

Precalculus · Angles, Radians and the Unit Circle · Worksheet

Common Core F-TF.A.1, F-TF.A.2, F-TF.A.3, F-TF.A.4 · mathovore.fr

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

This precalculus unit circle worksheet gives 23 problems on angles, radians and the unit circle, ordered from easy to hard, with a separate answer key.

These 23 problems practice the Precalculus standards F-TF.A.1 to F-TF.A.4: radian measure, the unit circle, special angles, reference angles, symmetry, and the even, odd and periodic behavior of sine, cosine and tangent.

The problems move from conversions to exact values and equations. The last six use arc length, angular speed and linear speed in everyday settings. Keep answers exact unless a decimal is requested.

PrecalculusCommon Core: F-TF.A.1 · F-TF.A.2 · F-TF.A.3 · F-TF.A.4

Precalculus Unit Circle Worksheet: problems 1-5

Problem 1: Degrees to radians

Convert each angle to radians. Give an exact answer in terms of π .

- a. 30°
- b. 135°
- c. 270°
- d. -210°
- e. 15°

Problem 2: Radians to degrees

Convert each angle to degrees. Round part (e) to two decimal places.

- a. $\frac{5\pi}{6}$
- b. $\frac{7\pi}{4}$
- c. $\frac{2\pi}{3}$
- d. $\frac{11\pi}{6}$
- e. 3 radians

Problem 3: Coterminal angles

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

- a. $\frac{17\pi}{6}$
- b. $-\frac{\pi}{3}$
- c. $\frac{25\pi}{4}$
- d. $-\frac{11\pi}{4}$

Problem 4: Reference angles

Find the reference angle for each angle.

- a. $\frac{5\pi}{6}$
- b. $\frac{7\pi}{4}$
- c. $\frac{11\pi}{6}$
- d. $\frac{7\pi}{3}$
- e. $-\frac{2\pi}{3}$

Problem 5: Special angle values

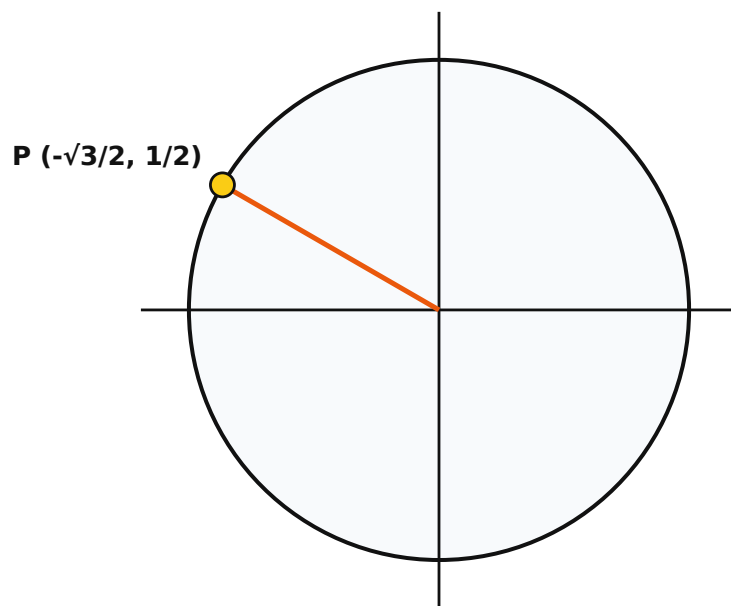
Complete the table with exact values.

θ	$\sin\theta$	$\cos\theta$	$\tan\theta$
$\frac{\pi}{6}$			
$\frac{\pi}{4}$			
$\frac{\pi}{3}$			

Precalculus Unit Circle Worksheet: problems 6-10

Problem 6: Point on the unit circle

The point $P\left(-\frac{\sqrt{3}}{2}, \frac{1}{2}\right)$ lies on the unit circle.



Point P on the unit circle in Quadrant II.

- Find the angle θ in $[0, 2\pi)$ whose terminal side passes through P .
- Find $\sin\theta$, $\cos\theta$ and $\tan\theta$.

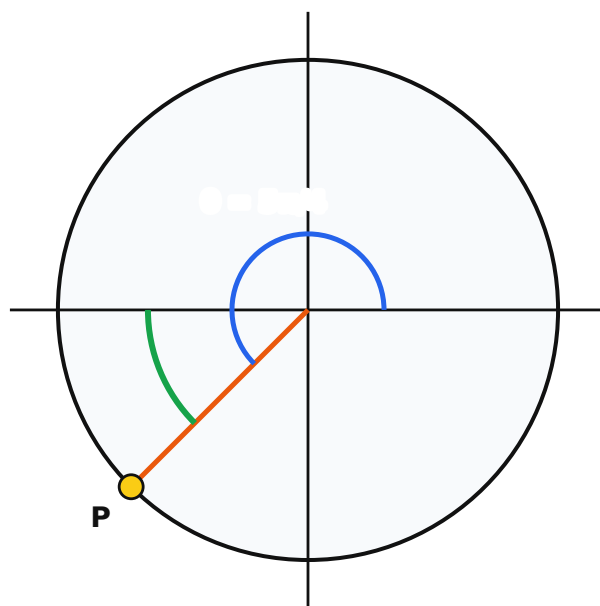
Problem 7: Exact values by symmetry

Find the exact value of each expression.

