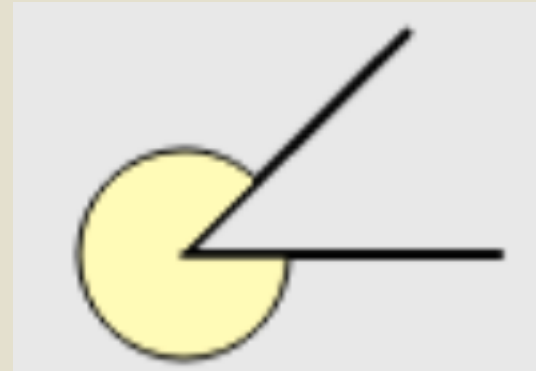
Something I noticed from the last assignment:

If you are asked to estimate the angle to the nearest one-half radian it does not need to be in terms of pi. If that is how you visualize it, just multiply it out and then give the nearest half radian answer.

1.



2.



Objective: Describe angles using radian and degree measures

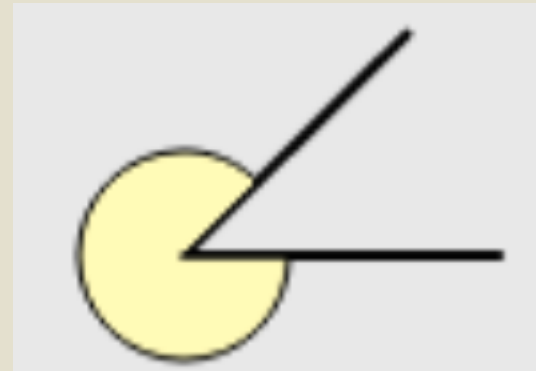
Something I noticed from the last assignment:

If you are asked to estimate the angle to the nearest one-half radian it does not need to be in terms of pi. If that is how you visualize it, just multiply it out and then give the nearest half radian answer.

1.



2.



For #1 maybe you see $\frac{2\pi}{3}$

Just multiply it out and round $2(3.14) \div 3 = 2.09$ so about 2 radians.

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How many degrees are in 1 radian?

A radian is the measure of an angle that is formed if the length of one radius is wrapped around the circle.

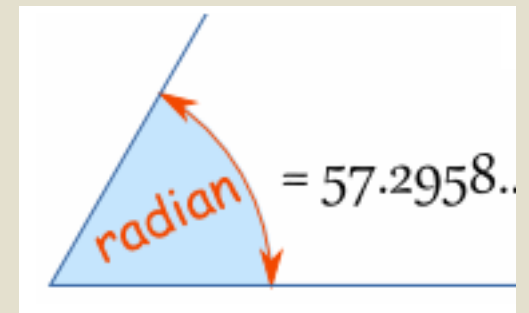
Since we know that the circumference of a circle is $C = 2\pi r$ we can calculate how many degrees are in one radian. We also know that C is 360° for a full circle.

$360^\circ = 2\pi r$ solve for r (divide both sides by 2π)

$\frac{360^\circ}{2\pi} = r$ reduce

$\frac{180^\circ}{\pi} = r$ divide 180 by 3.141589...

$r = 57.2958^\circ \dots$



This gives us our conversion for radians to degrees
(here is the math again, shown a little differently)

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

Divide both sides by 2

$$180^\circ = \pi$$

Divide both sides by 180

$$1^\circ = \frac{\pi}{180} \text{ rad}$$

This leaves us with 1 degree

On the previous slide we saw that $1 \text{ radian} = \frac{180^\circ}{\pi}$

Conversion Between Radians and Degrees

To convert degrees to radians, multiply degrees by

$$\frac{\pi \text{ rad}}{180^\circ}$$

To convert radians to degrees, multiply radians by

$$\frac{180^\circ}{\pi \text{ rad}}$$

A conversion to radians can be done in exact form (in terms of pi) or decimal form. I will usually ask for exact form (answers on next slides)

Convert degrees to radians:

1. 135°

2. 540°

3. -270°

Convert degrees to radians:

$$1. 135^\circ \left(\frac{\pi}{180^\circ} \right) = \frac{135\pi}{180} = \frac{27\pi}{36} = \frac{3\pi}{4} \text{ (exact answer)}$$

$\approx 2.34 \text{ radians}$

2.

3.

