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

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

**Task source**: Summit Public Schools

**Modeling Periodic Functions**

**TEACHER'S GUIDE**

1. **Task overview**:

Students will investigate a periodic phenomenon in the world and propose a mathematical model that demonstrates the phenomenon. Upon completion of the project, students will submit a poster or a written report demonstrating the periodic phenomenon investigated. A 5-6 minute presentation will also be required for all students to simulate their chosen periodic phenomenon.

1. **Aligned standards:**
2. **Primary Common Core State Standards**

#### [CCSS.MATH.PRACTICE.MP1](http://www.corestandards.org/Math/Practice/MP1/) Make sense of problems and persevere in solving them.

#### [CCSS.MATH.PRACTICE.MP2](http://www.corestandards.org/Math/Practice/MP2/) Reason abstractly and quantitatively.

#### CCSS.MATH.PRACTICE.MP3 Construct viable arguments and critique the reasoning of others.

#### [CCSS.MATH.PRACTICE.MP4](http://www.corestandards.org/Math/Practice/MP4/) Model with mathematics.

CCSS.MATH.PRACTICE.MP5Use appropriate tools strategically.

#### [CCSS.MATH.PRACTICE.MP6](http://www.corestandards.org/Math/Practice/MP6/)Attend to precision.

[CCSS.MATH.CONTENT.HSS.ID.B.6.A](http://www.corestandards.org/Math/Content/HSS/ID/B/6/a/) Fit a function to the data; use functions fitted to data to solve problems in the context of the data.

[CCSS.MATH.CONTENT.HSF.IF.B.4](http://www.corestandards.org/Math/Content/HSF/IF/B/4/) For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship.

[CCSS.MATH.CONTENT.HSF.IF.C.7](http://www.corestandards.org/Math/Content/HSF/IF/C/7/) Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.

[CCSS.MATH.CONTENT.HSF.BF.A.1](http://www.corestandards.org/Math/Content/HSF/BF/A/1/) Write a function that describes a relationship between two quantities.

[CCSS.MATH.CONTENT.HSF.TF.B.5](http://www.corestandards.org/Math/Content/HSF/TF/B/5/) Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline.

1. **Critical abilities**

Research: Conduct sustained research projects to answer a question (including a self-generated question) or solve a problem, narrow or broaden the inquiry when appropriate, and demonstrate understanding of the subject under investigation. Gather relevant information from multiple authoritative print and digital sources, use advanced searches effectively, and assess the strengths and limitations of each source in terms of the specific task, purpose, and audience.

Analysis of Information**:** Integrate and synthesize multiple sources of information (e.g., texts, experiments, simulations) presented in diverse formats and media (e.g., visually, quantitatively, orally) in order to address a question, make informed decisions, understand a process, phenomenon, or concept, and solve problems while evaluating the credibility and accuracy of each source and noting any discrepancies among the data.

Communication in Many Forms**:** Use oral and written communication skills to learn, evaluate, and express ideas for a range of tasks, purposes, and audiences. Develop and strengthen writing as needed by planning, revising, editing, and rewriting while considering the audience.

Modeling, Design, and Problem Solving:Use quantitative reasoning to solve problems arising in everyday life, society, and the workplace, e.g., to plan a school event or analyze a problem in the community, to solve a design problem or to examine relationships among quantities of interest. Plan solution pathways, monitoring and evaluating progress and changing course if necessary, and find relevant external resources, such as experimental and modeling tools, to solve problems. Interpret and evaluate results in the context of the situation and improve the model or design as needed.

Use of Technology:Present information, findings, and supporting evidence, making strategic use of digital media and visual displays to enhance understanding. Use technology, including the Internet, to research, produce, publish, and update individual or shared products in response to ongoing feedback, including new arguments or information.

1. **Time/schedule requirements:**

This task will take approximately 2 weeks to complete. See below for a suggested schedule accompanying the steps of the task.

1. **Materials/resources:**
* YouTube Video on moon phases (<https://www.youtube.com/watch?v=nXseTWTZlks>)
* Item A. Modeling Periodic Functions Task Overview
* Item B. Repeating Functions
* Item C. Phase 1
1. **Prior knowledge:**

None listed.

1. **Connection to curriculum:**

None listed.

1. **Teacher instructions:**

Day 1:

* Introduce periodic phenomena to class, guiding students through what is and what is not a periodic function. Teacher will provide feedback on part 1 of this document to whole class.
* Show YouTube Video on moon phases (<https://www.youtube.com/watch?v=nXseTWTZlks>).
* Have students Think-Ink and Pair Share Reflection questions:
* Do moon phases repeat?
* Do you think moon phases are predictable far into the future?
* Would the moon be considered a periodic function? Why or Why not?

Day 2:

* As a whole class, complete the Repeating Functions activity (Item B). Here students will gain a better understanding of repeating functions.

Day 3:

* Students get in groups (teacher-assigned) of 3-4 and complete Phase 1 Parts A-C (Item C). Teacher will provide feedback at the conclusion of the class to ensure students are on track.

Day 4:

* Students complete Parts D-E of Phase 1 activity in groups.
* Students will have the opportunity to self-assess and receive feedback from the teacher on Parts D-E.
* Students will peer-assess by comparing and contrasting their answers with other groups and determine the differences and/or similarities in their mathematical models.

Day 5:

* Students complete Parts D-E of Phase 1 activity in groups.
* Students begin Phase 2 (see Item A).
* Students will have the opportunity to self-assess and receive feedback from the teacher on beginning proposals.

Day 6:

* Students continue research for Phase 2 of project and draft proposal for teacher approval.
* Students will have the opportunity to self-assess and receive feedback from the teacher on proposals and progress.

Day 7:

* Teacher approves proposal and students begin Phase 3 of project (see Item A for requirements).

Day 8:

* Students continue to work through final project.

Days 9-10:

* Students continue research for Phase 3 of project and prepare presentation for whole class.
* Teacher will provide individualized feedback to students on an as-needed basis.

Day 11:

* Students will reflect upon their final product and have the ability to self-assess, assess their peers, as well as reflect on their process.
* Students finish Phase 3 of project.

Days 12-14:

* Presentations on periodic phenomenon.

Day 15:

* Students will reflect upon their final product and have the ability to self-assess, assess their peers, as well as reflect on their process after all classmate presentations are presented to whole class.
1. **Student support:**

None listed.

1. **Extensions or variations:**

None listed.

1. **Scoring:**

Student work can be scored using the Summit Public Schools Modeling Periodic Functions Rubric.