Unit 4: Day 12: You are so predictable!

MCT 4C

Minds On: 15 Action: 40 Consolidate:20 Total=75 min	**Math Learning Goals:** • Model periodic motion using a variety of materials. • Develop a sinusoidal function that models the data from the investigation developed by the group. • Interpret the sinusoidal function in terms of the context. • Solve problems involving sinusoidal functions using graphs and/or graphing technology. • Make connections between phenomena drawn from daily life to mathematical concepts.	**Materials** • BLM 4.12.1-4.12.5 • Graphing calculators • Graph paper • BLM 4.12.3 provides a detailed list of the equipment needed for this lesson.

				Assessment Opportunities
	Minds On…	**Groups of 4 → Brainstorm** Each group will get a bag with supplies to complete an investigation. Group members will brainstorm a plan on how to create periodic motion given the equipment in the brown paper bag. Distribute one copy of BLM 4.12.1 to each group. **Whole Class → Discussion** Ask each group to briefly share their plan for their investigation. Groups should include where the motion sensor will be placed in relation to their investigation. As groups present, if a student has feedback for a group regarding how to improve their investigation, ask them to note it on a piece of paper and pass it to the group once all groups have presented.		BLM 4.12.3 provides an overview of what should be included in each bag. Duplicates of bags may be needed for larger classes. Check that the CBL/CBR application is on the calculators to be used for the investigation. BLM 4.12.5 outlines how to transfer it from one calculator to another. Heterogeneous groupings should be used for the activity. A teacher led demonstration of how to use the motion sensor to collect data can be given.
	Action!	**Groups of 4 → Investigation** Groups will record answers to questions on BLM 4.12.1 on chart paper. Distribute a copy of BLM 4.12.4 to each group to assist them in using the motion sensor. **Learning Skills/Teamwork/Checkbric:** Observe teamwork skills of group members as students work through the investigation. **Mathematical Process Focus: Reasoning and Proving** – Students apply reasoning skills as they justify their investigation plan for creating periodic motion.		
	Consolidate Debrief	**Groups of 4 → Presentation** Each group should present their work. Chart paper copies of group work should be posted for reference. Students should be encouraged to ask questions of groups to probe understanding. Possible experiments: Bag #1 (…..), Bag #2 ( ), Bag #3 ( ), Bag #4 ( ) **Curriculum Expectations and Communication/Observation/Checkbric:** Students peer assess presentations for thoroughness and clarity using student generated checkbrics.		
	Reflection	**Home Activity or Further Classroom Consolidation** Students complete BLM 4.12.2 about their role in the investigation and the work of the group. Reflection/BLM 4.12.2/Rubric: Collect responses from BLM 4.12.2 to provide feedback to students which can be included in student portfolios.		

4.12.1: Mission Possible

Group Member Names: _____ _____ _____ _____

Instructions:
Your group has been given a bag of supplies, graphing calculator and motion sensor.
As a group you must:
- Develop an experiment that will create periodic data using the material found in the bag.
- Test the experiment by using the graphing calculator and motion sensor.
- Use the graphing calculator to find the best representative equation for the data.
- Record your answers to the questions below on the chart paper provided.
- Prepare to share your work with the class.

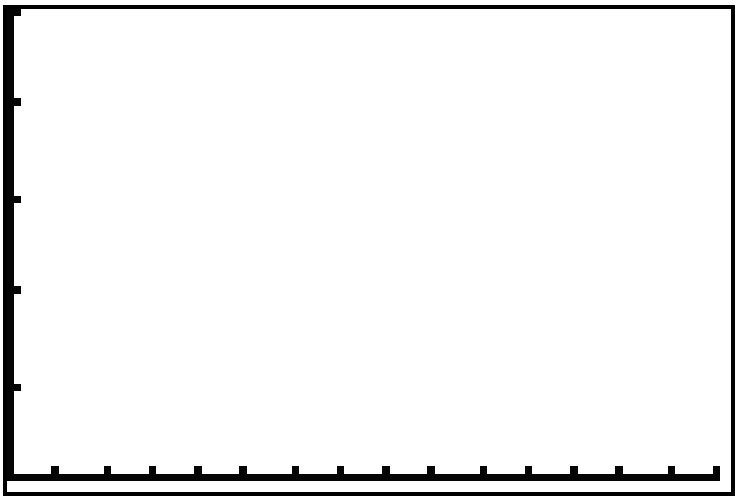
Remember, that this is real data and it will sometimes be impossible to get a model that will match all points.

Record the following on your chart paper.

