Reading Different Text Forms: Reading Graphical Texts (Reading Graphs)

MATHEMATICS

Graphical text forms (such as diagrams, photographs, drawings, sketches, graphs, schedules, maps, charts, timelines, and tables) are intended to communicate information in a concise format and illustrate how one piece of information is related to another. Providing students with an approach to reading graphical text also helps them to become effective readers.

Purpose

- Become familiar with the elements and features of graphical texts used in any course.
- Explore a process for reading graphical texts, using a range of strategies for before, during, and after reading.

Payoff

Students will:

- become more efficient at “mining” graphical texts for information and meaning.
- practise essential reading strategies and apply them to different course-related materials.

Tips and Resources

- Friel, Curcio, and Bright (2001) define students’ graph comprehension as being able to read and make sense of graphs created by others or by themselves. There are three levels of graph comprehension:
  - reading the data (literal);
  - reading between the data (making comparisons, observing relationships);
  - reading beyond the data (making inferences, predictions).
- “Students develop graph sense gradually as a result of creating graphs and using already designed graphs in a variety of problem contexts that require making sense of data.” (Friel, Curcio, and Bright, 2001)
- When interpreting graphs, it is important that students have ample opportunity to explain and justify their reasoning and receive feedback from others. Paired or small group activities are recommended.
- Making students aware of the similar structural components and conventions that graphs share will help them to read new graphs that they encounter. (See Student/Teacher Resource, *Reading Graphs – Features of Two Variable Graphs.)*
- Current magazines and newspapers can be great resources for graphs, especially when focusing on biased and misleading graphs.
- Technology-rich environments, in which students can explore and experiment with graphs, may be helpful in developing the kind of flexible thinking that supports the understanding of graphs.
- Providing graphs with no scale or units on the axes helps students to focus on the qualitative meaning of the graph, developing their ability to read between and beyond the data. (See Student Resource, *Reading Graphs – Reading Between the Data.)*
- Help students to make connections between reading graphs and activities requiring similar skills in which they have experience e.g., playing grid-based board games (e.g., Chess, Sink the Ship), using spreadsheets, and reading maps.
- The supporting resources for this strategy include the Student/Teacher Resource, *Reading Graphs – A Four Step Process*, and examples for three of the steps.
- See Student Resource, *Reading Beyond the Data.*
- See Teacher Resource, *Reading Graphs – Answers to Student Resources.*

Further Support

- Provide students with an advance organizer to guide them as they read a particular graphical text. This might be a series of prompts to guide them through the reading task.

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What teachers do	What students do
Before • Ask students to brainstorm the purposes and features of the type of graph in question. • Read the title and ask students to recall what they already know about the topic. • Model (using "think aloud") how to predict the content of the graph based on the title, labels, and type of graph. Invite students to predict what the graph might show.	• Individually brainstorm purposes and features of the type of graph in question. • Recall prior knowledge related to the title of the graph. • Predict what the graph might show.
During • Discuss the four levels of reading graphs. (See Student/Teacher Resource, *The Four Levels of Reading Graphs: A Four Step Process*). Previewing the Graph: - Provide students with questions that focus on the basic elements of the graph. For example: - What does the title tell us about the information in the graph? - What information is provided in the label on the horizontal axis? vertical axis? - What are the units in the scale? What is the range of values? By what increment does the scale increase? Reading the Data (literal): - Use the labels and scales on the axes to read or locate specific information on the graph. Reading Between the Data (making comparisons): - Encourage students to make comparisons and look for relationships in the data. - Pose comparison questions related to the data using phrases such as "Which is greater?" and "How did the value change?" - Explore some "what if" statements. For example, what if the data point was placed a little to the left? right? down? up? Compare what happens when you move diagonally up to left in the graph versus down to the right.	• Work with partners to discuss the focus questions provided. • Ask questions to clarify understanding of the basic elements of the graph. • Read specific data on a given graph. For example, place the top right corner of a rectangular piece of acetate on the data point and follow the edges of the acetate back to the two axes to read the information on each axis. • Look for relationships in the data and make comparisons in the data. Discuss these comparisons in the data with partners. • Investigate "what if" statements posed by the teacher.
After Reading Beyond the Data (making inferences and drawing conclusions): - Encourage students to synthesize the information in the graph. Pose questions that lead students to identify trends, make predictions, extend the data, or draw inferences.	• Work with partners to identify trends, make predictions, extend the data, or draw inferences from the data. • Individually record thinking by answering questions related to the graph. • Identify strategies for reading graphs that can be used in the future.

Notes

Reading Graphs – A Four Step Process

I. Previewing the Graph

Before answering any questions about the information in a graph, try to understand the basic elements of the graph:

- What **type of graph** is it? (e.g. pictograph, bar graph, line graph, scatter plot, circle graph)
- What does the **title** tell you about the information in the graph?
- Read the labels on each axis.
- What are the units for the scales?
- Read the legend (if there is one).

