

**WARM UP**

Write at least one complete sentence about what went wrong with this proof and why. Again, this will count as the first exercise for tonight's homework.

Verify the identity:  $\sin \theta + \sin \theta \cot^2 \theta = \csc \theta$

Statement	Reason
$\sin(1+\cot^2)$	factor
$\sin(\csc^2)$	Pythagorean Identity
$\sin(\frac{1}{\sin^2})$	reciprocal identity
$\csc \theta$	simplify/reciprocal identity

Oct 1-10:31 AM

Oct 28-1:38 PM

**5.3: Solving Trigonometric Equations**  
 We'll be on this section all week (read "This section is IMPORTANT").  
 Last section before next test (one week from tomorrow)

Verify that  $x=-4$  and  $x=-5$  are solutions to the following equation:  
 $3x^2 + 65 = 5 - 27x$

$3(-4)^2 + 65 = 5 - 27(-4)$	$3(-5)^2 + 65 = 5 - 27(-5)$
$3(16) + 65 = 5 + 108$	$3(25) + 65 = 5 + 135$
$48 + 65 = 113$	$75 + 65 = 140$
$113 = 113$	$140 = 140$

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**We can do the same with trigonometric equations! Of course!**

**Example**  
 Verify that each  $x$ -value is a solution to the equation  $4\cos^2 2x - 2 = 0$

$x = \frac{\pi}{8}$ $4\cos^2(2(\frac{\pi}{8})) - 2 = 0$ $4\cos^2(\frac{\pi}{4}) - 2 = 0$ $4(\frac{\sqrt{2}}{2})^2 - 2 = 0$ $4(\frac{2}{4}) - 2 = 0$ $2 - 2 = 0$ $0 = 0$	$x = \frac{7\pi}{8}$ $4\cos^2(2(\frac{7\pi}{8})) - 2 = 0$ $4\cos^2(\frac{7\pi}{4}) - 2 = 0$ $4(\frac{\sqrt{2}}{2})^2 - 2 = 0$ $4(\frac{2}{4}) - 2 = 0$ $2 - 2 = 0$ $0 = 0$
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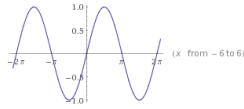
p. 376, #3 (HW)

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Now we want to SOLVE these types of equations...

Strategies

- Isolate trigonometric expression
- If necessary, use identities so that you only have one trigonometric function
- Unless domain is restricted, recall that you have an infinite number of solutions (called the general solution)

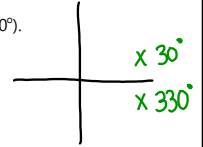


Examples

Find all solutions of the equation in the interval  $[0, 360^\circ)$ .

$$\cos x = \frac{\sqrt{3}}{2}$$

$30^\circ + 330^\circ$



$$\begin{matrix} \sin \\ \tan x = -\frac{\sqrt{3}}{2} \\ \cos \frac{1}{2} \end{matrix}$$



p. 376, # 15 (HW)

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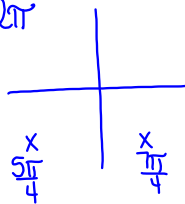
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Example

Solve the equation. Check your work on a graphing calculator.

$$\begin{aligned} \sqrt{2} \sin x + 1 &= 0 \\ \sqrt{2} \sin x &= -1 \\ \sin x &= -\frac{1}{\sqrt{2}} = -\frac{\sqrt{2}}{2} \end{aligned}$$

Period:  $2\pi$



$$\begin{aligned} \frac{5\pi}{4} + 2\pi n \\ \frac{7\pi}{4} + 2\pi n \end{aligned}$$

p. 376, #25 (HW)

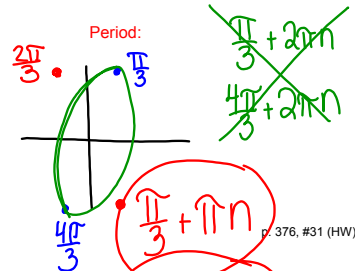
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Example

Solve the equation. Check your work on a graphing calculator.