1. Materials:

2. Process for the experiment: (List steps that were followed. Provide as much detail as possible.)

3. Graph of data. (Label your axes and provide a scale.)



4. Determine the sinusoidal function that will model the data your group collected.

5. Explain the significance of all numbers and variables in the model with respect to the experiment.

6. Based on the general equation $y = a \sin k(x + h) + k$, what would you have to do in your experiment to change the values of a, k, h and k.

4.12.2: Reflection

Today in math our investigation was about….

What did you enjoy about today's activity?

Was there anything during today's activity you did not enjoy?

Did everyone in your group participate? Explain how you made sure of this.

Create **two** questions that can be answered using the sinusoidal model your group created for your data.

Explain how you would solve the two questions you created.

4.12.3: It's in the bag! – Teacher Instrutions

You will need to make up enough bags so that each group of four will have the materials necessary to perform their experiment. Duplicates of some bags may be needed to accommodate larger classes.

Materials for each of the bags:

Bag #1:

- □ Retort stand
- □ Clamp for retort stand
- □ Spring
- □ Weight with a hook

Bag #2:

- □ Oven mitt or table tennis paddle

Bag #3:

- □ Elastics (about 15)
- □ Barbie® doll

Bag #4:

- □ String
- □ Large, heavy steel washer

Each group gets:

- □ a graphing calculator
- □ motion sensor
- □ measuring tape
- □ markers
- □ chart paper
- □ graph chart paper

4.12.4: Using a Motion Sensor

Follow these directions to connect and operate your motion sensor with the calculator.

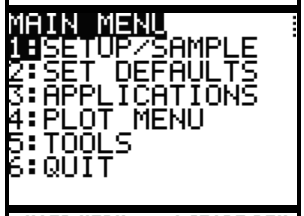
1. Connection the motion sensor to the graphing calculator.
2. Press the A button. Select the CBL/CBR application by moving down to it and pressing e or by select the number next to the application.

*If the CBL/CBR application is missing, you can transfer it from another calculator. If you're not sure how to, ask your teacher.

3. Once you have passed the introductory screen, select 3: RANGER from the first menu.

4. You will need to press e once the Ranger program is started.

5. Select 2: SET DEFAULTS. The default screen should look like the one at right.

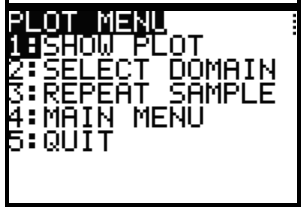


* If you would like to change the amount of time you are collecting data, you can return to this screen after you have tried collecting data.

6. Make sure the > symbol is next to START NOW and press e.

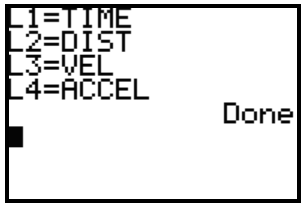
7. Get your equipment ready to collect data. Once you are ready, press e to collect data.

8. Once you have finished collecting your data, press e.



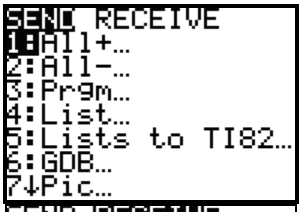
- If you want to view the plot in a "nicer" window, select 1: SHOW PLOT.
- If just part of your data is needed, you can select 2: SELECT DOMAIN.
- If you are unhappy with the data, select 3: REPEAT SAMPLE.
- If you would like to change some of the defaults, select 4: MAIN MENU.

9. Once you are satisfied with your data collection, select 5: QUIT from the PLOT MENU. The data will be stored in lists for further work if needed.

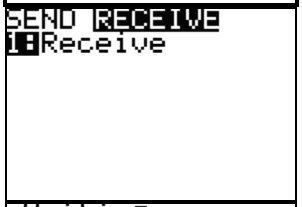


4.12.5: Transferring the CBL/CBR Application – Teacher Instructions

1. Connect the receiving and sending calculators using a link cable.
2. Press ` > x to access the link operation on each calculator.



3. On the **receiving calculator**, press > to move to the RECEIVE menu and select 1: Receive. You will see the message that the calculator is waiting to receive whatever is sent. If the message does not appear, check the cable connections.



4. On the **sending calculator**, from the SEND menu select C: Apps… by scrolling down the list. From the list of applications, move the cursor next to the CBL/CBR application and press e. A small square marks the program as ready to transmit.

5. Press > to move to the TRANSMIT menu and select 1: Transmit.

Sending Unit

6. The following messages will be displayed on each calculator. If a transmission is received, check the cables and repeat the process.

Receiving Unit