II. Reading the Data

Some questions about data can be answered by stating a fact directly from the graph. To answer these types of questions, use the labels and scale on the horizontal and vertical axes to read or locate specific information on the graph.

III. Reading Between the Data

The answers to some questions require that you interpret information by identifying relationships and trends within the graph. Compare two or more points on the graph to determine a relationship or trend (see Student Resource, *Reading Graphs – Reading Between the Data*, questions 1-4).

IV. Reading Beyond the Data

Some questions about data in graphs ask you to extend, predict, or infer an answer using your own prior knowledge and experience. To read beyond the data is to draw conclusions from evidence in the graph.

- Identify your own knowledge and experience related to the question.
- Consider the evidence in the graph that supports your prediction or conclusion.
- See Student Resources, *Reading Graphs – Reading Between the Data,* questions 5-7 and *Reading Graphs – Reading Beyond the Data*.

Student/Teacher Resource

Reading Graphs – Features of Two Variable Graphs

Graphs with an "L-shaped" framework are used to organize and analyze information about *two variables*, e.g., weight and cost, time and distance, colour and number.

The variables can *vary* by **quantity** or by **type**,
e.g., "Cost" varies by quantity ($2, $5) whereas "colour" varies by type (blue, red).

The horizontal axis is used to show the *quantity* (e.g. $2) or *type* (e.g. blue) of one of the two variables. This variable is called the *independent* variable.

The second variable is called the *dependent* variable.
The vertical axis is a number line, used to show the *quantity* of the second variable.

The axes are usually labeled with the name of the variable and units of measure if applicable e.g., Cost ($). When both axes are number lines then the location of the data point (0, 0) is called origin.

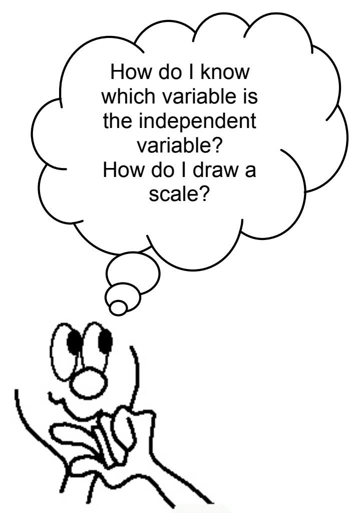
Title

The title provides an introduction to the data contained within the graph.

Label

The vertical axis is used to show different **quantities** of the second variable. This axis needs a **scale** and units of measure.

Data can be represented in a variety of ways, for example, by points in a scatter plot, lines on a line graph, or bars on a bar graph.



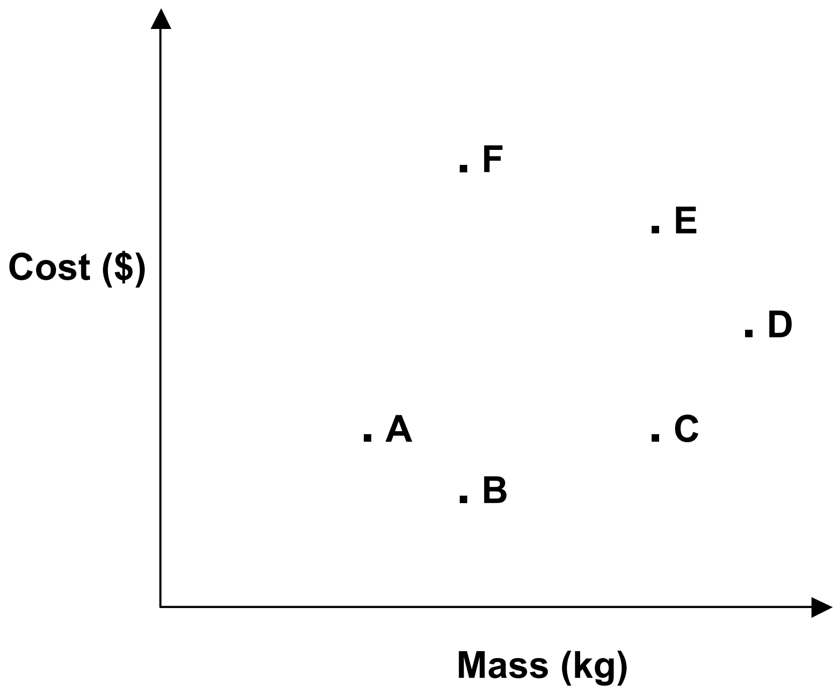
Label

The horizontal axis is used to show different **quantities** or different **types** of the first variable. When the axis is used to show different quantities then it needs a **scale** and units of measure.

Reading Graphs - Reading Between the Data

Bulk Birdseed

Seven different sized bags of birdseed are available for sale at the costs represented in the graph below. Each point represents information about one bag of birdseed.



