PreCalculus with TRIG – Unit 6 – Solving Trig Equations

<u>Day 1 – Section 5.5 – Solving Trig Functions – Introduction to</u> <u>Solving Trig Equations</u>

Objectives: SWBAT solve equations with trig functions.

Review Questions of the Day:

- 1) What is the period for y = sin(x)? What about tan(x)?
- 2) If $\sin(\beta) = \frac{1}{5}$, find β
- 3) Draw and find the negative reference angle for 320°
- 4) Using the Unit Circle, Find all radian measures where $\cos(\theta) = \frac{\sqrt{2}}{2}$



Solve for x given that x is $[0, 2\pi)$

1)
$$\sin(x) = \frac{1}{2}$$

 $\overrightarrow{T | C}$
a) $\cos(x) = -\frac{\sqrt{3}}{2}$
 $\overrightarrow{T | C}$
b) \overrightarrow{A}

TIP I: Equations with one trig function and a single angle (no double, no triple, no half, etc). Just cos(x), sin(x), tan(x) not cos(2x), not tan(3x), etc.

Steps for Success:

- **1.** Get the Trig function by itself
- 2. Find the angles which produce the trig value.
- 3. Always map it out by drawing your unit circle and going to the appropriate quadrants! THE PICTURE IS THE KEY!!!
- 4. If you value doesn't appear on the unit circle, then use your calculator (Radian Mode)

Solve each for $0 < x < 2\pi$, i.e. $[0, 2\pi)$. Then write an expression for all solutions.

2) $2\sin(x) - 1 = 0$	SA	b) $2\cos(x) + 1 = 0$	SA
	TC		TC
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Solutions for $[0, 2\pi)$:

Solutions for $[0, 2\pi)$:

All Solutions: _____

3) 2sec(x) - 2 = 0

All Solutions: _____

4) 3tan(x) + 1 = 2tan(x)

Solutions for $[0, 2\pi)$:

Solutions for $[0, 2\pi)$:

All Solutions: _____

All Solutions: _____

Using a calculator for equations that don't fall exactly on the Unit Circle.

For each of the following.

5) tan(x) = 2.5

Solutions for $[0, 2\pi)$:



6) sin(x) = -5/12 c) cos(x) = -3/5

Solutions for $[0, 2\pi)$:	Solutions for $[0, 2\pi)$:
All Solutions:	All Solutions:

7) $-4\cos(x) + 2 = 3\cos(x)$

8) 7tan(x) = 3

Solutions for $[0, 2\pi)$:	Solutions for $[0, 2\pi)$:
All Solutions:	All Solutions:
d) $3\cos(x) = -1$	9) $4cot(x) + 9 = 0$

Solutions for $[0, 2\pi)$:	Solutions for $[0, 2\pi)$:
All Solutions:	All Solutions:

Solutions for $[0, 2\pi)$:	Solutions for $[0, 2\pi)$:
All Solutions:	All Solutions:
e) $14cos(x) = 28$	12) $2\sin(x) + 6 = 10$

Solutions for $[0, 2\pi)$:

Solutions for [0, 2*π***):**_____

All Solutions: _____

Day 2 - Section 5.5A - Solving Trig Functions - Tip II

Objectives: SWBAT solve equations with trig functions by Factoring.

Review Questions of the Day:

1) What is the **frequency** of $y = 2\sin(2t)$?

2) What is the period of y = cscx?

3) Solve by Factoring $2x^2 + x = 21$ 4) Find the exact value of $cos(15^\circ)cos(15^\circ) - sin(15^\circ)sin(15^\circ)$

Mapping:



Write an expression that maps the following radians onto each other (Hint: draw a picture).

1)	π 5 π	\mathbf{n} π	$7\pi 11\pi$ (1)	π	7π	11π
I)	4'4	$\frac{2}{2}, \frac{1}{2}, \frac{1}{2}$	6 ' 6 a)	4	3	12

TIP II: Equations that need to be factored or simplified first, as well as equations with more than one trig function.

Solve each for $0 < x < 2\pi$, i.e. [0, 2π). Then write an expression for all solutions using k = integer.

3) (cosx - 1)(sinx + 1) = 0

Solutions for $[0, 2\pi)$:

All Solutions: _____

4) cosx(cotx-1) = 0

5) $4\sin^2(x) - 1 = 0$

Solutions for [0, 2π):	Solutions for $[0, 2\pi)$:
All Solutions:	All Solutions:
b) $cosx + 2sinxcosx = 0$	$6) \cot^2 x \sin x = \cot^2 x$

Solutions for $[0, 2\pi)$:	Solutions for $[0, 2\pi)$:
All Solutions:	All Solutions:

TIP III: Use "U" Substitution for a trig function to make it easier to factor.

7) $2\cos^2 x - \cos x - 1 = 0$ 8) $\tan^2 x = \tan x$

Solutions for $[0, 2\pi)$:	Solutions for [0 , 2 <i>π</i>):
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All Solutions: _____

All Solutions: _____

c) $6sin^2x + sinx - 2 = 0$

9) $\cot(x)\tan(x) - \tan(x) = 0$

Solutions for $[0, 2\pi)$:

Solutions for $[0, 2\pi)$:

All Solutions: _____

Day 3 - Section 5.5B - Solving Trig Equations - Part III

Objectives: SWBAT Solve trig equations by using substitution of identities in order to get one trig function.

