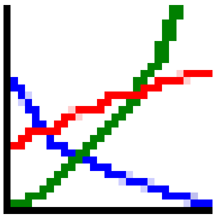

Relating Graphs to Events
Version 2 for PC and Mac OS X

Teachers' Manual

by Sharon Dugdale and David Kibbey

"Relating Graphs to Events" was originally published as part of a package titled *Interpreting Graphs*. The current version is part of the *Green Globs & Graphing Equations* package.

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Introduction

Relating Graphs to Events is an activity that helps students make meaningful interpretations of line graphs of physical phenomena. This computer activity can help students develop skills and concepts useful for dealing with graphs in any area.

Intended Audience

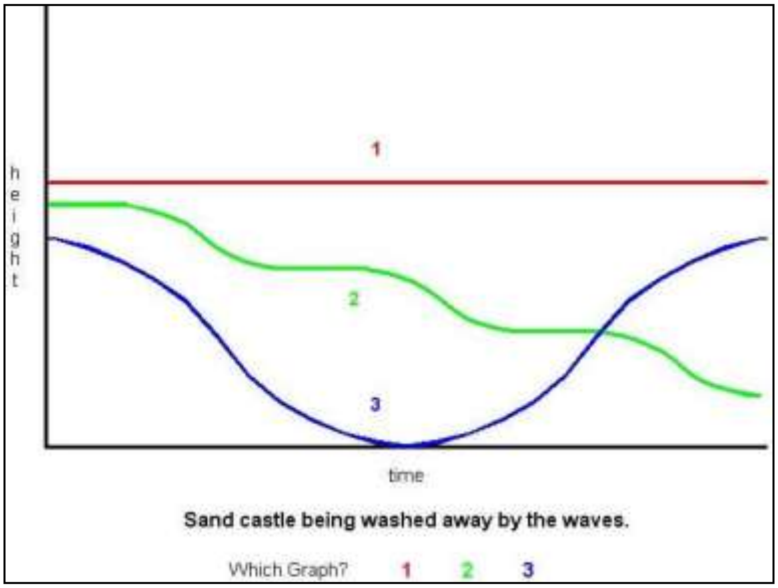
This program is appropriate for a wide range of courses involving graphing. This activity is recommended for students at the secondary level or even the college level, but students in the intermediate grades who have had some introduction to graphing concepts can also benefit from using this program.

Brief Program Description

Relating Graphs to Events provides practice in matching line graphs with descriptions of events in the physical world, such as a bicycle traveling up a hill.

Prerequisite:	Have a basic idea of what a graph is.
Skills:	Associate the basic shape of a graph with an event, paying attention to the labels on the axes.
Grade Level:	5 - adult (lower than 5 if prerequisite is met)
Time Required:	about 20 minutes

Relating Graphs to Events



RELATING GRAPHS TO EVENTS provides practice matching line graphs with descriptions of events in the physical world, such as a bicycle traveling up a hill.

