Lesson 2: Situation Graphs

Selected Content Standards

Benchmarks Addressed:
P-1-H Modeling the concepts of variables, functions, and relations as they occur in the real world, and using the appropriate notation and terminology.
P-5-H Analyzing real-world relationships that can be modeled by elementary functions
P-2-H Translating between tabular, symbolic, or graphic representations of functions.

GLEs Addressed:
Grade 9
37. Analyze real-life relationships that can be modeled by linear functions (P-1-H) (P-5-H)
Grade 10
27. Translate among tabular, graphical, and symbolic representations of patterns in real-life situations, with and without technology (P-2-H) (P-3-H) (A-3-H)

Lesson Focus
The goal of this lesson is to introduce function graphs for real life phenomenon. By the end of the lesson students should be able to:
• Identify the correct function graph for a given situation
• Sketch and label simple function graphs to match given situations
• Answer questions about a situation by interpreting a function graph

GEE 21 Connection
In this lesson, students will develop skills in:
• Matching a situation to a function graph.
• Graphing a function model to fit a situation.
• Interpreting graphs of functions in the context of a situation.

Translating Content Standards into Instruction

A. To begin the lesson, we want the students to understand that a function graph is a model of behavior of two phenomena as they are related to one another. An excellent method of demonstrating this is to use a motion detector with your overhead graphing calculator. Have the students walk particular graphs to demonstrate distance time graphs. Discuss the fact that time goes on the positive horizontal axis and that it never goes backwards. Distance is measured in relation to a fixed point on the vertical axis.
1. **Teacher Blackline #1** has some graphs of functions for the students to walk. If a motion detector is not available, have the students describe or physically model the function.

   a. Model #1 would depict the student walking at a steady pace away from the motion detector.
   b. Model #2 would depict the student walking at a steady pace toward the motion detector.
   c. In model #3, the student would walk at a steady pace away from the motion detector, stop for a bit, then continue walking away at a steady pace.
   d. Model #4 would depict walking away from the motion detector slowly and then speeding up.
   e. Model #5 would depict walking slowly toward the motion detector and then speeding up.
   f. To Model #6, have the students stand in line in the path of the motion detector and then they jump out of the way in sequence.

2. In **Teacher Blackline #2** students will practice matching a story to a graph and drawing a graph to a story. Discuss with students that distance/time graphs are not the only relationship that is modeled with this type of graph.

   B. Students must be able to draw accurate graphs and interpret those graphs that depict real life situations. They must be able to find the value of a particular quantity and make comparisons. The students must also be able to determine changes in the graph, whether they are rapid, slow, or constant.

   1. In **Teacher Blackline #3** students will practice making a graph from data and draw conclusions from reading a graph. Discuss scale with students and using appropriate labels. Give students ample time to draw conclusions before discussing appropriate answers to the questions.
   2. Allow students to do the **Student Worksheet** individually. As they complete the worksheet, allow them to discuss their conclusions with partners.

**GEE 21 Connection**
On the GEE 21 test, students will be asked to interpret graphs for given values, and make conclusions based on the shape of the graph. They may also be expected to make comparisons between quantities of two graphs.
Sources of Evidence of Student Learning

A. Have students do student worksheets provided with the lessons. Verify that the students are proficient in understanding the graphs by monitoring the progress at all times throughout the lesson. Additional problems should be assigned if students are not achieving at an acceptable level.

B. Supplement with problems at the end of the PATTERNS unit from outside resources.

GEE 21 Connection

Sample items similar to what students might see on the GEE 21 test are shown below.

1) A parking garage charges $1.50 for the first hour and $0.75 for each additional hour or part of an hour. How much will it cost to park in the garage for 6 ½ hours?
   a. $5.63  *b. $6.00  c. $6.38  d. $14.63  e. $15.75

(2) Which path would describe Celia’s bike trip, if Celia rode slowly at first and gradually increased her speed?

a. Time
   * b. Time
   c. Time
   d. Time

Illinois Department of Education
(3) The graph below shows the miles per gallon for a van driven at various speeds.