$$\begin{aligned} 3 \cot^2 x - 1 &= 0 \\ 3 \cot^2 x &= 1 \\ \sqrt{\cot^2 x} &= \frac{1}{\sqrt{3}} \\ \cot x &= \frac{1}{\sqrt{3}} = \frac{\sqrt{3}}{3} \\ \cos &= \frac{1}{2} \\ \sin &= \frac{\sqrt{3}}{2} \end{aligned}$$

Period:  $2\pi$



$$\begin{aligned} \frac{\pi}{3} + 2\pi n \\ \frac{2\pi}{3} + \pi n \end{aligned}$$

p. 376, #31 (HW)

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Ideas for #33?

$$\frac{\sin^2 x = 3 \cos^2 x}{\cos^2 x \cancel{\cos^2 x}} \quad \frac{\sqrt{3} \div 2}{1 \div 2}$$

$$\sqrt{\tan^2 x = 3}$$

$$\tan x = \pm \frac{\sqrt{3} \sin}{\frac{1}{2} \cos}$$

$$\tan x = \frac{\pi}{3}, \frac{4\pi}{3}$$

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# HOMEWORK

...due tomorrow with 5.1 and 5.2

5.3a (p. 376): 1-33 (odd)

Don't forget--Basic Identities Quiz 1 of 3 tomorrow

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## WARM UP

On a clean sheet of paper, use complete sentence(s) to answer the following question in your own words:

What is the period for  $y=\sin(x)$ ,  $y=\cos(x)$ , and  $y=\tan(x)$ ?

How do you use this to solve for the general solution (infinite number of solutions) of trigonometric equations?

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## Equations Quadratic in Form

Strategy:

- Factor or use Quadratic Formula to solve for trigonometric expression
- Use Unit Circle to find solution, if possible
- If answer is not exact, use inverse function

Find all solutions of the equation in the interval  $[0, 2\pi)$ .

$$2\sin^2 x - \sin x - 1 = 0$$

p. 376, #41 (HW)

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**Example**

Find all solutions of the equation in the interval  $[0, 2\pi)$  algebraically. Then use a calculator to check your work.

$$\sec^2 x - 2 \tan x = 4$$

**Strategy:**

- Factor or use Quadratic Formula to solve for trigonometric expression
- Use Unit Circle to find solution, if possible
- If answer is not exact, use inverse function

p. 376, #47 (HW)

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**Approximating Solutions Using a Graphing Calculator****Example**

Use a graphing utility to approximate the solutions of the equation in the interval  $[0, 2\pi)$  by setting the equation equal to 0, graphing the new equation, and using the zero or root feature to approximate the x-intercepts of the graph.

$$\frac{1 + \sin x}{\cos x} + \frac{\cos x}{1 + \sin x} = 4$$

p. 377, #55 (HW)

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**Example (p. 378, #99)**

The monthly sales  $S$  (in thousands of units) of lawn mowers are approximated by  

$$S = 74.50 - 43.75 \cos \frac{\pi t}{6}$$
 where  $t$  is the time (in months), with  $t=1$  corresponding to January. Determine the months during which sales exceed 100,000 units.

p. 378, #100 (HW)

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**HOMEWORK****...solve, solve, solve!****5.3b (p. 376-378):** 35, 39, 41, 47, 51, 55, 85, 100, 101**Don't forget--Basic Identities Quiz 3 of 3 tomorrow**

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**5.3c: Functions Involving Multiple Angles** $\sin kx$  $\cos kx$  $\tan kx$ **Strategy:**

- (1) Solve for  $kx$
- (2) Divide your result by  $k$

**Example**

$2\cos 3t - 1 = 0$

period of  $\cos(t)$ :

p. 377, #65 (HW)

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**Example** (p. 377, #68)

$\tan^2 3x = 3$

period of  $\tan(x)$ :

p. 377, #67 (HW)

$\sin \frac{x}{2} = -\frac{\sqrt{3}}{2}$

 $[180^\circ, 450^\circ]$ 

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# **HOMEWORK**

**...and then the long weekend!**

**5.3c (p. 377):** 61-75 (odd)

**Next test**\\Wednesday, November 6 (5.1-5.3)

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