Convert degrees to radians:

$$1. 135^\circ \left(\frac{\pi}{180^\circ} \right) = \frac{135\pi}{180} = \frac{27\pi}{36} = \frac{3\pi}{4} \text{ (exact answer)}$$

$$\approx 2.34 \text{ radians}$$

$$2. 540^\circ \left(\frac{\pi}{180^\circ} \right) = \frac{54\pi}{18} = 3\pi \text{ (exact answer)}$$

$$\approx 9.42 \text{ radians}$$

$$3. -270^\circ \left(\frac{\pi}{180^\circ} \right) = \frac{-27\pi}{18} = \frac{-3\pi}{2} \text{ (exact answer)}$$

$$\approx -4.71 \text{ radians}$$

Conversion Between Radians and Degrees

Convert radians to degrees:

1. $-\frac{\pi}{2} \text{ rad}$

2. $\frac{9\pi}{2} \text{ rad}$

3. 2 rad

Conversion Between Radians and Degrees

Convert radians to degrees:

$$1. \quad -\frac{\pi}{2} \left(\frac{180}{\pi} \right) = -\frac{180}{2} = -90^\circ$$

$$2. \quad \frac{9\pi}{2} \left(\frac{180}{\pi} \right) = \frac{9(180)}{2} = 810^\circ$$

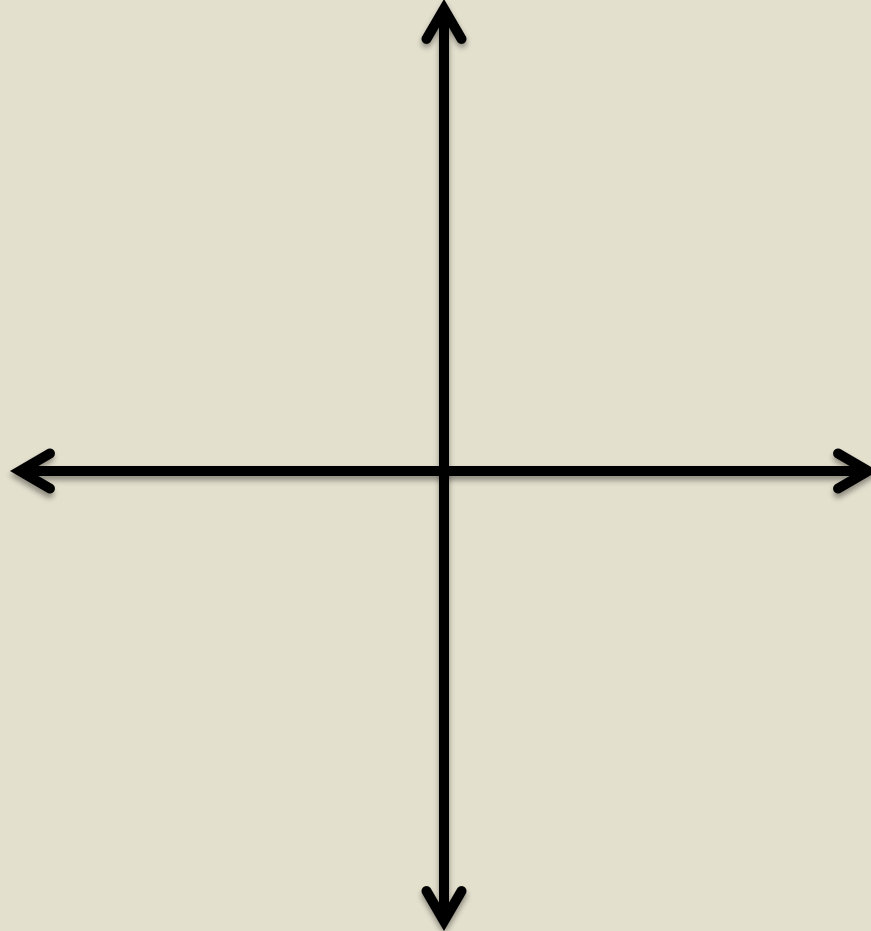
$$3. \quad 2 \left(\frac{180}{\pi} \right) = \frac{360}{\pi} = 114.59^\circ$$

Objective: Describe angles using radian and degree measures

Coterminal Angles

Sketch each angle in standard position.

an angle of 60° , 420° , and -300° on the same axes



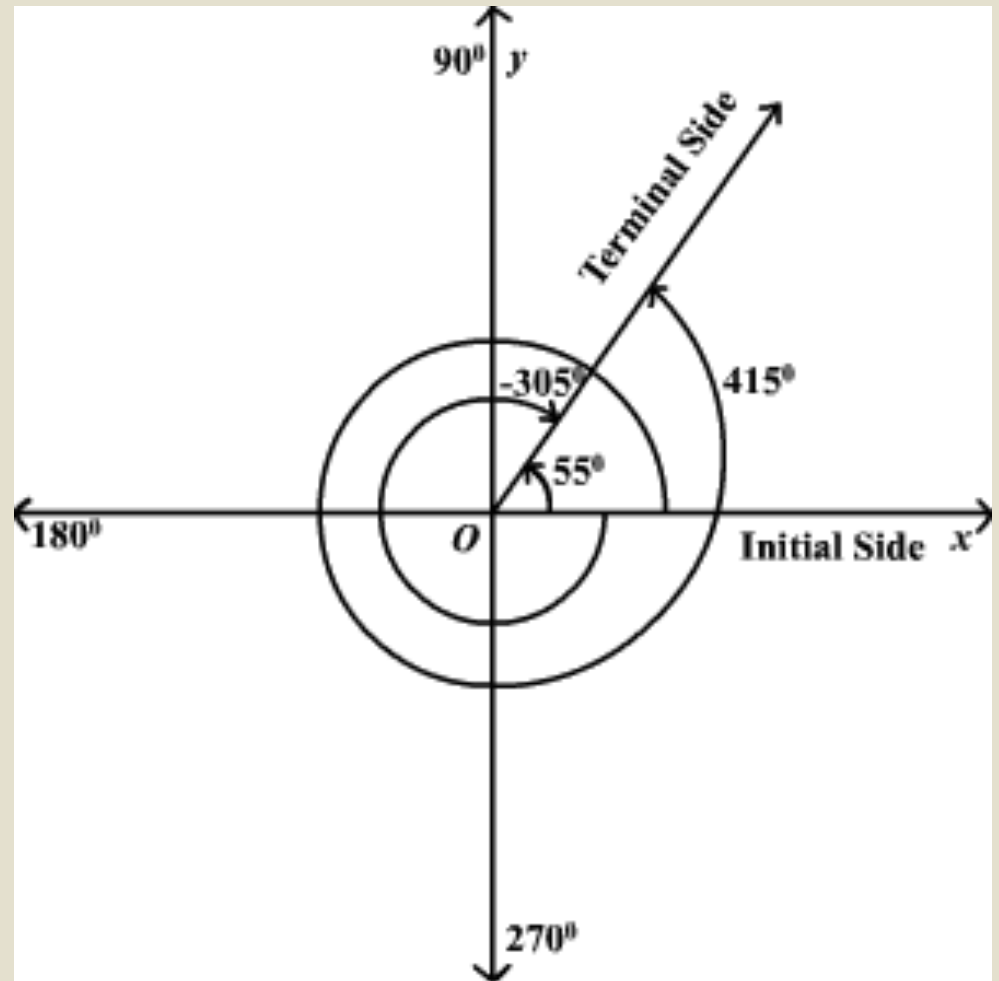
What do you notice?

Objective: Describe angles using radian and degree measures

Coterminal Angles

Coterminal Angles are angles that have the same initial and terminal sides.

Here is another example.



Objective: Describe angles using radian and degree measures

Finding Coterminal Angles

Coterminal angles happen every 360° (or 2π radians), since that is one full rotation around the circle.

So if we want to find the next coterminal angle we just add 360° or 2π radians.

To go the other direction, just subtract 360° or 2π radians.

Objective: Describe angles using radian and degree measures

Determine two coterminal angles (one positive and one negative) for each angle. Give your answer in radians.

1. $\theta = \frac{7\pi}{6}$

Objective: Describe angles using radian and degree measures

Determine two coterminal angles (one positive and one negative) for each angle. Give your answer in radians.

1. For a positive coterminal angle, add 2π , get a common denominator, simplify if needed.

$$\frac{7\pi}{6} + 2\pi = \frac{7\pi}{6} + \frac{12\pi}{6} = \frac{19\pi}{6}$$

For a negative coterminal angle, subtract 2π ...

$$\frac{7\pi}{6} - 2\pi = \frac{7\pi}{6} - \frac{12\pi}{6} = -\frac{5\pi}{6}$$

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Finding a Positive and a Negative Coterminal Angle in the same units given.

2.

$$\alpha = -\frac{11\pi}{4}$$

Objective: Describe angles using radian and degree measures

Determine two coterminal angles (one positive and one negative) for each angle. Give your answer in radians.

2. This time when we add 2π we still have a negative angle. Just add another 2π ... The negative answer can be used for the negative coterminal angle.

$$-\frac{11\pi}{4} + 2\pi = -\frac{11\pi}{4} + \frac{8\pi}{4} = -\frac{3\pi}{4}$$

$$-\frac{3\pi}{4} + 2\pi = -\frac{3\pi}{4} + \frac{8\pi}{4} = \frac{5\pi}{4}$$

Objective: Describe angles using radian and degree measures

Determine two coterminal angles (one positive and one negative) for each angle. Give your answer in degrees.

$$\theta = 110^\circ$$

1. For a positive coterminal angle, add 360, get a common denominator, simplify if needed.

$$110 + 360 = 470^\circ$$

For a negative coterminal angle, subtract 360...

$$110 - 360 = -250^\circ$$

Objective: Describe angles using radian and degree measures

Determine two coterminal angles (one positive and one negative) for each angle.

Give your answer in radians.

$$\theta = \frac{13\pi}{6}$$

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

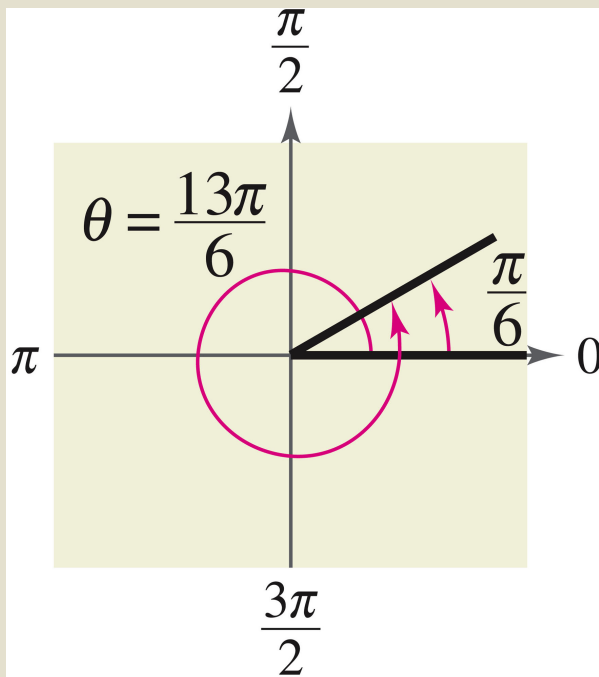
$$\theta = -\frac{2\pi}{3}$$

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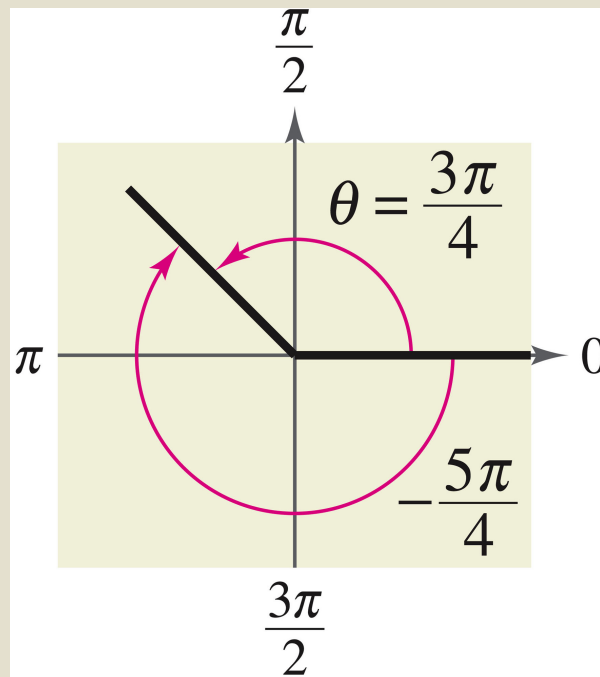
Determine two coterminal angles (one positive and one negative) for each angle.

Give your answer in radians.

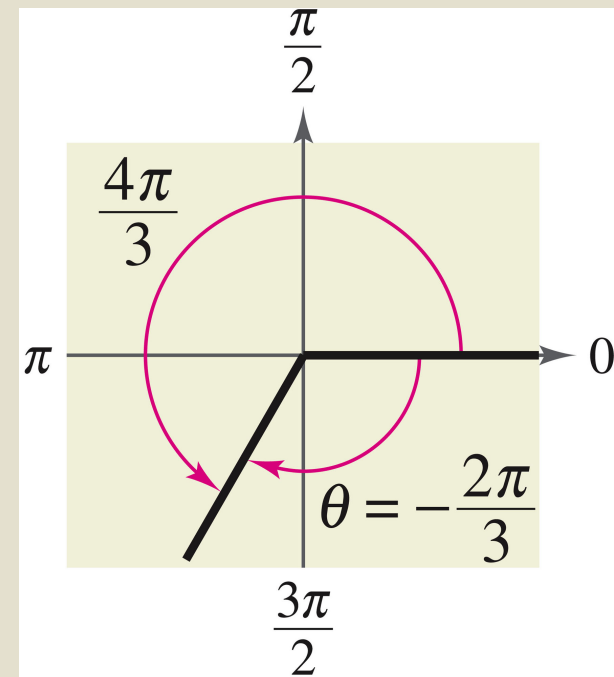
$$\theta = \frac{13\pi}{6}$$



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



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



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Assignment:

Log in to Office 365

Complete the assignment:

Coterminal Angles and Converting Units (Week 1, Day 3)