Finding the Equation of a Trigonometric Function from its Graph

Steps for determining the equation of a sinusoidal function from its graph

1. Find the maximum and minimum values

2. Use the formula $a = \frac{max-min}{2}$ and $c = \frac{max+min}{2}$ to determine the amplitude and the vertical displacement (which is also the equation of the axis of the curve). On the graph, draw a **dashed line** to represent the equation of the axis.

3. Highlight one complete cycle that is closest to the y-axis.
   - To write your equation in terms of **cosine**: Use two consecutive maximum values of the function as the starting point and end point for your cycle
   - To write your equation in terms of **sine**: Use two values on the axis of the curve of the function as a starting point and end point for your cycle

4. Using your highlighted cycle, find the period of your function and use the period to find the k value
   - $New\ period = \frac{Original\ period}{|k|}$ so $|k| = \frac{2\pi}{p}$ for $sin(x)$ and $cos(x)$, and $|k| = \frac{\pi}{k}$ for tan(x)

5. Find the phase shift of your function by determining the horizontal distance of the beginning of your highlighted cycle from the y-axis.

6. Incorporate all of the transformations into the equation $y = a\mathbf{sin}[k(x-d)] + c$ or $y = a\mathbf{cos}[k(x-d)] + c$

7. To convert from sine to cosine: phase shift by $-\frac{\pi}{2k}$ in the (x-d) bracket (i.e. subtract a quarter of the period from x).

   To convert from cosine to sine phase shift by $+\frac{\pi}{2k}$ in the (x-d) bracket (i.e. add a quarter of the period to x).