![Graph showing miles per gallon vs speed]

Which statement describes the relationship between the van’s mileage per gallon and rate of speed?

a. As speed increases past 50 mph, gas efficiency increases.
b. Speed is proportional to gas efficiency.
c. As speed increases, gas efficiency decreases.
d. Gas efficiency increases as speed increases up to 50 mph

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**Attributes of Student Work at the “Got-It” level**

A. Students should be able to grasp the relationships between time as the horizontal axis and distance as the vertical axis. It is important that they are able to recognize coming toward the x-axis as getting closer to an object and moving away from the x-axis as moving away from a defined object.

B. Students should be able to recognize the difference between when a graph is increasing, decreasing, or constant. They should recognize the steeper the graph, the more rapid the rate of change from one quantity to the next. They should be able to distinguish a curved graph as a change that is not constant.

C. Students should be able to make comparisons in two graphs and draw conclusions about a situation by reading a line graph.

D. Students should be able to create and read a scale on the axes of line graphs.
Try to walk, jump, run, or otherwise model the following graphs with the motion detector. If a motion detector is not available, try to write an explanation of the motion behind each graph.

1. Distance

![Graph 1]

2. Distance

![Graph 2]

3. Distance

![Graph 3]
4. Distance

5. Distance

6. Distance
Lesson 2: Situation Graphs

Below, you will see a short story about the relationship between two quantities. Choose the correct graph model for each story.

1. Jeffery left his home headed toward the school. He started out at a steady moderate pace until he got to a red light. While stopped at the light, he realized that he had forgotten his math homework. He turned around and headed back home at a faster pace. Then he drove to school at a fast pace without stopping on the way.

Discuss the flaws in the incorrect graphs.

2. The post office charges $.37 for any mail up to an ounce in weight. After that the charge is $.23 for each additional ounce or part of an ounce. For instance, if it weights 1.1 ounces or 1.9 ounces, it will cost the same, $.60.

What are the flaws in the incorrect graph?
3. The price of a certain CD varied over a period of time. It started high and remained the same for a period of time. Then it had a steady decrease until it reached an all time low, where it stayed the same for a period of time. In the end, the stock rose fast to a moderate price, where it remained for the remaining time.

What are the flaws in the incorrect graph?
1. Draw a line graph that would represent the following situation: (Use appropriate scale and titles for each axis.)

*Mama Mia’s Pizza shop recorded the following pizza sales for the year.*

```
Mama Mia’s Pizza Shop recorded the following pizza sales for the year.

<table>
<thead>
<tr>
<th>Month</th>
<th>Sales</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan</td>
<td>1200</td>
</tr>
<tr>
<td>Feb</td>
<td>1155</td>
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<tr>
<td>Mar</td>
<td>1300</td>
</tr>
<tr>
<td>Apr</td>
<td>1350</td>
</tr>
<tr>
<td>May</td>
<td>1435</td>
</tr>
<tr>
<td>Jun</td>
<td>1750</td>
</tr>
<tr>
<td>Jul</td>
<td>1600</td>
</tr>
<tr>
<td>Aug</td>
<td>1750</td>
</tr>
<tr>
<td>Sept</td>
<td>1450</td>
</tr>
<tr>
<td>Oct</td>
<td>1325</td>
</tr>
<tr>
<td>Nov</td>
<td>1290</td>
</tr>
<tr>
<td>Dec</td>
<td>1775</td>
</tr>
</tbody>
</table>
```

Answer the following questions.

a. Which month was best for pizza sales?

b. Between which two months was the greatest increase in sales?

c. Between which two months was the least amount of decrease in sales?

d. Which months had about the same amount of pizza sales?

2. The following graph shows the record low monthly temperatures for Baton Rouge, Louisiana. This data is courtesy of The Weather Channel's weather.com.

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Record Lows for Louisiana (F)

