LESSON MAKER PRO

Where Graphs Meet

Check trig solutions two ways

HIGH SCHOOL · PC.T.3.3

PC.T.3.3 "Graphically and algebraically verify solutions to trigonometric equations."

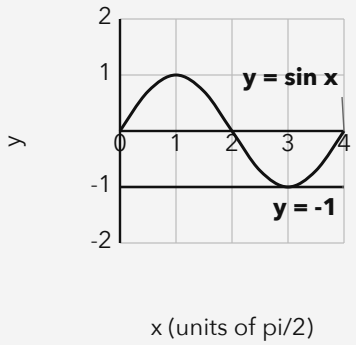
NAME _____ DATE _____

GRAPH AND SUBSTITUTE

For a trig equation, a solution is an x-value where the graphs of both sides meet. Substitute the angle and compare exact values to confirm what the graph shows. When no graph is given, make a quick sketch.

WORKED EXAMPLE

Is x = 3pi/2 a solution of sin x = -1? The graph uses units of pi/2 on the x-axis.



1. Convert the proposed angle: 3pi/2 is x = 3 on this graph.
2. At x = 3, the two graphs meet at y = -1.
3. Substitute: sin(3pi/2) = -1.

Answer: Yes, x = 3pi/2 solves sin x = -1.

PRACTICE 4 problems

1 Sketch both graphs. Does x = pi/3 solve sin x = sqrt(3)/2? Substitute to check.

ANSWER _____

2 Sketch both graphs. Does x = 2pi/3 solve cos x = 1/2? Substitute to check.

ANSWER _____

3 Sketch both graphs. Does x = pi/4 solve tan x = 1? Substitute to check.

ANSWER _____

_____

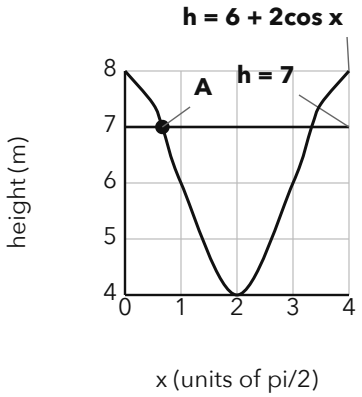
4 Sketch both graphs. Does x = 7pi/6 solve sin x = 1/2? Substitute to check.

ANSWER _____

_____

APPLY IT Show your work

1 A stage light moves to height h = 6 + 2cos x meters as its arm turns through angle x radians. At x = pi/3, is its height 7 meters? Use the graph, then substitute. The graph uses units of pi/2 on the x-axis.



ANSWER _____

2 A game character's vertical offset is d = 3sin x meters at angle x radians. At x = 5pi/6, is the offset 3/2 meters? Sketch both graphs and substitute.

WORK SPACE

ANSWER _____

CHALLENGE One step up

A student claims x = 5pi/12 solves sin(2x) = 1/2. Sketch both graphs and substitute. Explain why you use 2x, not x, to find the sine value.

WORK SPACE AND ANSWER

Where Graphs Meet

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Sketch both graphs. Does x = pi/3 solve sin x = sqrt(3)/2? Substitute to check.	**Yes. The graphs meet at (pi/3, sqrt(3)/2), and sin(pi/3) = sqrt(3)/2.**
2	Sketch both graphs. Does x = 2pi/3 solve cos x = 1/2? Substitute to check.	**No. The graphs do not meet at x = 2pi/3; cos(2pi/3) = -1/2, not 1/2.**
3	Sketch both graphs. Does x = pi/4 solve tan x = 1? Substitute to check.	**Yes. The graphs meet at (pi/4, 1), and tan(pi/4) = 1.**
4	Sketch both graphs. Does x = 7pi/6 solve sin x = 1/2? Substitute to check.	**No. The graphs do not meet at x = 7pi/6; sin(7pi/6) = -1/2, not 1/2.**

PART 2 · APPLY IT

1. **Yes, the height is exactly 7 meters.** On the graph, x = pi/3 is 2/3 of a pi/2 unit, where the curves meet at A. Substitution gives 6 + 2cos(pi/3) = 6 + 2(1/2) = 7.
2. **Yes, the offset is exactly 3/2 meters.** The sketches of y = 3sin x and y = 3/2 meet at x = 5pi/6. Substitution gives 3sin(5pi/6) = 3(1/2) = 3/2.

CHALLENGE

Yes. The graphs meet at x = 5pi/12 because 2x = 5pi/6 and sin(5pi/6) = 1/2. The sine function takes 2x as its input, so the value to check is sin(2 · 5pi/12), not sin(5pi/12).

Accept rough sketches that show whether the graphs meet at the proposed x-value. Require an exact substitution as the algebraic check.