Math Analysis CP- Unit 3 Review WS

1. Write an equation for the given function given the period, phase shift, and vertical shift.
   a. tangent function, period = 2π, phase shift = 0, vertical shift = -6
   b. cotangent function, period = $\frac{\pi}{2}$, phase shift = $\frac{\pi}{8}$, vertical shift = 7
   c. secant function, period = π, phase shift = $-\frac{\pi}{4}$, vertical shift = -10
   d. cosecant function, period 3π, phase shift = π, vertical shift = -1

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2. Write a sine equation that has the following information
   a. amplitude = 4, period = $\frac{\pi}{2}$, phase shift = -2π, and vertical shift = -1
   b. amplitude = 0.5, period = π, phase shift = $\frac{\pi}{3}$, and vertical shift = 3
   c. amplitude = 0.75, period = $\frac{\pi}{4}$, phase shift = 0, and vertical shift = 5

3. The average monthly temperatures for Seattle, WA, are given below.

Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
41°	44°	47°	50°	56°	61°	65°	66°	61°	54°	46°	42°

   a. Find the amplitude of a sinusoidal function that models the monthly temperatures.
   b. Find the vertical shift of a sinusoidal function that models the monthly temperatures.
   c. What is the period of a sinusoidal function that models the monthly temperatures?
   d. Write a sinusoidal function that models the monthly temperatures, using $t = 1$ to represent January.
   e. According to your model, what is the average monthly temperature in February? How does this compare to the actual average?
   f. According to your model, what is the average monthly temperature in October? How does this compare to the actual average?

4. In the wild, predators such as wolves need prey such as sheep to survive. The population of the wolves and the sheep are cyclic in nature. Suppose the population of the wolves W is modeled by $W = 1000\sin\left(\frac{\pi}{6}t\right) + 2000$ and population of the sheep S is modeled by $S = 5000\cos\left(\frac{\pi}{6}t\right) + 10000$ where t is the time in months.
   a. What are the maximum number and the minimum number of wolves?
   b. What are the maximum number and the minimum number of sheep?
   c. Use a graphing calculator to graph both equations for values of t from 0 to 24.
   d. During which months does the wolf population reach a maximum?
   e. During which months does the sheep population reach a maximum?
   f. What is the relationship of the maximum population of the wolves and the maximum population of the sheep? Explain.

5. As you ride a Ferris wheel, the height that you are above the ground varies periodically. Consider the height of the center of the wheel to be the equilibrium point. Suppose the diameter of a Ferris Wheel is 42 feet and travels at a rate of 3 revolutions per minute. At the highest point, a seat on the Ferris wheel is 46 feet above the ground.
   a. What is the lowest height of a seat?
   b. What is the equation of the midline?
   c. What is the period of the function?
   d. Write a sine equation to model the height of a seat that was at the equilibrium point heading upward when the ride began.
   e. According to the model, when will the seat reach the highest point for the first time?
   f. According to the model, what is the height of the seat after 10 seconds?