<table>
<thead>
<tr>
<th>Month</th>
<th>Temperature</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan</td>
<td>0</td>
</tr>
<tr>
<td>Feb</td>
<td>20</td>
</tr>
<tr>
<td>Mar</td>
<td>60</td>
</tr>
<tr>
<td>Apr</td>
<td>80</td>
</tr>
<tr>
<td>May</td>
<td>80</td>
</tr>
<tr>
<td>Jun</td>
<td>60</td>
</tr>
<tr>
<td>Jul</td>
<td>40</td>
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<td>Aug</td>
<td>20</td>
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<td>Oct</td>
<td>-20</td>
</tr>
<tr>
<td>Nov</td>
<td>-40</td>
</tr>
<tr>
<td>Dec</td>
<td>-60</td>
</tr>
</tbody>
</table>
```

a. Approximately what is the record low temperature for Louisiana? In which month(s)?

b. Which month has the highest record low for Louisiana?

c. Which month’s record low was about 40 degrees?

d. What is the approximate difference between the low for March and the low for July?

e. Between which two successive months is there the greatest drop in record lows?
3. The following graph shows the comparison of the average low temperatures in Baton Rouge and Mexico City.

![Graph showing average low temperatures for Baton Rouge and Mexico City]

a. During which month(s) are the average low temperatures of the two cities about the same?
b. During which months is the average low temperature of Mexico City higher than the average low temperature of Baton Rouge?
c. During which months do the temperatures remain fairly constant in Mexico City?
d. During which month is the difference in temperature between the two cities the greatest?
Complete the following work by yourself. You may compare your work with a partner after all have finished.

1. Draw a distance-time graph that represents the following story.

A golden retriever puppy was chasing a ball and bringing it back to its owner. On one particular throw, the puppy chased the ball, brought it half way back, and then sat down and stared at a frog before finally picking up the ball and bringing it slowly back to the master. The puppy always sits by the owner until the ball is thrown.

2. A car repairman charges a $25 service fee to look at an automobile. He charges an additional $20 for each hour (or fraction thereof) while he is working on the car. Draw a cost-time graph for three hours of work on a particular automobile.
3. Write a story about the following graph. It can be about distance-time, money, or anything else that you might think the graph may describe.

The following graph shows the average precipitation for Oklahoma City and Baton Rouge over a twelve month period.

a. What is Baton Rouge’s heaviest rainfall month? Oklahoma City’s?

b. Between which two successive months is the highest increase in rainfall in Baton Rouge? Oklahoma City?

c. When is the rainfall in Baton Rouge between 5 and 6 inches?
d. During which months of the year is the rainfall in Oklahoma City likely to be more than Baton Rouge?

e. Which month is likely to have the least amount of rain recorded in Baton Rouge?

f. During which two successive months does the amount of rainfall remain unchanged in Oklahoma City?

g. For which months is the rainfall in the two cities about the same?

h. What is the expected average rainfall in Baton Rouge for September?
Teacher Blackline #1

1. The person would be walking at a steady pace away from the motion detector.
2. The person would be walking a steady pace toward the motion detector.
3. The person would walk away from the motion detector at a steady pace, stop, then walk away some more at the same pace.
4. The person would start walking slowly at first away from the motion detector and speed up.
5. The person would start walking slowly toward the motion detector and gradually speed up.
6. This one will take several students standing in a row in front of the motion detector and they will then jump out of its path in sequential order.

Teacher Blackline #2

1. The second graph models the description. The first graph does not show a steady pace or returning home. The third graph does not show a stop and it looks as if time went backwards.
2. The second graph is correct. The first graph looks as if the post office has all denominations of money for postage. It does not take into account the rounding. You could pay $.40 or $.56 instead of the $.57 in the problem.
3. The first graph is correct. The second graph does not show the price decreasing steadily, it does not show it remaining low for a period, and it does not show the fast rise.

Teacher Blackline #3

Sales in Hundreds

<table>
<thead>
<tr>
<th>Months (1-12)</th>
<th>Sales in Hundreds</th>
</tr>
</thead>
<tbody>
<tr>
<td>X=1</td>
<td>Y=1200</td>
</tr>
</tbody>
</table>

a. December
b. May to June
c. January to February
d. June and August
2.  
   a. The lowest temperatures are around 10 degrees in January and December)
   b. August
   c. May
   d. 38 degrees
   e. August to September
3.  
   a. March and November
   b. January to March and November to December
   c. May to September
   d. July

Student Worksheet

1. Ball

   Owner

   Time

2. Cost

   85
   65
   45

   Time (hrs)

3. See student story; you might ask them to give the story to another student and have that person draw the graph from the story.
4.
   a. Baton Rouge, July; Oklahoma City, May
   b. Baton Rouge, Mar to Apr; Oklahoma City, Apr to May
   c. February, April, and December
   d. May
   e. March
   f. July and August
   g. May, June, and October
   h. About 5 inches

**GEE 21 Connection**

   a. b
   b. a
   c. d