MS 113 In-class Problems

August 25, 2024

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Chapter 5 Section 1

360 is divisible by many numbers:

$$1, 2, 3, 4, 5, 6, 8, 9, 10, 12, 15, 18, 20, 24,$$

$$30, 36, 40, 45, 60, 72, 90, 120, 180, 360$$

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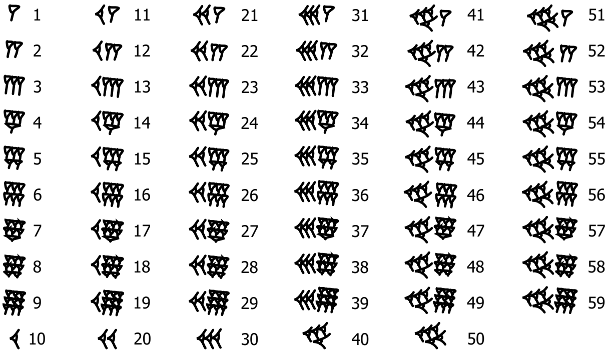

DMS

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So

$$\begin{aligned} 1^{\circ} &\equiv 60' \\ 1' &\equiv 60'' \\ 1^{\circ} &\equiv 3600'' \end{aligned}$$

Minute $<$ **Middle French** *minute* $<$ **post-classical Latin** *minuta* or *minutum*.

Second $<$ **French** *seconde* $<$ **medieval Latin** *secunda*.

“St Augustine refers to *minuta* and to *minutae minutarum* ‘minutes of minutes’, i.e. seconds ... as terms in use by *mathematici*.”

“... used elliptically for *secunda minuta*, lit. ‘second minute’, i.e. the result of the second operation of sexagesimal division; the result of the first such operation (now called ‘minute’ simply) being the ‘first’ or ‘prime minute’ or ‘prime”’

Oxford English Dictionary, s.v. “minute (n.1),” March 2024, https://doi.org/10.1093/OED/1094508711.
Oxford English Dictionary, s.v. “second (n.1),” December 2023, https://doi.org/10.1093/OED/7821975804.

Convert 6 ft to inches.

Convert 3 min to seconds.

Convert $3 \dfrac{\text{ft}}{\text{min}}$ to $\dfrac{\text{in}}{\text{s}}$.

Convert 2° to minutes.

Convert $3'$ to seconds.

Etymology of angle adjectives

right Seems to be influenced from classical Latin *rect* meaning to be 90°.

acute From Latin *acūtus* meaning sharp.

obtuse From classical Latin *obtūsus* meaning blunt, dull, stupid. So most likely dull in comparison with acute's meaning of sharp.

reflex Not sure, but one meaning of classical Latin *reflexus* is curved back. So maybe this?

Gradian

$$1 \quad \text{grad} \equiv \frac{1}{400} \quad \text{rev}$$

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It's the original proposed unit of measure for angles in the metric system (which became SI), but was replaced with radians. (The metric system was proposed during the French revolution.)

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Mostly used in surveying and lasers in USA.

Find the gradian measure of the angle with the given degree measure.

$$135^\circ$$

Find the gradian measure of the angle with the given degree measure.

$$180^\circ$$

Find the degree measure of the angle with the given gradian measure.

$$300 \text{ grad}$$

Find the degree measure of the angle with the given gradian measure.

$$50 \text{ grad}$$

Dimensional Analysis - a little bit

Suppose you have a rectangle with length $l = 2$ in and width $w = 5$ in.

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Can the following be the formula for the area of the rectangle?

$$A = w$$

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Can the following be the formula for the area of the rectangle?

$$A = w$$

Why not?

What about

$$A = lwh?$$

Why or why not?

Find the radian measure of the angle with the given degree measure.

$$45^\circ$$

Find the radian measure of the angle with the given degree measure.

$$-30^\circ$$

Find the radian measure of the angle with the given degree measure.

$$60^\circ$$

Find the radian measure of the angle with the given degree measure.

$$90^\circ$$

Find the radian measure of the angle with the given degree measure.

$$180^\circ$$

Find the radian measure of the angle with the given degree measure.

$$270^\circ$$

Find the radian measure of the angle with the given degree measure.

$$360^\circ$$

Find the degree measure of the angle with the given radian measure.

$$\frac{7\pi}{4}$$

Find the degree measure of the angle with the given radian measure.

$$\frac{5\pi}{6}$$

Find the degree measure of the angle with the given radian measure.

$$-\frac{\pi}{2}$$

Find the degree measure of the angle with the given radian measure. (Round your answer to one decimal place.)

$$6$$

Find the degree measure of the angle with the given radian measure. (Round your answer to one decimal place.)

$$1$$

Find the degree measure of the angle with the given radian measure. (Round your answer to one decimal place.)

$$-2.3$$

Danger

When writing an angle if you do not write the degree symbol it is interpreted as a radian!

