LESSON MAKER PRO

Circle to Coordinates

Use positions on the unit circle to find sine and cosine.

HIGH SCHOOL · PC.T.1.9

PC.T.1.9 "Describe and analyze the relationships of the properties of a unit circle."

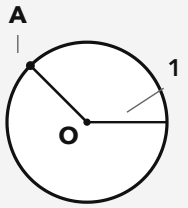
NAME _____ DATE _____

THE BIG IDEA

On the unit circle, a point at angle θ has coordinates (cos θ, sin θ). Use the reference angle to find the coordinate magnitudes, then use the quadrant to decide whether each coordinate is positive or negative.

WORKED EXAMPLE

In the figure, A is 135° counterclockwise from the right. Find A's coordinates and sin 135°.

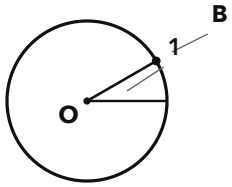


1. The reference angle is 180° - 135° = 45°.
2. At a 45° reference angle, both coordinate magnitudes are sqrt(2)/2.
3. A is in quadrant II, so its x-coordinate is negative and its y-coordinate is positive.

Answer: A = (-sqrt(2)/2, sqrt(2)/2); sin 135° = sqrt(2)/2.

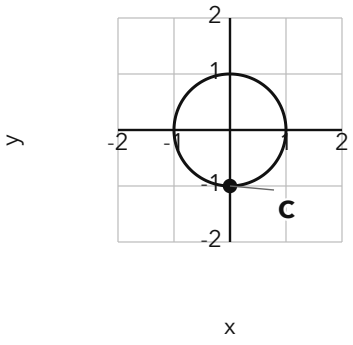
PRACTICE 6 problems

1 Point B marks 30° on the unit circle in the figure. Find B's coordinates.



ANSWER _____

2 For point C in the figure, find its angle from 0° up to, but not including, 360°. Then find the sine of that angle.



ANSWER _____

_____

3 Find cos 120° and sin 120°.

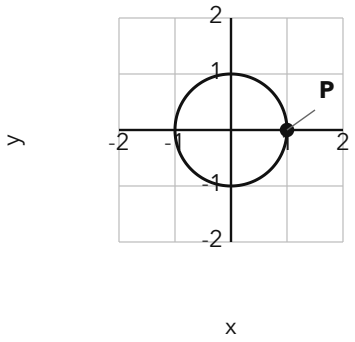
ANSWER _____

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4 Find the coordinates of the point at 225° on the unit circle.

ANSWER _____

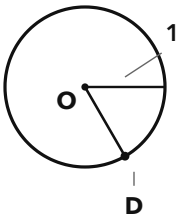
5 For point P in the figure, find its angle from 0° up to, but not including, 360°. Then find the sine of that angle.



ANSWER _____

_____

6 Point D marks 300° on the unit circle in the figure. Find cos 300° and sin 300°.



ANSWER _____

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APPLY IT Show your work

1 In a video game, a joystick's direction is a point on the unit circle. It points 240° counterclockwise from the right. What are its horizontal and vertical input values?

WORK SPACE

ANSWER _____

2 A music app moves a dot once around a unit circle during each beat, starting at the rightmost point and moving counterclockwise. After 7/8 of a beat, what is the dot's signed vertical position relative to the center?

WORK SPACE

ANSWER _____

CHALLENGE One step up

A point on the unit circle has cos θ = -sqrt(3)/2 and sin θ = -1/2, where 0° ≤ θ < 360°. Find θ and sin(θ + 90°). Explain how the coordinates support your answers.

WORK SPACE AND ANSWER

Circle to Coordinates

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Point B marks 30° on the unit circle in the figure. Find B's coordinates.	**(sqrt(3)/2, 1/2)**
2	For point C in the figure, find its angle from 0° up to, but not including, 360°. Then find the sine of that angle.	**270°; sin 270° = -1.**
3	Find cos 120° and sin 120°.	**cos 120° = -1/2; sin 120° = sqrt(3)/2.**
4	Find the coordinates of the point at 225° on the unit circle.	**(-sqrt(2)/2, -sqrt(2)/2)**
5	For point P in the figure, find its angle from 0° up to, but not including, 360°. Then find the sine of that angle.	**0°; sin 0° = 0.**
6	Point D marks 300° on the unit circle in the figure. Find cos 300° and sin 300°.	**cos 300° = 1/2; sin 300° = -sqrt(3)/2.**

PART 2 · APPLY IT

1. **Horizontal: -1/2; vertical: -sqrt(3)/2.** The reference angle is 60°. At 240°, both coordinates are negative, so (cos 240°, sin 240°) = (-1/2, -sqrt(3)/2).
2. **-sqrt(2)/2 units.** The dot has moved (7/8)(360°) = 315°. Its vertical position is sin 315° = -sqrt(2)/2.

CHALLENGE

θ = 210° because both coordinates are negative and the reference angle is 30°. Rotating the point 90° counterclockwise makes its original x-coordinate the new y-coordinate, so sin(θ + 90°) = -sqrt(3)/2.

Accept equivalent exact forms, including 1/sqrt(2) in place of sqrt(2)/2. Signed vertical positions below the center are negative.