Review Questions of the Day:

1) Solve for all values of $x \sin(x) = 0$ 2) Solve for all values of $x \tan(x) = -1$

3) Simplify and write in terms of sin(x) only sin(2x)/cosx

4) Solve the following using the quadratic formula and round to the nearest thousand $x^2 + 4x = 2$

TIP IV: Use a Trig Identity, and substitute one trig function for another. Think Pythagorean Identities and Double Angle Identities.

Solve each for $0 < x < 2\pi$, i.e. $[0, 2\pi)$. Then write an expression for all solutions.

1) $2\cos^2(x) - \sin(x) - 1 = 0$ 2) $\cos(2x) + 4\cos(x) + 1 = 0$

Solutions for $[0, 2\pi)$: _____

Solutions for $[0, 2\pi)$:

All Solutions: _____

3)	$3sin^2(x) = \cos^2(x)$	a) $\sin(2x) = -\sin(x)$
- /		

Solutions for $[0, 2\pi)$: Solutions for $[0, 2\pi)$:

All Solutions: _____ All Solutions: _____

TIP V: Sometimes... you need to square both sides. But when you do, you need to check for extraneous solutions.

4) sin(x) + cos(x) = 1

 Solutions for [0, 2π):
 All Solutions:

TIP VI: Sometimes... you may need to factor then use a calculator to get your angles.

5) $4tan^{2}(x) + 8tan(x) + 3 = 0$

TIP VII: Sometimes... It doesn't factor at all and you must use the Quadratic Formula.

6) $3\cos^2 x + 2\cos(x) - 2 = 0$

Solutions for $[0, 2\pi)$:

All Solutions: _____

b) $7\sin^2 x + 4\sin x - 2 = 0$

Solutions for $[0, 2\pi)$:

Day 4 - Section 5.5C - Solving Trig Functions - Multi-Angle

Objectives: SWBAT Solve equations with multiple angles, like 2x, 3x, x/2 etc.

Review Questions of the Day:

- 1) What are the principal values for cos(x)?
- 2) What is the domain for the graph of y = -2cotx?
- 3) Find two radian measures for which tan x = 9.
- 4) Graph the following function $y = \cos(2x) + 1$



Take the graph $sin(2x) = \frac{1}{2}$ below. Compare the to a Double, Triple, and Half angles below.



As the "*Bx*" increases, the number of solutions _____

TIP VIII: Delta Substitution: Rewrite the equation with Δ as the variable, and solve like normal. Don't forget to Back-Substitute and Divide at the end.

Solve each on the interval [0, 2π). Then write an expression for all solutions using k = integer.

2) $sin(2x) = \frac{1}{2}$

Solutions for $[0, 2\pi)$: All Solutions: _____

3) $cos(2x) = \frac{1}{2}$

 Solutions for [0, 2π):
 All Solutions:

4) tan(3x) = -1

Solutions for $[0, 2\pi)$: _____ All Solutions: _____

a) $\sin 4x = \sin(4x) = \frac{\sqrt{2}}{2}$

 Solutions for [0, 2π):
 All Solutions:

5) $tan\left(\frac{x}{2}\right) = 1$

 Solutions for [0, 2π):
 All Solutions:

6) $sin\left(\frac{2x}{3}\right) = 1$

Solutions for $[0, 2\pi)$:

All Solutions: _____

b) $\cot(2x) = \sqrt{3}$

Solutions for [**0**, 2*π*): _____

<u>Day 5 – Section 5.5D – Solving Trig Functions – Putting it all</u> <u>Together</u>

Objectives: SWBAT Solve equations with trig functions.

Review Questions of the Day:

- 1) What is the **period** of $y = 2\sin(4t)$?
- 2) Find the value of $cos^{-1}(-0.5)$
- **3**) Find the value of $sin^{-1}(-0.5)$
- 4) Write all the Eight (8) Tips for solving Trig Functions

Solve each equation for $0 < x < 2\pi$, *ie* $[0, 2\pi)$. Then write an expression for all solutions using k = integer.

1) $(\csc x - 1)(\sin x + 1) = 0$ 2) $\cot^2 x = \cot x$

Solutions for $[0, 2\pi)$:

Solutions for $[0, 2\pi)$:

All Solutions: _____

3) $4\cos^2 x - 1 = 0$

Solutions for $[0, 2\pi)$:

Solutions for $[0, 2\pi)$:

All Solutions: _____

5) $tan^{2}(x)sinx = tan^{2}(x)$

All Solutions: _____

6) $2\sin^2(x) - \sin x = 1$

Solutions for $[0, 2\pi)$:	Solutions for $[0, 2\pi)$:
All Solutions:	All Solutions:
7) $2\sin(2x) - \sqrt{3} = 0$	8) $2\cos(3x) = -1$

Solutions for $[0, 2\pi)$:	Solutions for $[0, 2\pi)$:
All Solutions:	All Solutions:



Solutions for $[0, 2\pi)$: _____

All Solutions: _____

10) $4sin^2(x) + 4\cos(x) - 1 = 0$

 Solutions for [0, 2π):
 All Solutions: