TEACHER NOTES ON EXTENSIONS

Here is the general activity with extensions. You can add or extend it as you see fit.

Materials List:

- Copy of **OBJECT LIST** to project on board (can be electronic)
- Copy of **DATA GATHERING SHEET** (can be electronic or printed, one per student)
- Copy of **ACTIVITY SHEET** (one per group, can re-use each hour)
- Copy of the **EXIT SLIP** problem to project on board. Paper for answers (one per student).
- Large graph paper (one page per group)
- Colored markers (one COLOR per group)

1. Toward the end of an hour/after a test, assign students an object or have them each draw a letter which will correspond to an object. Then, group the students into groups of 3-4. If you have multiple classes, you can always add more objects. Project the **OBJECT LIST** on the board and have students write in their object. No need to use all of the objects! (10 minutes)

2. Their overnight homework will be to research the object and gather data. You can make copies of the **DATA-GATHERING SHEET**, have them take a screen shot, post it on your website, or send it electronically for them to gather the data. Note: If the object is a clock, the students should write down data for the hour and minute hands and choose which one to graph. Students will need to print a full-size, front view of their object as they might have to use proportional relationships and reasoning to find the center of the clock. From some objects, measurements can be found.

3. The next day in class, students will divide into their groups and use the step-by-step **GROUP ACTIVITY SHEET** (located at the end of this document) to graph a height vs. time scatterplot of their data and write the sinusoidal function for their graph. Students will determine the best "start" point for their graphs. You can establish a start time for clocks or let students decide and justify. Start times of 12, 3, 6, and 9 will initially eliminate a phase shift and will make writing the equations easier. (20-30 minutes).

4. Do a **GALLERY WALK**. Set a timer (90 seconds), then have each group rotate around to each poster and look at its graph to determine if they feel the equation matches the graph. If it does, they will use **THEIR GROUP COLOR** and put a checkmark if they believe the equation is correct. If they believe the equation is wrong, have them write what they believe is the correct equation. At this point, the activity can also be extended to write an additional sine or cosine function which would match the graph (add another 90 seconds to the timer, in this case). Adjust times as necessary; as students see the patterns, they should get faster.

5. Once groups get back to their original poster, they should analyze all the additional equations and verify their accuracy.

6. Post the **EXIT TICKET** problem. Have students work individually on this problem and turn it in as they leave the classroom. You can use these problems the following day to discuss good things and misconceptions.

7. For homework, students can research an additional object or activity which would supply data creating a sinusoidal function.

8. Referring to the activity, teach a more traditional lesson over sinusoidal graphing, including phase shift. Use one or more of the extensions.
    a. Do another Gallery Walk and have each group write an additional equation for each function.
    b. Have the students change the start time and re-graph their equation on the same graph. Can they distinguish between the two graphs? Will the times 12, 3, 6, and 9 all create different graphs?
    c. Write an equation of your function with a different start time . . . like 2 o'clock.