

Algebra 2 · Radians and the Unit Circle · Worksheet

Common Core F-TF.A.1, F-TF.A.2, F-TF.C.8 · mathovore.fr

Name: _____ Date: ____/____/____ Score: _____

These 23 problems practice radian measure, arc length, and the unit circle (F-TF.A.1, F-TF.A.2), then the Pythagorean identity for finding one ratio from another (F-TF.C.8). Early problems are quick conversions and exact values, and each one has a full worked answer.

The last six are word problems about clocks, pizza, bicycles and a Ferris wheel. Keep answers exact in terms of π and radicals unless the problem asks for a decimal.

Algebra 2 Common Core: F-TF.A.1 · F-TF.A.2 · F-TF.C.8

Problem 1: Degrees to radians

Convert each angle to radians. Leave the answer in terms of π .

- a. 45°
- b. 120°
- c. 270°
- d. 15°

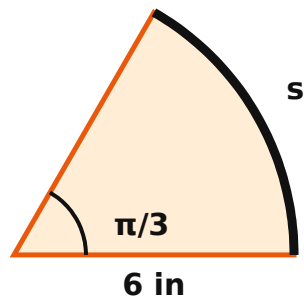
Problem 2: Radians to degrees

Convert each angle to degrees.

- a. $\frac{\pi}{6}$
- b. $\frac{5\pi}{4}$
- c. $\frac{7\pi}{3}$
- d. $-\frac{\pi}{2}$

Problem 3: Arc length

Find the arc length for each central angle.



Part a: radius 6 inches, angle $\frac{\pi}{3}$.

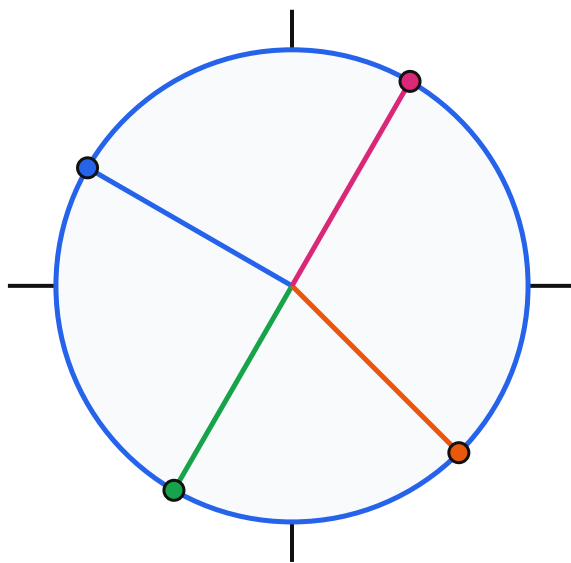
- Radius 6 inches and central angle $\frac{\pi}{3}$. Give the exact length and a decimal rounded to hundredths.
- Radius 4 feet and central angle 2.5 radians.

Problem 4: Angle from an arc

An arc of length 9 inches lies on a circle of radius 6 inches. Find the central angle in radians and in degrees to the nearest tenth.

Problem 5: Locating the quadrant

Name the quadrant of the terminal side of each angle.



Points A, B, C and D on the unit circle.

- a. $\frac{5\pi}{6}$ (point A)
- b. $\frac{4\pi}{3}$ (point B)
- c. $\frac{7\pi}{4}$ (point C)
- d. $\frac{\pi}{3}$ (point D)

Problem 6: Special angle values

Write the exact value of each expression.

- a. $\sin \frac{\pi}{6}$
- b. $\cos \frac{\pi}{4}$
- c. $\tan \frac{\pi}{3}$
- d. $\cos \frac{\pi}{3}$

Problem 7: Unit circle coordinates

Find the exact coordinates of the point where the terminal side of each angle meets the unit circle.

- a. $\frac{2\pi}{3}$
- b. $\frac{5\pi}{4}$
- c. $\frac{11\pi}{6}$

Problem 8: Reference angles

Find the reference angle for each angle.

- a. $\frac{5\pi}{6}$
- b. $\frac{7\pi}{6}$
- c. $\frac{5\pi}{3}$
- d. $\frac{3\pi}{4}$

Problem 9: Quadrantal angles

Complete the table of exact values. Write undefined where it applies.

θ	$\sin \theta$	$\cos \theta$	$\tan \theta$
0			
$\frac{\pi}{2}$			
π			
$\frac{3\pi}{2}$			

Problem 10: Evaluating in other quadrants

Find the exact value.

- a. $\sin\left(\frac{7\pi}{6}\right)$
- b. $\cos\left(\frac{5\pi}{3}\right)$
- c. $\tan\left(\frac{3\pi}{4}\right)$

Problem 11: Negative and large angles

Find the exact value.

- a. $\cos\left(-\frac{\pi}{3}\right)$
- b. $\sin\left(-\frac{\pi}{4}\right)$
- c. $\sin\frac{13\pi}{6}$
- d. $\cos\frac{9\pi}{4}$

Problem 12: Solving for the angle

Find all angles θ with $0 \leq \theta < 2\pi$ that satisfy each equation.

- a. $\sin\theta = \frac{\sqrt{3}}{2}$
- b. $\cos\theta = -\frac{\sqrt{2}}{2}$

Problem 13: Checking the identity

Verify that $\sin^2\theta + \cos^2\theta = 1$ for each angle by substituting exact values.