So 2 is 2 rad and 2° is 2 deg.

Error correcting frame.

Starting at $\frac{\pi}{2}$ count to 2π beyond it by $\frac{\pi}{2}$ths.

Starting at $\dfrac{\pi}{3}$ count to 2π beyond it by $\dfrac{\pi}{2}$ths.

Starting at $\frac{\pi}{6}$ count to 2π beyond it by $\frac{\pi}{6}$ths.

The measure of an angle in standard position is given. Find two positive angles and two negative angles that are coterminal with the given angle.

$$45^\circ$$

The measure of an angle in standard position is given. Find two positive angles and two negative angles that are coterminal with the given angle.

$$-30^\circ$$

The measure of an angle in standard position is given. Find two positive angles and two negative angles that are coterminal with the given angle.

$$400^\circ$$

The measure of an angle in standard position is given. Find two positive angles and two negative angles that are coterminal with the given angle.

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

The measure of an angle in standard position is given. Find two positive angles and two negative angles that are coterminal with the given angle.

$$5$$

The measures of two angles in standard position are given. Determine whether the angles are coterminal.

$$70^\circ, 430^\circ$$

The measures of two angles in standard position are given. Determine whether the angles are coterminal.

$$\frac{5\pi}{6}, \frac{19\pi}{6}$$

Find an angle between 0° and 360° that is coterminal with the given angle.

$$-1190^\circ$$

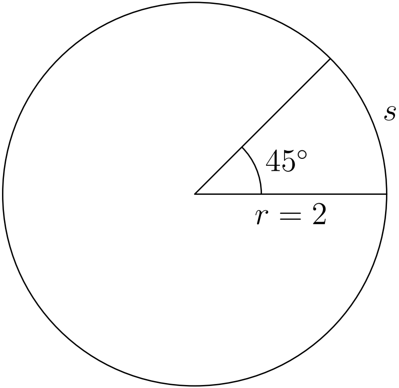
Find an angle between 0 and 2π that is coterminal with the given angle.

$$\frac{21\pi}{4}$$

Find an angle between 0 and 2π that is coterminal with the given angle.

$$7$$

Find the length s of the circular arc.



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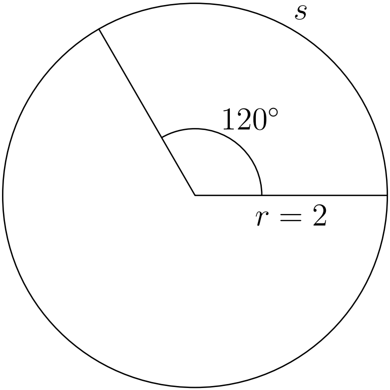

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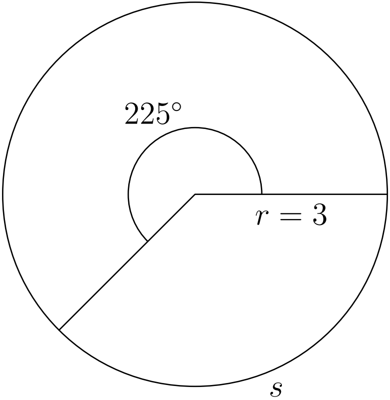

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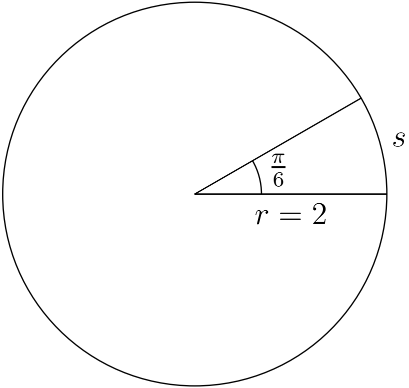
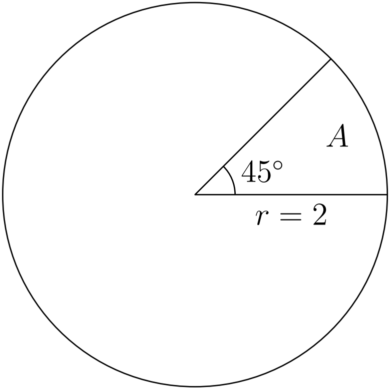


Find the area A of the sector.



