

Radians and the Unit Circle Explained

Grade 11 – Algebra 2 math · Worksheet · Standards: F-TF.A.1, F-TF.A.2, F-TF.C.8

Name: _____ Date: _____ Class: _____

These problems train radian measure, unit-circle coordinates, exact values of sine, cosine and tangent, and the Pythagorean identity, matching standards F-TF.A.1, F-TF.A.2 and F-TF.C.8.

They begin with conversions and special angles, then use quadrants, arc length and a Ferris wheel. Give exact values unless a decimal is requested.

Standards: F-TF.A.1, F-TF.A.2, F-TF.C.8 · **Level:** Grade 11 Algebra 2

Problem 1 Degrees to radians (easy)

Convert 150° to radians.

Problem 2 Radians to degrees (easy)

Convert $\frac{7\pi}{4}$ radians to degrees.

Problem 3 A radian measure without π (easy)

A dial on a machine turns through 4.2 radians. Express this turn in degrees, rounded to the nearest tenth.

Problem 4 Special angle in quadrant I (easy)

Find $\cos \frac{\pi}{3}$ and $\sin \frac{\pi}{3}$.

Problem 5 Reference angle in quadrant II (medium)

Find the coordinates of the unit-circle point at $\frac{5\pi}{6}$.

Problem 6 Quadrant III values (medium)

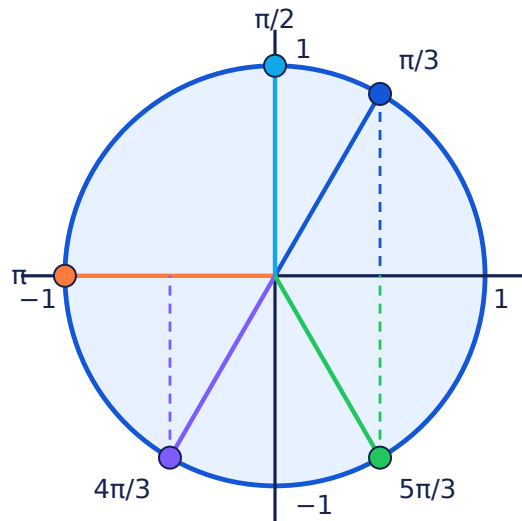
An angle of $\frac{4\pi}{3}$ radians is drawn in standard position. Name its quadrant and give its exact sine and cosine.

Problem 7 Tangent from coordinates (medium)

Find $\tan \frac{3\pi}{4}$.

Problem 8 Read an angle on the unit circle (medium)

The unit circle shows five angles. Give the exact coordinates of the point at $5\pi/3$ (300°).



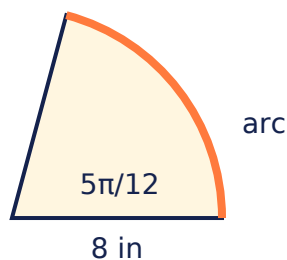
Marked angles on the unit circle.

Problem 9 Negative angle (medium)

Find $\sin(-\pi/4)$ and $\cos(-\pi/4)$.

Problem 10 Arc length of a sector (medium)

A sector has radius 8 inches and central angle $5\pi/12$. Find the arc length, exactly and to the nearest hundredth.



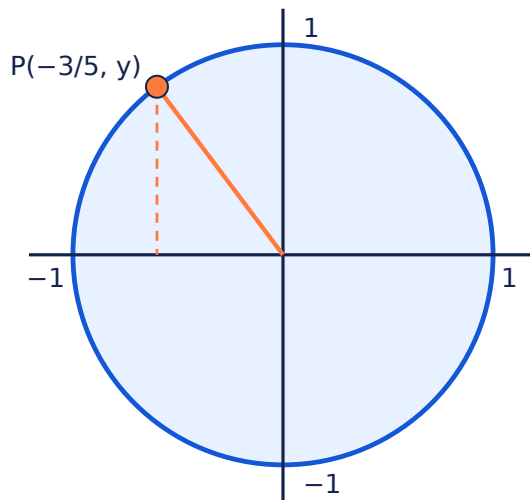
A sector with radius 8 in.

Problem 11 Coterminal angle (medium)

Name the angle in the interval $[0, 2\pi)$ that has the same terminal side as $23\pi/4$, and state its sine.

Problem 12 Point on the unit circle (medium)

The point $P(-3/5, y)$ is on the unit circle in quadrant II. Find y , then $\sin$, $\cos$ and $\tan$ of the angle.



Point P in quadrant II.

Problem 13 Cosine from sine, quadrant II (medium)

Suppose $\sin \theta = 5/13$ and θ is in quadrant II. Find $\cos \theta$ and $\tan \theta$.

Problem 14 Sine from cosine, quadrant IV (hard)

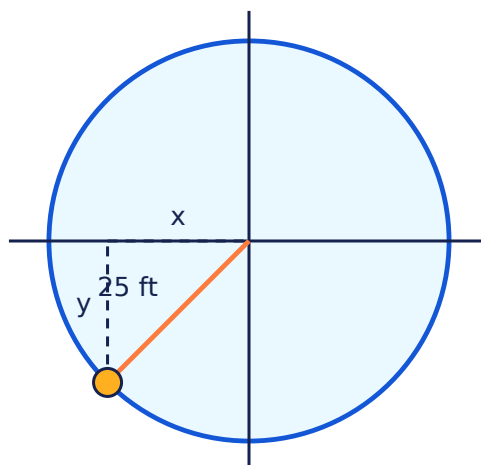
Suppose $\cos \theta = 8/17$ and θ is in quadrant IV. Find $\sin \theta$ and $\tan \theta$.

Problem 15 Sine and cosine from tangent (hard)

Suppose $\tan \theta = 7/24$ and θ is in quadrant III. Find $\sin \theta$ and $\cos \theta$.

Problem 16 Ferris wheel position (hard)

A Ferris wheel has radius 25 feet. Place its center at the origin. A rider starts at the rightmost point and rotates counterclockwise by $5\pi/4$. Find the rider's horizontal and vertical distances from the center, to the nearest hundredth.



Problem 17 Distance traveled by a clock hand (hard)

A minute hand is 9 inches long. In 40 minutes, through what angle in radians does it turn, and how far does its tip travel? Give the distance to the nearest hundredth.

Problem 18 Show an identity (hard)

Show that $(\sin \theta + \cos \theta)^2 = 1 + 2 \sin \theta \cos \theta$.

Problem 19 Two-step ratio problem (hard)

Suppose $\cos \theta = -\sqrt{5}/3$ and θ is in quadrant II. Find $\sin \theta$ and $\tan \theta$ exactly.

Problem 20 Can both values be true? (hard)

Justify whether any angle θ can have $\sin \theta = 0.6$ and $\cos \theta = 0.7$.