CCSS Algebra 4   How do I solve Trigonometric Equations?
1.   **Using a graph**.
      Consider the function $f(x) = 3sin(x) - 1$.
      - Open desmos.com (or use the TI-84 Calculator) and graph $f(x)$.
        - What part(s) of the graph are you looking for if you are trying to solve the equation
          $$3sin(x) - 1 = 2 \quad ?$$

      - To help you visualize the solutions to this equation, graph the function $y = 2$ on a separate line in desmos (or on the calculator).
        - How does this help you see the solutions to
          $$3sin(x) - 1 = 2 \quad ?$$

        - How many solutions are there to the equation $3sin(x) - 1 = 2$? How can you tell?

        - What if the equation was written as
          $$3sin(x) - 1 = 2, \ -2\pi \le x \le 2\pi \quad ?$$
          What does the condition $-2\pi \le x \le 2\pi$ tell you about the solutions?

        - If using desmos, graph the inequality $-2\pi \le x \le 2\pi$ on a separate line. How does this help you recognize the solutions for the equation?

      - Use a similar strategy to solve each inequality below:
        - $-4cos(2x) - 3 = -7, \quad 0 \le x \le 4\pi$

        - $2 \ sin(3x) = \sqrt{2}, \quad -\pi \le x \le \pi$

        - $cos(4(x - \pi)) - 1 = 0, \quad 0 \le x \le 2\pi$

2.   **Using a Unit Circle**
      Again consider the equation
      $$3sin(x) - 1 = 2, \ -2\pi \le x \le 2\pi$$
      - Reverse operations to solve for x in the form $x = sin^{-1}(\#)$.

- Use the Unit Circle to find two solutions to this equation by locating appropriate coordinate points on the circle (recall that the x-coordinates correspond to cosine and y-coordinates to sine.
  - How could you find a 3rd and 4th solution to this equation?

  - How could you find negative solutions to this equation?

  - Explain the following statement,
  If $x = A$ is a solution to the equation $3sin(x) - 1 = 2$, then $A + 2\pi$ and $A - 2\pi$ are also solutions.

    - Would $A + 4\pi$ and $A - 4\pi$ also be solutions? Explain why or why not.

    - How could you find all of the solutions that fit the constraint $-2\pi \leq x \leq 2\pi$?

- What if the equation is more challenging? Consider
  $$4cos(2x - \pi) - 1 = 1$$
  - Reverse operations to solve the equation for x in the form $x = \frac{cos^{-1}(\#)+\#}{\#}$

  - Use the Unit Circle to find 2 solutions to $cos^{-1}(\#)$ from your equation. How could you use those solutions to find 2 solutions for x?

  - How could you find additional solutions for x?

  - Use a similar strategy to solve each of the following:
    - $2sin(3x) + 4 = 4, \quad 0 \leq x \leq 2\pi$
    - $-cos(x - \pi) = \frac{\sqrt{3}}{2}, \quad -4\pi \leq x \leq 0$

3. **Using the Calculator**
   Solve the equation $3sin(x) - 1 = 2$ using the inverse sine function on the calculator.
   - What mode should you be in?

   - What answer does the calculator give?

   - How can you find more answers?