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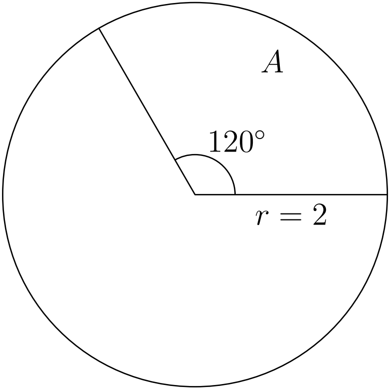

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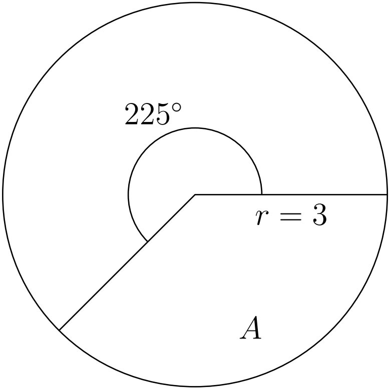

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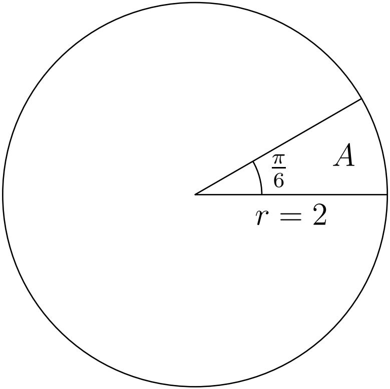
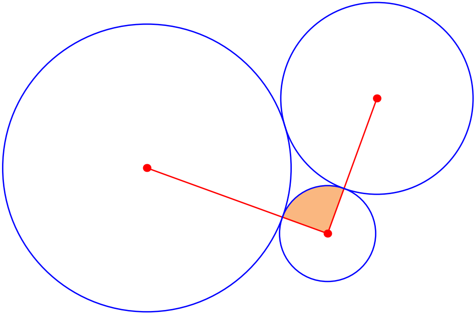


- If the central angle is $\theta = \frac{\pi}{2}$ and the arc length is $s = 3$, find the radius r.

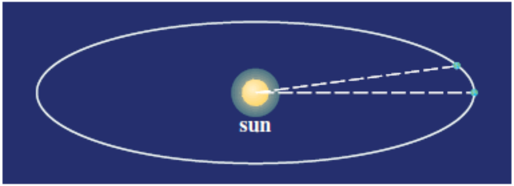
- If the radius is $r = 5$ and the arc length is $s = 10$, find the central angle θ.

- If the central angle is $\theta = \pi$ and the sector area is $A = 6\pi$, find the radius r.

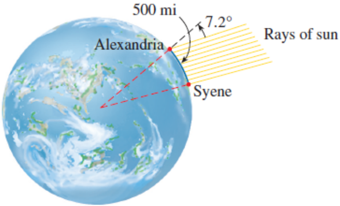
5.1.071 Three circles with radii 1, 2, and 3 ft are externally tangent to one another, as shown in the figure. Find the area of the sector of the circle of radius 1 that is cut off by the line segments joining the center of that circle to the centers of the other two circles.



5.1.079 Find the distance that the earth travels in two days in its path around the sun. Assume that a year has 365 days and that the path of the earth around the sun is a circle of radius 93 million miles.



5.1.080 The Greek mathematician Eratosthenes (ca. 276–195 B.C.) measured the circumference of the earth from the following observations. He noticed that on a certain day the sun shone directly down a deep well in Syene (modern Aswan). At the same time in Alexandria, 500 mi north (on the same meridian), the rays of the sun shone at an angle of 7.2° to the zenith.



1. Find the radius of the earth. (Round to nearest ten miles.)
2. Find the circumference of the earth.