- $\sin\left(\frac{5\pi}{6}\right)$
- $\cos\left(\frac{7\pi}{4}\right)$
- $\tan\left(\frac{2\pi}{3}\right)$
- $\sin\left(\frac{11\pi}{6}\right)$
- $\cos\left(\frac{4\pi}{3}\right)$

Problem 8: Reading a point from an angle

The figure shows the angle $\theta = \frac{5\pi}{4}$ and the point P where its terminal side meets the unit circle.



The green arc marks the reference angle.

- Find the reference angle.
- Find the exact coordinates of P .
- Find $\tan \frac{5\pi}{4}$.

Problem 9: Even and odd identities

Use the even and odd properties to find each exact value.

- $\sin\left(-\frac{\pi}{3}\right)$
- $\cos\left(-\frac{\pi}{4}\right)$
- $\tan\left(-\frac{\pi}{6}\right)$
- $\sin\left(-\frac{5\pi}{6}\right)$
- $\cos\left(-\frac{2\pi}{3}\right)$

Problem 10: Coordinates on the unit circle

Use the equation of the unit circle.

- The angle θ lies in Quadrant IV and $\cos\theta = \frac{3}{5}$. Find $\sin\theta$ and $\tan\theta$.
- The point $\left(-\frac{5}{13}, y\right)$ is on the unit circle in Quadrant III. Find y .

Precalculus Unit Circle Worksheet: problems 11-15

Problem 11: Periodicity

Use periodicity to find the exact value of each expression.

- a. $\sin\left(\frac{25\pi}{6}\right)$
- b. $\cos\left(-\frac{13\pi}{3}\right)$
- c. $\tan\left(\frac{9\pi}{4}\right)$
- d. $\sin\left(-\frac{17\pi}{4}\right)$
- e. $\tan\left(-\frac{11\pi}{6}\right)$

Problem 12: Solving trigonometric equations

Solve each equation for θ in $[0, 2\pi)$.

- a. $\sin\theta = \frac{1}{2}$
- b. $\cos\theta = -\frac{\sqrt{2}}{2}$
- c. $\tan\theta = -1$
- d. $\sin\theta = -\frac{\sqrt{3}}{2}$

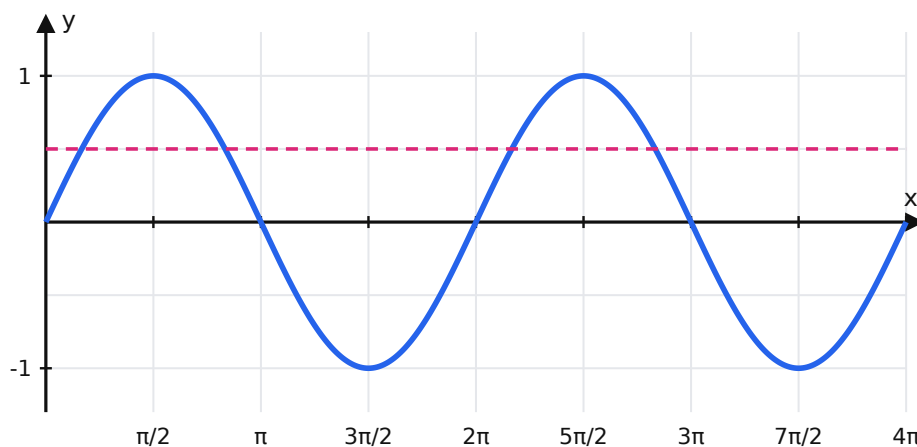
Problem 13: Even or odd functions

Decide whether each function is even, odd or neither. Justify using $f(-x)$.

- a. $f(x) = x\sin x$
- b. $g(x) = x\cos x$
- c. $h(x) = \sin x + \cos x$

Problem 14: Solutions from a graph

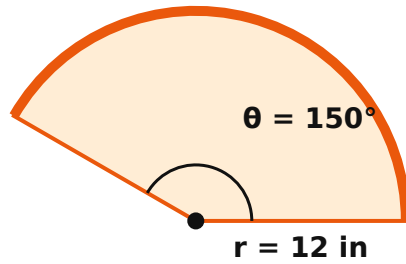
The graph shows $y = \sin x$ and the dashed line $y = \frac{1}{2}$. List every x in $[0, 4\pi]$ with $\sin x = \frac{1}{2}$.



