Degrees, Radians and Revolutions

Unit: Mathematics

NGSS Standards: N/A

MA Curriculum Frameworks (2006): N/A

AP Physics 1 Learning Objectives: N/A

Knowledge/Understanding Goals:

- express angles and arc length in degrees, radians, and full revolutions

Skills:

- convert between degrees, radians and revolutions

Language Objectives:

- Understand and correctly use the terms "degree," "radian," and "revolution"
- Accurately describe and apply the concepts described in this section using appropriate academic language.

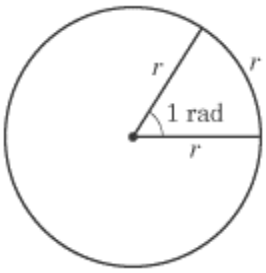
Notes:

degree: an angle equal to $\frac{1}{360}$ of a full circle. A full circle is therefore 360°.

revolution: a rotation of exactly one full circle (360°) by an object.

radian: the angle that results in an arc length that equal to the radius of a circle. *I.e.*, one "radius" of the way around the circle. Because the distance all the way around the circle is 2π times the radius, a full circle (or one rotation) is therefore 2π radians.

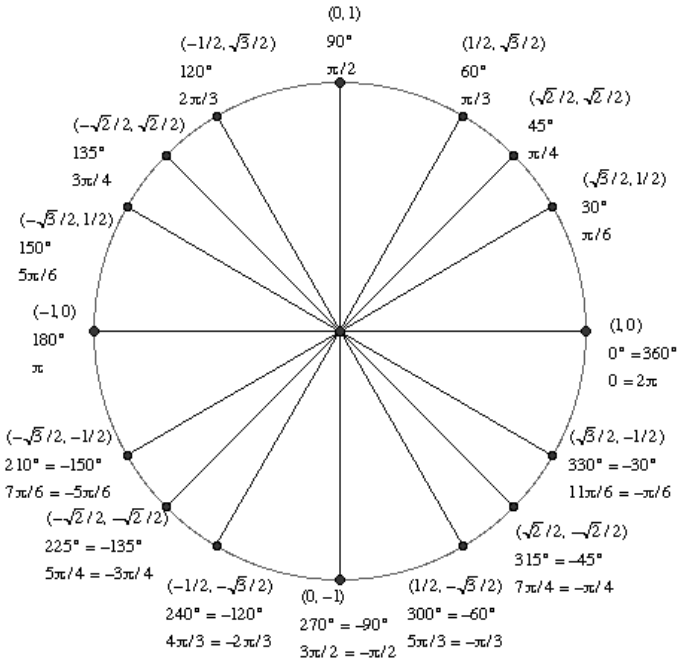
We are used to measuring angles in degrees. However, trigonometry functions are often more convenient if we express the angle in radians:



Use this space for summary and/or additional notes.

This is often convenient because if we express the angle in radians, the angle is equal to the arc length (distance traveled around the circle) times the radius, which makes much easier to switch back and forth between the two quantities.

On the following unit circle (a circle with a radius of 1), several of the key angles around the circle are marked in radians, degrees, and the (*x,y*) coördinates of the corresponding point around the circle.



In each case, the angle in radians is equal to the distance traveled around the circle, starting from the point (1,0).

It is useful to memorize the following:

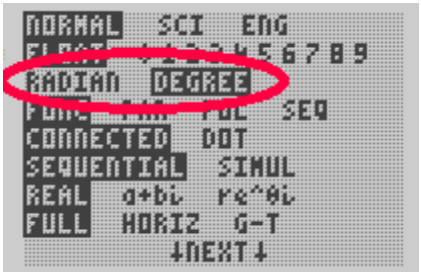
Degrees	0°	90°	180°	270°	360°
Rotations	0	¼	½	¾	1
Radians	0	$\frac{\pi}{2}$	π	$\frac{3\pi}{2}$	2π

Use this space for summary and/or additional notes.

In algebra 2 and precalculus, students learn and make use of the conversion between degrees and radians, but often lose sight of the most important feature of radians—that their purpose is to allow you to easily determine the arc length (distance traveled around the circle) by simply multiplying the angle (in radians) times the radius.

In physics, you will generally need to use degrees for linear (Cartesian) problems, and radians for rotational problems. For this reason, when using trigonometry functions it will be important to make sure your calculator mode is set correctly for degrees or radians, as appropriate to each problem:

TI-30 scientific calculator



TI-84+ graphing calculator

If you convert your calculator to degrees, don't forget to convert it back to radians before you use it for precalculus!

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