Introduction to Sinusoidal Functions

General Outcome: Develop algebraic and graphical reasoning through the study of relations.

SO8: Represent data, using sinusoidal functions, to solve problems. [C, CN, PS, T, V]

8.1. Describe, orally and in written form, the characteristics of a sinusoidal function by analyzing its graph.
8.2. Describe, orally and in written form, the characteristics of a sinusoidal function by analyzing its equation.
8.3. Match equations in a given set to their corresponding graphs.
8.4. Graph data, and determine the sinusoidal function that best approximates the data.
8.5. Interpret the graph of a sinusoidal function that models a situation, and explain the reasoning.
8.6. Solve, using technology, a contextual problem that involves data that is best represented by graphs of sinusoidal functions, and explain the reasoning

Mathematical Processes

- **Connections [CN]** Students are expected to make *connections* among mathematical ideas, other concepts in mathematics, everyday experiences and other disciplines
- **Problem Solving [PS]** Students are expected to develop and apply new mathematical knowledge through *problem solving*
- **Visualization [V]** Students are expected to develop *visualization* skills to assist in processing information, making connections and solving problems.
- **Communications [C]**
- **Technology [T]** Students are expected to select and use technology as a tool for learning and for solving problems

Real Life Applications

Connection

1. At the beginning of the unit ask the student to find a photograph or a computer image of a sinusoidal curve. Encourage students to find out what be reasonable units for their photo or image. Placing a grid over top of the picture and using these units to have the students scale the axis properly, the students can find 5 good points on the curve. By the end of 6.5 the students can then use sinusoidal regression to determine the equation that best fits the data.

   If you show a few examples in class, students will see that such curves are common and will be able to find examples on their own. Create a bulletin board of the photos and equations students find.

Understanding Angles Notes

Goal:

- Understand that angles can be measured in both radian and degrees and that you can convert between the two measures .

Lesson Links:

- Click here for a Notebook version of ERLC Lesson Link. Please use this lesson as a framework for your own teaching environment.
- Click here for a pdf version of the same ERLC Lesson Link.

Video:

- Understanding Angles -- (Youtube Link)

Discovery Based Learning

1. **Visualizing Radian Measure** -- Click here to link to Ted Coe's Unwrapping A Circle Applet [T], [V]
   This is a tool to help students envision the meaning of "radian" by thinking in terms of radius-lengths.

2. **Radians and Degrees [V], [C]**
   The purpose of this activity is to help students visualize the meaning of a radian.
   Materials:
   - Copy of the worksheet: Click here to download
   - Pipecleaner or a string
   - Scissors

   Alternative: You can have students check their answers to Part (b) by cutting a string or pipe cleaner rod to the length of the number of radii they determine and wrapping it around the circle to see if the length is correct.
   Students should come to realize that no matter the length of the radius of a circle, there are exactly 2π radii around the circumference of any circle. Thus an angle that cuts off an arc equal in length to the radius of a circle will have the same measure no matter the length of the radius of the circle. The measure of such an angle is one radian.

3. **Radian Explorer** -- Tools For Teachers (you will need a user name and password) [T], [V]
   Click here to follow along in a Discovery Based Learning Activity

Assessment For Learning

Journal Prompts [C]

- Is a radian large or small compared to a degree?
- How do you find the radian measure of an angle if you know its degree measure?
- How can you remember that there are 2pi radians in a full revolution?

Exploring Graphs of Periodic Functions Notes

Achievement Indicators:

8.1. Describe, orally and in written form, the characteristics of a sinusoidal function by analyzing its graph.

Lesson Links:

- Click here for a Notebook version of ERLC Lesson Link. Please use this lesson as a framework for your own teaching environment.

Videos:

- Exploring Graphs of Periodic Functions -- (Youtube Link)
- Radians and degrees – Khan Academy

Discovery Based Learning

1. **Sine and Cosine Graphs and Law of Sines using Spaghetti [V]** -- Lesson Plans by Michael D. Sturdivant
   Click here to download a worksheet to support the Lesson.

2. **Ferris Wheel Investigation [CN], [PS], [V]**
   Click here to download Investigation
   Click here to download the Scaffolding Questions to the Investigation

Assessment For Learning

Journal Prompts [C]

- In your own words, explain what it means for a function to be "periodic".
- What is the relationship between the amplitude, midline, maximum value and minimum value of a periodic function?
- In this lesson, we have been introduced to some real life examples that model periodic behavior, including the number of daylight hours during a year. Describe a real world situation that you can think of that can be represented by a periodic function and explain why this situation is periodic.

Learning from Mistakes

Show students graphs created by other students or graphs you've created with mistakes and ask them to correct them. For example, flip the sine graph vertically across the x-axis and ask students how they know it is wrong.
Extension: Similar activities can be done for tangent.

The Graphs of Sinusoidal Functions Notes

Achievement Indicators:

8.3 Match equations in a given set to their corresponding graphs.
8.5 Interpret the graph of a sinusoidal function that models a situation, and explain the reasoning.

Lesson Links:

- Click here for a Notebook version of ERLC Lesson Link. Please use this lesson as a framework for your own teaching environment.
- Click here for a pdf version of the same ERLC Lesson Link.

Videos:

- The Graphs of Sinusoidal Functions (Youtube Link)

Assessment For Learning

Exit Entrance Slips – Click here to download

Student Created Assessment
Have students create a sinusoidal graph and then give it to a friend to describe the characteristics.

The Equations of Sinusoidal Functions

Achievement Indicators

8.1. Describe, orally and in written form, the characteristics of a sinusoidal function by analyzing its graph.
8.2. Describe, orally and in written form, the characteristics of a sinusoidal function by analyzing its equation.
8.3. Match equations in a given set to their corresponding graphs.

Lesson Links:

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- Click here for a pdf version of the same ERLC Lesson Link.

Videos

- The Equations of Sinusoidal Functions (Youtube Link)

Assessment For Learning

Exit/Entrance Slips

- 8.2 Exit/Entrance Slip
- 8.3 Exit/Entrance Slip

Modelling Data with Sinusoidal Functions

Achievement Indicators:

8.4 Graph data, and determine the sinusoidal function that best approximates the data.
8.5 Interpret the graph of a sinusoidal function that models a situation, and explain the reasoning.
8.6 Solve, using technology, a contextual problem that involves data that is best represented by graphs of sinusoidal functions, and explain the reasoning

Lesson Links:

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- Click here for a pdf version of the same ERLC Lesson Link.

Videos

- Modelling Data with Sinusoidal Functions (Youtube Link)

Discovery Based Learning

Connections

1. At the beginning of the unit ask the student to find a photograph or a computer image of a sinusoidal curve. Encourage students to find out what be reaonsble units for their photo or image. Placing a grid over top of the picture and using these units to have the students scale the axis properly, the students can find 5 good points on the curve. By the end of 6.5 the students can then use sinusoidal regression to determine the equation that best fits the data.

Assessment For Learning

Exit/Entrance Slips

- 8.4 - 8.6 Exit/Entrance Slip