The line $y = 1/2$ crosses the sine curve four times.

Problem 15: Arc length

A sector has radius 12 in and a central angle of 150° .



A 150 degree sector of radius 12 inches.

- Write the central angle in radians.
- Find the arc length, first exactly and then to two decimal places.
- A different arc has central angle 2.5 radians on a circle of radius 8 ft. Find its length.

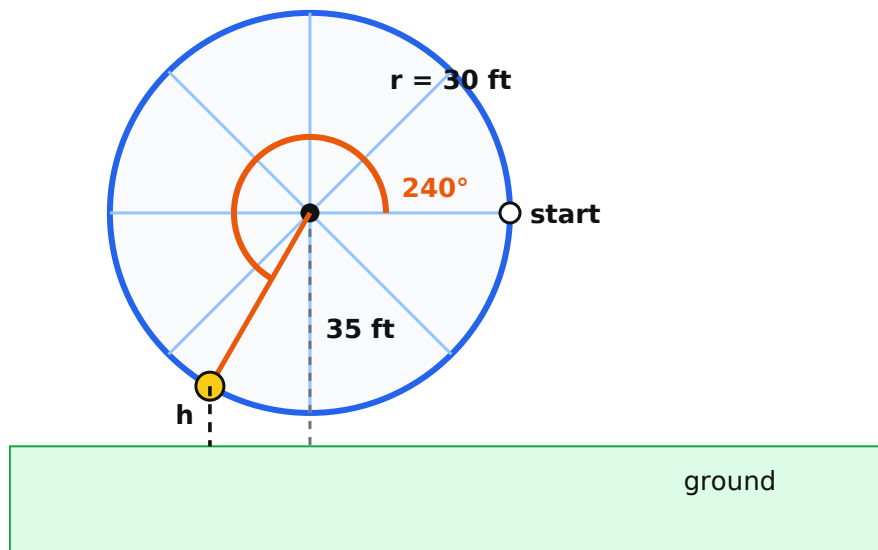
Precalculus Unit Circle Worksheet: problems 16-20

Problem 16: Central angle from arc length

An arc of length 9 ft lies on a circle of radius 6 ft. Find the central angle in radians and in degrees. Round degrees to two decimal places.

Problem 17: Ferris wheel height

Priya rides a Ferris wheel of radius 30 ft whose center is 35 ft above the ground. She starts at the point level with the center on the right and the wheel turns counterclockwise. Her height after turning through $\frac{4\pi}{3}$ radians is $h = 35 + 30\sin\theta$. Find her exact height and then round it to two decimal places.



The rider turns through 240 degrees.

Problem 18: Bicycle wheel speed

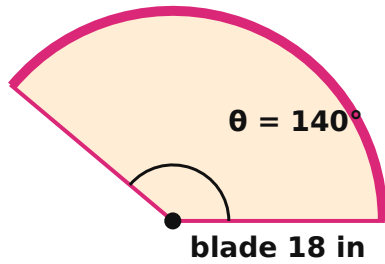
Jamal's bicycle wheel has a diameter of 26 in and turns 3 revolutions per second. Find the angular speed in radians per second and the linear speed of a point on the tire in inches per second. Then convert the linear speed to miles per hour. Round to two decimal places.

Problem 19: Turntable speed

A turntable spins at 33 and one third revolutions per minute, which is $\frac{100}{3}$ revolutions per minute. Find its angular speed in radians per minute, and the linear speed in inches per minute of a point 5 in from the center. Round to two decimal places.

Problem 20: Windshield wiper

A windshield wiper blade is 18 in long and sweeps through 140° on each pass. Find the length of the arc traced by the tip of the blade, exactly and to two decimal places.



The wiper blade sweeps a 140 degree sector.

Precalculus Unit Circle Worksheet: problems 21-23

Problem 21: Lighthouse beam

A lighthouse lamp turns 2 revolutions per minute. Find its angular speed in radians per minute. Then find the speed in miles per hour of the spot of light on a cliff 5 miles away, treating the path as a circular arc of radius 5 miles. Round to two decimal places.

Problem 22: Running track curve

Maya runs 300 ft along a circular curve of radius 100 ft. Find the central angle of her path in radians and in degrees. Round degrees to two decimal places.

Problem 23: Minute hand travel

The minute hand of a wall clock is 6 in long. Find the exact distance its tip travels from 12:00 to 12:20, and the average speed of the tip in inches per minute, to two decimal places.

How to use this precalculus unit circle worksheet

Print this precalculus unit circle worksheet as a PDF, solve every problem on paper, then compare with the answer key.

