LESSON MAKER PRO

Triangle to Circle

Find exact trig values and track angles around the unit circle.

HIGH SCHOOL · F.TF.A.3

F.TF.A.3 "Use special triangles to determine geometrically the values of sine, cosine, tangent for π/3, π/4, and π/6 and use the unit circle to express the values of sine, cosine, and tangent for x, π + x, and 2π − x in terms of their values for x..."

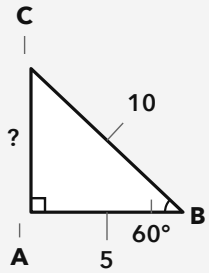
NAME _____ DATE _____

THE BIG IDEA

In a right triangle, sine is opposite/hypotenuse, cosine is adjacent/hypotenuse, and tangent is opposite/adjacent. Special triangles give exact side ratios. On the unit circle, a point at angle x has coordinates (cos x, sin x); a half-turn or a reflection across the horizontal axis helps you find related angles.

WORKED EXAMPLE

In the triangle shown, find sin 60°.

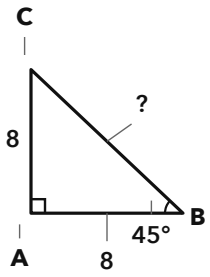


1. Use the Pythagorean theorem: $AC^2 + 5^2 = 10^2$.
2. $AC^2 = 75$, so $AC = 5\sqrt{3}$.
3. sin 60° = opposite/hypotenuse = $5\sqrt{3}/10$.

Answer: sin 60° = √3/2

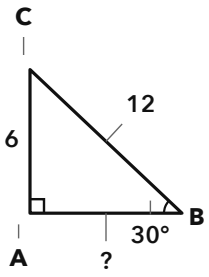
PRACTICE 6 problems

1 Find cos B for the triangle shown.



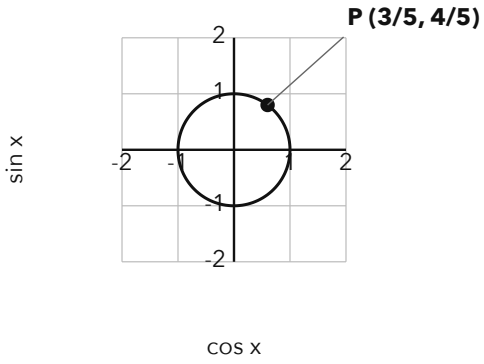
ANSWER _____

2 Find tan B for the triangle shown.



ANSWER _____

3 The angle to P is x. Use the point shown to find sin(π + x).



ANSWER _____

4 Find cos(π/3) exactly.

ANSWER _____

5 Express tan(π + x) in terms of tan x.

ANSWER _____

6 Express tan(2π − x) in terms of tan x.

ANSWER _____

APPLY IT Show your work

1 An animation app moves a dot around a unit circle. The dot starts at angle π/3 and then turns another π radians. What are its final coordinates?

WORK SPACE

ANSWER _____

2 A music app shows a marker on a unit circle at angle π/4. It moves the marker to angle 2π − π/4. Find the marker's new y-coordinate and the tangent of its new angle.

WORK SPACE

ANSWER _____

CHALLENGE One step up

For an angle x on the unit circle, cos x = -8/17 and sin x = 15/17. Find tan(π + x) and cos(2π − x). Explain the signs in one or two sentences.

WORK SPACE AND ANSWER

ANSWER KEY

Triangle to Circle

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Find cos B for the triangle shown.	**√2/2**
2	Find tan B for the triangle shown.	**√3/3**
3	The angle to P is x. Use the point shown to find sin(π + x).	**-4/5**
4	Find cos(π/3) exactly.	**1/2**
5	Express tan(π + x) in terms of tan x.	**tan x, where tangent is defined**
6	Express tan(2π − x) in terms of tan x.	**-tan x, where tangent is defined**

PART 2 · APPLY IT

1. **(-1/2, -√3/2)** At π/3, the coordinates are (1/2, √3/2). A half-turn changes both coordinate signs.
2. **y-coordinate: -√2/2; tangent: -1** The new angle is a reflection of π/4 across the horizontal axis. Its sine is -√2/2, and its tangent is -1.

CHALLENGE

tan(π + x) = -15/8 and cos(2π − x) = -8/17. A half-turn keeps the tangent ratio negative, and reflection across the horizontal axis keeps the horizontal coordinate negative.

Accept equivalent exact forms, such as 1/√3 for √3/3. Tangent expressions apply only where tangent is defined.