LESSON MAKER PRO

Unit Circle Paths

Connect arcs, angles, and radians on a unit circle.

HIGH SCHOOL · AII-F.TF.1

AII-F.TF.1 "Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle."

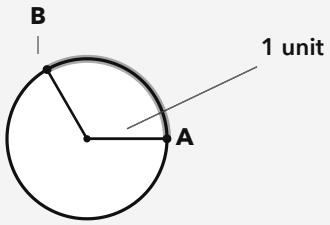
NAME _____ DATE _____

ARC LENGTH EQUALS RADIANS

On a unit circle, the radius is 1, so the length of a subtended arc is equal to the angle's radian measure. To change degrees to radians, multiply the degree measure by pi/180.

WORKED EXAMPLE

Use the unit circle shown. Central angle AOB measures 120°. Find its radian measure and the length of its highlighted arc.

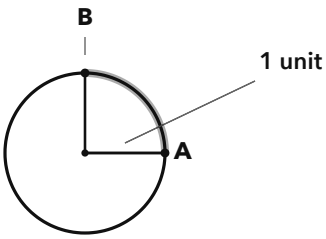


1. Convert the angle: 120° x pi/180° = 2pi/3 radians.
2. Use s = rtheta with r = 1.
3. s = 1(2pi/3) = 2pi/3 units.

Answer: 2pi/3 radians; 2pi/3 units

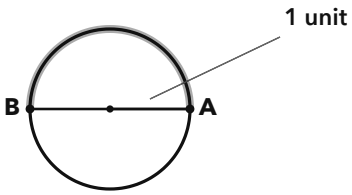
PRACTICE 6 problems

1 Use the unit circle shown. Find the radian measure of central angle AOB. Given: ∠AOB = 90°.



ANSWER _____

2 Use the unit circle shown. Find the length of the highlighted arc from A to B. Given: AB is a diameter, so the highlighted arc is a semicircle.



ANSWER _____

3 A unit-circle arc subtends a central angle of 45°. What is the arc length?

ANSWER _____

4 A central angle on a unit circle measures 270°. What is its radian measure?

ANSWER _____

5 On a unit circle, an arc has length 5pi/6 units. What is the measure of its central angle in radians?

ANSWER _____

6 A central angle on a unit circle measures 7pi/6 radians. What is the length of its subtended arc?

ANSWER _____

APPLY IT Show your work

1 A music app animates a marker moving counterclockwise around a unit-circle album-art ring. During one transition, the marker turns 210°. What is its radian measure, and how far does the marker travel along the ring?

2 A fitness app uses a unit-circle progress ring. A workout fills 135° of the ring. Find the radian measure of the filled angle and the length of the filled arc.

CHALLENGE One step up

In an animation, a dot begins at angle 0 on a unit circle and moves counterclockwise through 13pi/6 radians. How far does the dot travel along the circle? Give the dot's final position as its least nonnegative radian measure. Explain why the travel distance is not pi/6.

ANSWER KEY

Unit Circle Paths

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PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Use the unit circle shown. Find the radian measure of central angle AOB. Given: ∠AOB = 90°.	**pi/2 radians**
2	Use the unit circle shown. Find the length of the highlighted arc from A to B. Given: AB is a diameter, so the highlighted arc is a semicircle.	**pi units**
3	A unit-circle arc subtends a central angle of 45°. What is the arc length?	**pi/4 units**
4	A central angle on a unit circle measures 270°. What is its radian measure?	**3pi/2 radians**
5	On a unit circle, an arc has length 5pi/6 units. What is the measure of its central angle in radians?	**5pi/6 radians**
6	A central angle on a unit circle measures 7pi/6 radians. What is the length of its subtended arc?	**7pi/6 units**

PART 2 · APPLY IT

1. **7pi/6 radians; 7pi/6 units** Convert 210° by multiplying by pi/180° to get 7pi/6 radians. Because the ring is a unit circle, the arc length is also 7pi/6 units.
2. **3pi/4 radians; 3pi/4 units** Convert 135° to radians: 135° x pi/180° = 3pi/4. On a unit circle, that same value is the arc length.

CHALLENGE

The dot travels 13pi/6 units and ends at pi/6 radians. Since 13pi/6 = 2pi + pi/6, the dot makes one full turn plus pi/6, so its final location is pi/6 but its path includes the full turn.

Accept equivalent exact forms, such as pi/2 units for an arc length. Require radians for angle measures and units for arc lengths when requested.