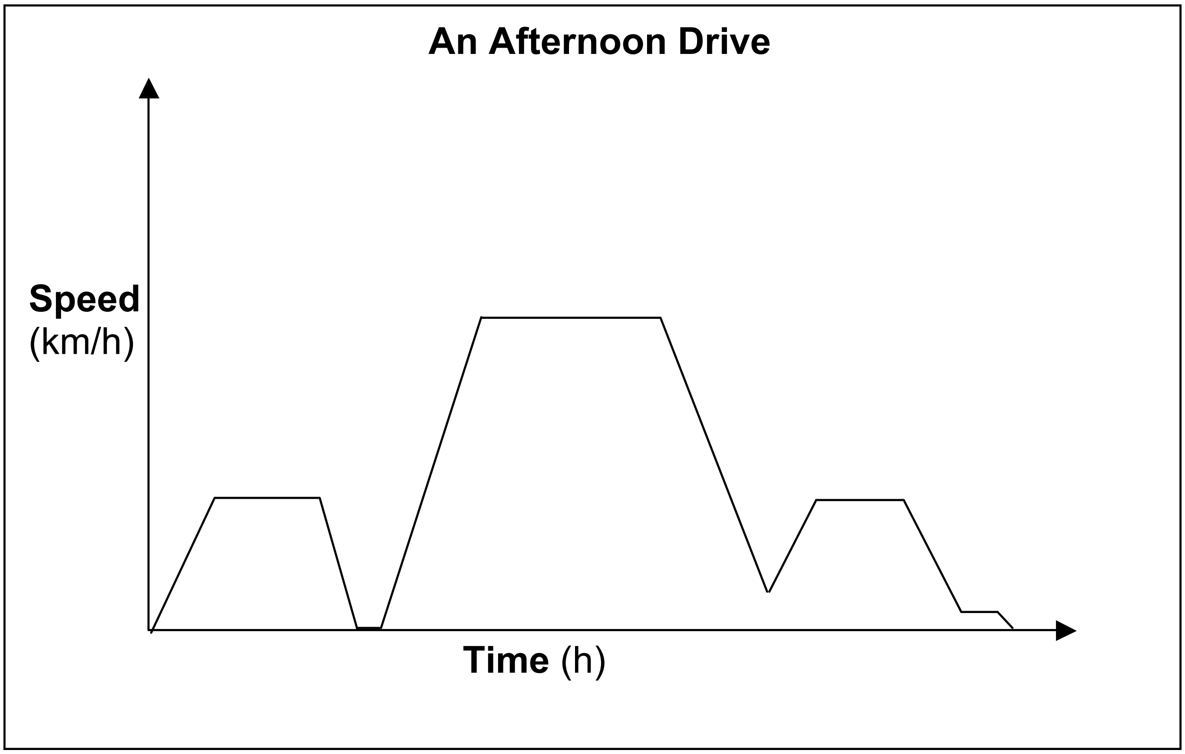
Answer the following questions and justify your reasoning.

1. Which bag is the lightest?
2. Which bag is the most expensive?
3. Which bags have the same mass?
4. Which bags cost the same?
5. Does bag F or bag C give you better value for your money?
6. Does bag B or bag D give you better value for your money?
7. Which two bags give you about the same value for your money?

Reading Graphs - Reading Beyond the Data

Think/Pair/Share Activity

1. **Think:** Study the graph below. Think about what is happening as the afternoon drive unfolds. Write down possible explanations for the changes in the car's speed.



2. **Pair:** With a partner, discuss what might be happening as the afternoon drive unfolds. Compare your ideas to clarify your understanding of the graph.

3. **Share:** Share your ideas with the whole class. Ask questions to further clarify your understanding of the graph.

Reading Graphs - Answers to Student Resources

Answers to *"Bulk Birdseed"*

1. Bag A is the lightest.
2. Bag F is the most expensive.
3. Bags B and F have the same mass, and bags C and E have the same mass.
4. Bags A and C cost the same.
5. Bag C has a better value for your money because it has a greater mass than bag F but costs less than bag F. (Point C is further right than point F which means bag C's mass is greater than bag F's mass. Point C is lower down than point F which means bag C *costs* less than bag F.)
6. Bag B has a better value for your money because although its mass is about half the mass of bag D, its cost is less than half the cost of bag D. (The cost/mass ratio for bag B is less than bag D's.)
7. Bags B and C give about the same value for your money. (The cost/mass ratio for the two bags is the same. If a line is drawn from origin to point B and extended past point B, the line goes through point C. The cost/mass ratio is the same for any two points on this line.)

Consider asking students to pose additional questions for this graph e.g., How would the information about bag A change if point A was moved lower but not left or right?

Sample Explanation for the Graph, "An Afternoon Drive"

The car begins from home with a fairly constant acceleration to a reasonable city/town street speed. It travels at this speed for a time before stopping at a traffic light/stop sign. The car then continues on the trip, entering a highway/expressway to travel at a greater speed for a time. The car slows down as it exits the highway then speeds up again as it travels along another city/town street. Finally, the car slows down before turning and driving slowly up a long driveway to its destination.

Consider asking students to pose additional questions for this graph e.g., How would you describe the afternoon drive if the vertical axis was labeled "Distance" instead of "Speed"?