Angles, UC, Trig Graphs/Equations – Solving Trigonometric Equations

Steps For Solving Trigonometric Equations

1.) Simplify the equation like any other equation such as…

- Get rid of parentheses by using the distributive property
- Collect like terms and isolate the trigonometric function (which contains x) on one side
- If the trigonometric function is already in factored form →
  SET EACH FACTOR = 0 and solve them! Do NOT divide out each side by a trig expression!
- Cross multiply if have (or get) the equation to have a ratio (fraction) on either side of equal sign.

Example: $\sin x (\cos x - 1) = 0$

Do NOT do → $\dfrac{\sin x (\cos x - 1)}{\sin x} = \dfrac{0}{\sin x}$

Do do → $\sin x = 0$ and $\cos x - 1 = 0$

2.) Many equations will have MULTIPLE SOLUTIONS (ANGLES) where some (or all) don't check →
so you can have… a.) 1 , 2 , 3 , or 4 solutions b.) some extraneous solution(s) c.) no solution

3.) Make sure you know what QUADRANTS sine, cosine, and tangent are POSITIVE and NEGATIVE.
Refer to your Trig Chart/Unit Circle Sheet and where to obtain some multiple answers (angles).

**Notes:
- Your solution(s) will need to be between 0° and 360° so some angles may not "fit", any angle that doesn't "fit" this rule is considered an extraneous solution (doesn't fit/work/check).
- You are ALLOWED to add 360° to make a negative angle become positive
  BUT you are NOT ALLOWED to subtract 360° to make positive angle "fit" the rule.
- You must put final solution(s) in ascending order, do not include any extraneous solutions, and do not rewrite solutions that are repeated.

Example 1: Solve each trigonometric equation. Keep your answer(s) in degrees where $0° \le x < 360°$.

a.) $\cos x + \cos x = \sqrt{2}$ Solution(s): _____	b.) $3\sin x - 2 = 5\sin x - 1$ Solution(s): _____	c.) $\tan x\left(2\sin x - \sqrt{3}\right) = 0$ Solution(s): _____	d.) $2\tan 2x - 8\tan 2x = 6\sqrt{3}$ Solution(s): _____
e.) $3\cos x = 6 - 2(1 - \cos x)$ Solution(s): _____	f.) $\dfrac{1}{\sin x} = \dfrac{2}{\sqrt{2}}$ Solution(s): _____	g.) $(2\cos x - 1)(\sin x + 1) = 0$ Solution(s): _____	h.) $8\cos\left(\dfrac{3}{7}x\right) + 4\sqrt{3} = 0$ Solution(s): _____

<u>Example 2</u>: Complete each application problem involving trigonometric equations.

a.) The tide cycle of a city on the Atlantic coast can be represented by the equation of $h = 9\sin(30^\circ t)$ where h = height of the tide in feet and t = number of hours since the last high tide. A tide is at equilibrium when it's at its normal level, halfway between its highest and lowest points. How many hours will it take for the first low tide to reach 3 feet?	b.) A buoy in the harbor of San Juan, Puerto Rico, bobs up and down. The distance between the highest and lowest point is 4 feet. It moves from its highest point down to its lowest point and back to its highest point every 10 seconds. What is the height of the buoy after 3 seconds?
c.) As you ride a Ferris wheel, the height that you are above the ground varies periodically as a function of time. Jason gets into a seat that is at the bottom of the Ferris wheel, he is 3 feet above the ground. The wheel has a diameter of 32 feet and it takes the wheel 18 seconds to complete one cycle. How high above the ground will Jason be after 8 seconds riding the wheel?	d.) In a certain wildlife refuge, the population of field mice can be modeled by the equation $h = 3000 - 1250\cos(120^\circ t + 4)$ where h = the number of mice and t = the number of months past March 1 of a given year. About what date will the number of mice reach its maximum amount?