

MATH 109 – TOPIC 2
ANGLES AND THEIR MEASURES

I. Relationship Between Degrees and Radians

Practice Problems

II. Angles in Standard Position

Practice Problems

I. Relationship Between Degrees and Radians

Angles are measured in either degrees or radians (rad). One complete revolution, which is 360° , equals 2π rad. So $360^\circ = 2\pi$ rad, or $180^\circ = \pi$ rad.

$$\text{This means } 1^\circ = \frac{\pi}{180} \text{ rad and } 1 \text{ rad} = \frac{180^\circ}{\pi}.$$

To change from degrees to radians, multiply by $\frac{\pi}{180}$.

To change from radians to degrees, multiply by $\frac{180}{\pi}$.

In calculus, the trigonometric functions are nearly always expressed in terms of radians. Thus, it is important to think of $\sin \frac{\pi}{6}$, $\sin \frac{\pi}{2}$, etc. instead of $\sin 30^\circ$, $\sin 90^\circ$, etc.

PRACTICE PROBLEMS

2.1 a) $\frac{\pi}{2}$ radians = _____ $^\circ$

b) $\frac{3\pi}{4}$ radians = _____ $^\circ$

c) $\frac{7\pi}{6}$ radians = _____ $^\circ$

d) 150° = _____ rad

e) 300° = _____ rad

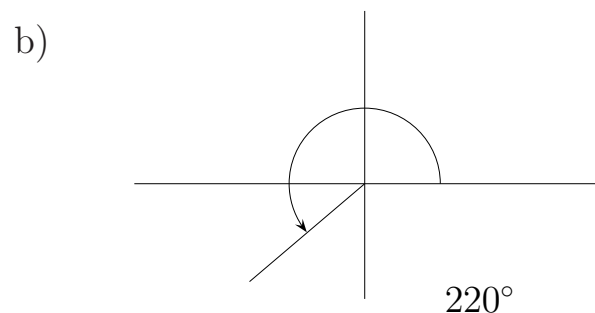
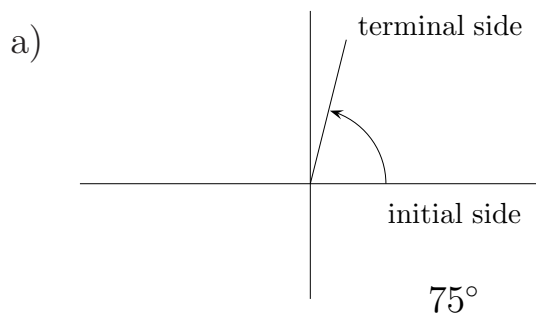
f) 30° = _____ rad

[Answers](#)

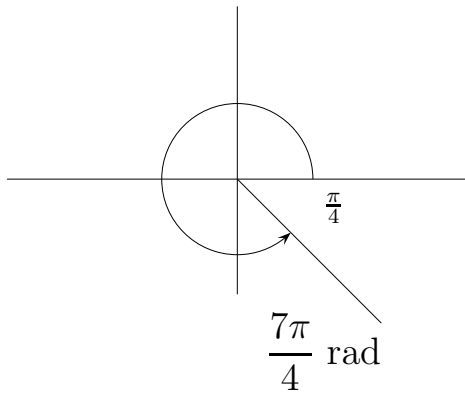
II. Angles in Standard Position

In trig, you'll routinely have need for drawing an angle in standard position based on a given measure. To draw such an angle, start with a rectangular type axis (I say "type" because we won't be graphing ordered pairs). The positive side of the horizontal axis serves as the initial side of the given angle. Now rotate in a counterclockwise direction with each quadrant counting an additional 90° . At the appropriate measure the second (or terminal side) is drawn. A negative angle is drawn in like manner, but with a counter-clockwise rotation.

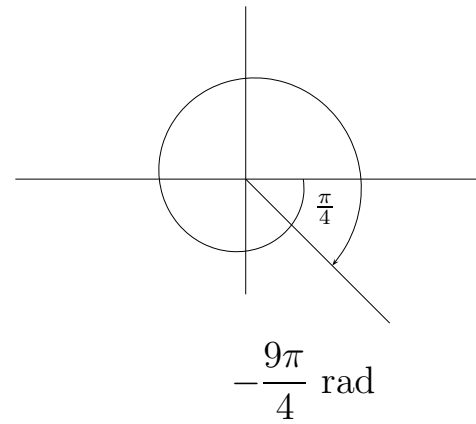
Illustration: Here are 4 angles, all drawn in standard position.



c)



d)

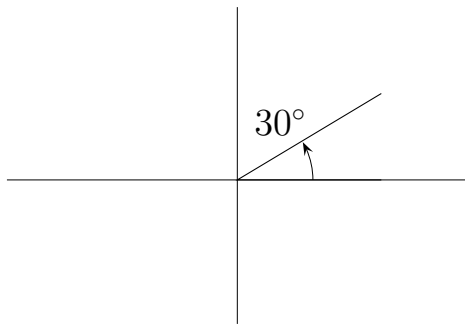


The significance of arrows is demonstrated in Examples c) and d). Although both angles have the same terminal side, they clearly have different measures.

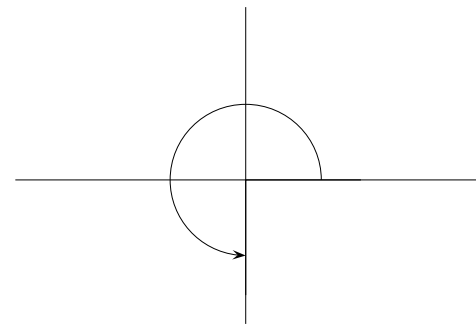
PRACTICE PROBLEMS

2.2 State the measure of each angle in both radians and degrees.

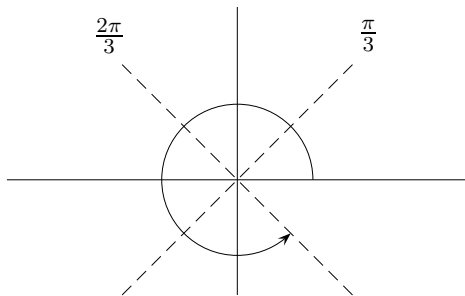
a)



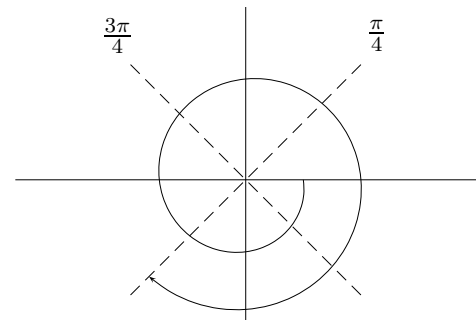
b)



c)



d)



[Answers](#)

ANSWERS to PRACTICE PROBLEMS (Topic 2-Relationship Between Degrees and Radians)

- 2.1 a) 90°
b) 225°
c) 210°
d) $\frac{5\pi}{6}$ rad
e) $\frac{5\pi}{3}$ rad
f) $\frac{\pi}{6}$ rad

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- 2.2 a) 60° or $\frac{\pi}{3}$ rad
b) 270° or $\frac{3\pi}{2}$ rad
c) 300° or $\frac{5\pi}{3}$ rad
d) $-(360 + 135) = -495^\circ$ or $-\frac{11\pi}{4}$ rad

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