**Subject area/course**: Mathematics/Pre-Calculus

**Grade level/band**: 10-12

**Task source**: Summit Public Schools

**Modeling Periodic Functions**

**STUDENT INSTRUCTIONS**

1. **Task context**:

What do Ferris Wheels, sound waves, hours of daylight, moon phases, and tides all have in common? All of these phenomena can be modeled with mathematics and represent natural periodic patterns.

As humans, we witness periodic phenomena in our everyday lives. We all notice that the sun rises and falls, the existence of seasons, and the cycles of weather and rush hour traffic. Periodic functions exist all around us and they can help us predict outcomes in the future. This project will require you to use your knowledge of graphing/interpreting trigonometric functions to identify and interpret a natural periodic phenomenon. Creating models of these phenomena help make sense of what we are seeing.

1. **Final product**:

You will explore how a Ferris Wheel fits into the periodic function realm through using multiple representations not limited to diagrams, tables, and graphs. In doing so you will begin to see the relationships among all the Ferris Wheel’s components. The knowledge gained from this introduction will be based on evidence that will help you anticipate and predict the potential opportunities and limitations of such a model. Then, you will propose a periodic phenomenon in our natural world to research and model.

Next, you will use your knowledge of trigonometric functions to graph your periodic phenomenon and explain its various parts. This phase of your performance task will demonstrate your ability to make sense of data, model in various ways, and make multiple connections based on evidence.

For the final submission you will make a multimedia presentation explaining your phenomenon and its model, including its significance and limitations.

See the *Modeling Periodic Functions Task Overview* document (Item A) for instructions.

**Additional Information**

1. **Knowledge and skills you will need to demonstrate on this task:**

* Ability to identify phenomena that have periodic behavior
* Ability to identify the components of a periodic function (e.g., period, amplitude, phase shift)
* Ability to model a periodic phenomenon with a trigonometric function and understand the limitations of such a model
* Ability to make a formal presentation of your findings

1. **Materials needed:**

Documents:

* Item A. Modeling Periodic Functions Task Overview
* Item B. Repeating Functions
* Item C. Phase 1

Resources for Phase 3 (optional):

* Business Cycles
  + <http://kalyan-city.blogspot.com/2011/06/4-phases-of-business-cycle-in-economics.html>
  + <http://www.frbatlanta.org/cqer/researchcq/chauvet_real_time_analysis.cfm>
* Days (sunrise to sundown)
  + <http://aa.usno.navy.mil/data/docs/Dur_OneYear.php>
* Orbits
  + <http://www.windows2universe.org/our_solar_system/planets_orbits_table.html>
* Phases of the Moon
  + <http://aa.usno.navy.mil/data/docs/MoonPhase.php>
* Weather Patterns (focus on one state or country)
  + <http://www.usclimatedata.com/>
  + <http://www.ncdc.noaa.gov/cdo-web/search?datasetid=ANNUAL>
* Solar Cycles
  + <http://solarscience.msfc.nasa.gov/SunspotCycle.shtml>
* Waves
  + <http://tidesandcurrents.noaa.gov/stations.html?type=Datums#California>
* Rush Hour
  + <http://traffic.findthebest.com/>

1. **Time requirements:**

This task will take approximately 2 weeks to complete. Your teacher will provide additional details regarding deadlines and due dates.

1. **Scoring:**

Your work will be scored using the Summit Public Schools Modeling Periodic Functions Rubric. You should make sure you are familiar with the language that describes the expectations for proficient performance.