- a. $\theta = \frac{\pi}{6}$
- b. $\theta = \frac{5\pi}{4}$

Problem 14: Cosine from sine

Given $\sin\theta = \frac{3}{5}$ with the terminal side of θ in Quadrant II, find $\cos\theta$ and $\tan\theta$.

Problem 15: Sine from cosine

Given $\cos\theta = \frac{5}{13}$ with the terminal side in Quadrant IV, find $\sin\theta$ and $\tan\theta$.

Problem 16: Using the tangent

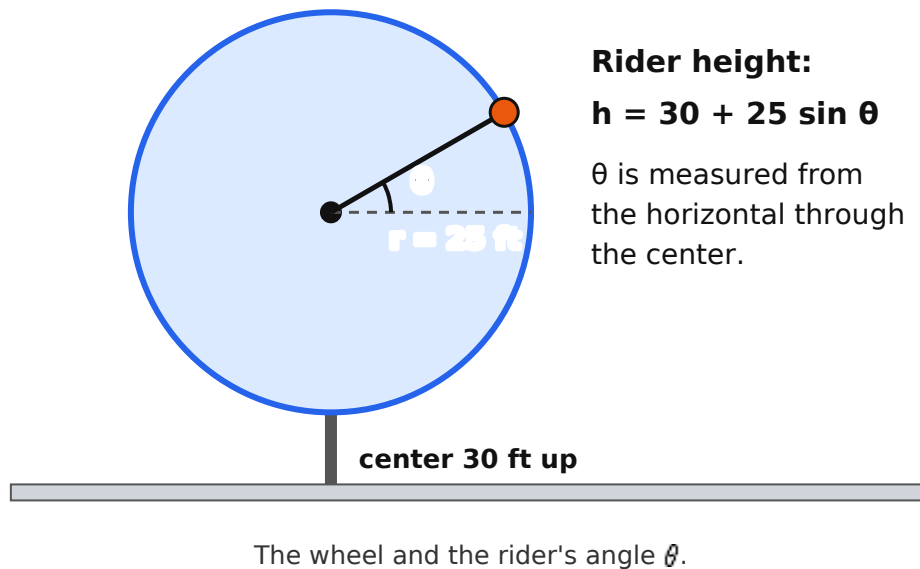
Given $\tan\theta = \frac{4}{3}$ with the terminal side in Quadrant III, find $\sin\theta$ and $\cos\theta$.

Problem 17: Radical values

Given $\cos\theta = -\frac{\sqrt{5}}{3}$ with the terminal side in Quadrant III, find $\sin\theta$ and $\tan\theta$.

Problem 18: Ferris wheel height

A Ferris wheel has radius 25 feet and its center is 30 feet above the ground. Mei's height is $h = 30 + 25\sin\theta$, where θ is measured from the horizontal through the center.

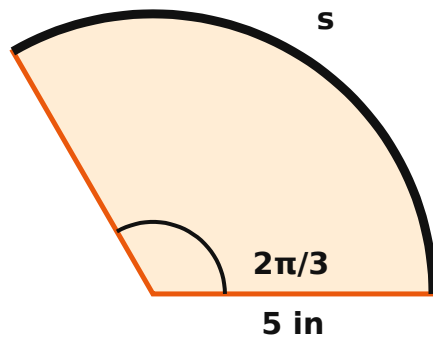


Find Mei's height for each angle. Round to the nearest tenth when needed.

- a. $\theta = \frac{\pi}{6}$
- b. $\theta = \frac{\pi}{2}$
- c. $\theta = \frac{5\pi}{4}$
- d. $\theta = \frac{3\pi}{2}$

Problem 19: Clock hand

Sofia's wall clock has a minute hand 5 inches long. In 20 minutes the hand turns through $\frac{1}{3}$ of a full circle.

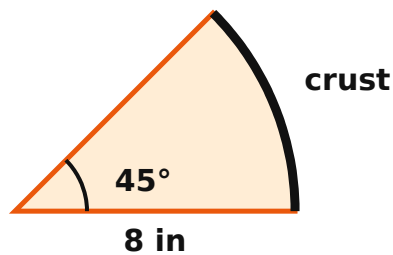


The tip travels along the arc s .

- Write the angle in radians.
- How far does the tip of the minute hand travel? Give the exact value and a decimal to the nearest hundredth.

Problem 20: Pizza slice

Liam cuts a pizza of radius 8 inches into slices with a central angle of 45° .



One slice and its crust arc.

- Convert 45° to radians.
- Find the length of the crust on one slice to the nearest hundredth of an inch.

Problem 21: Bicycle wheel

A bicycle wheel has radius 13 inches. Noah rides until the wheel turns exactly 3 full revolutions.

- Find the angle the wheel turns through, in radians.
- Find the distance he travels in inches and in feet, to the nearest hundredth.

Problem 22: Point on the circle

The point $P\left(-\frac{12}{13}, y\right)$ lies on the unit circle in Quadrant III, and it is on the terminal side of angle θ . Find y , then $\sin\theta$, $\cos\theta$ and $\tan\theta$.

Problem 23: When is the rider low

On the same wheel, $h = 30 + 25\sin\theta$. Find all angles θ with $0 \leq \theta < 2\pi$ for which Mei is 17.5 feet above the ground.