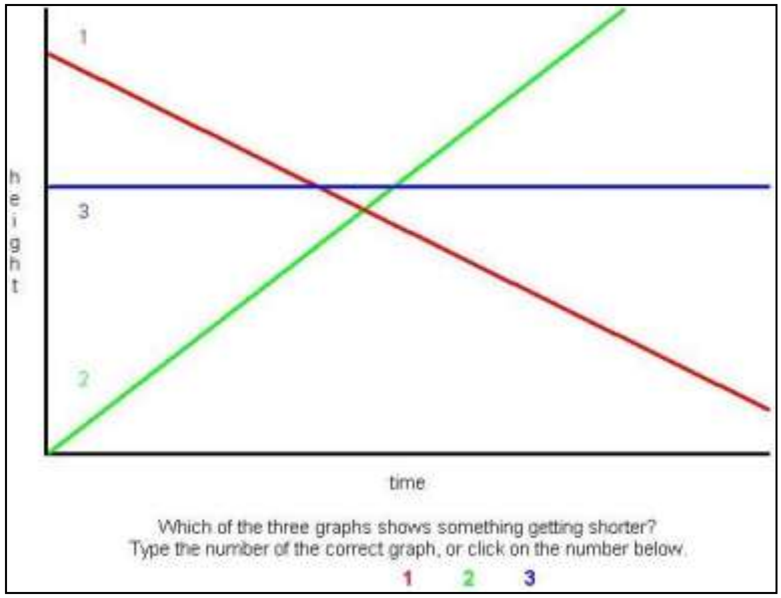
Prerequisite:	Have a basic idea of what a graph is.
Skills:	Associate the basic shape of a graph with an event, paying attention to the labels on the axes.
Grade Level:	5 - adult (lower than 5 if prerequisite is met)
Time Required:	About 20 minutes
Description:	In each of the twenty practice problems, three line graphs are plotted on one set of axes. A description of a physical event appears below the graphs. The student selects the graph which most closely matches the event.
Objectives:	Interpret line graphs qualitatively, recognizing the general shape of the graph as it relates to the labels on the axes. Relate physical events to their graphical representations.

RELATING GRAPHS TO EVENTS has two parts: the **Introduction** and **Practice Problems**.

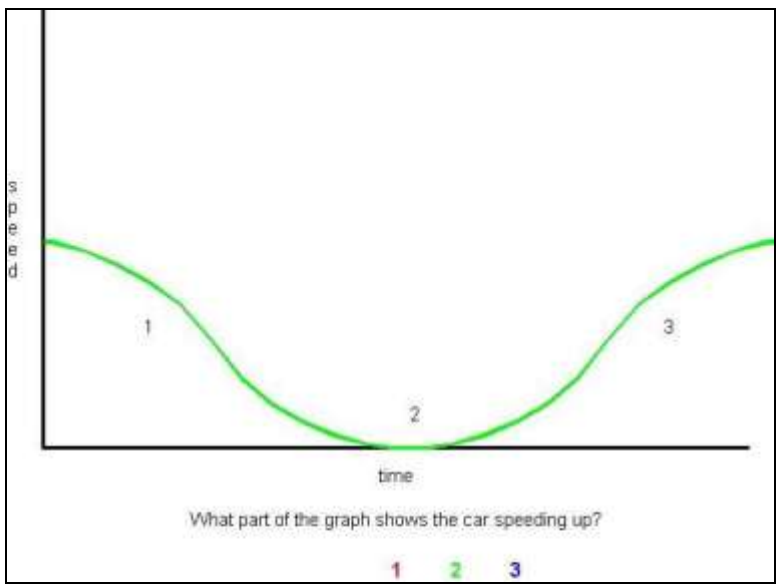
Introduction

The Introduction provides two examples of graphs of physical events and guides students through a brief explanation of each.

The first example plots height over a period of time. Students choose which graph shows something getting taller, getting shorter, or staying the same.



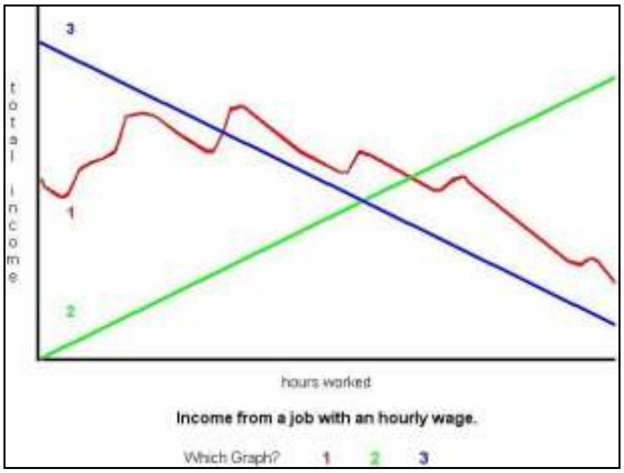
The second example graphs the speed of a car over time. Students decide where the graph shows the car is speeding up, where the car is slowing down, and where the car is sitting still.

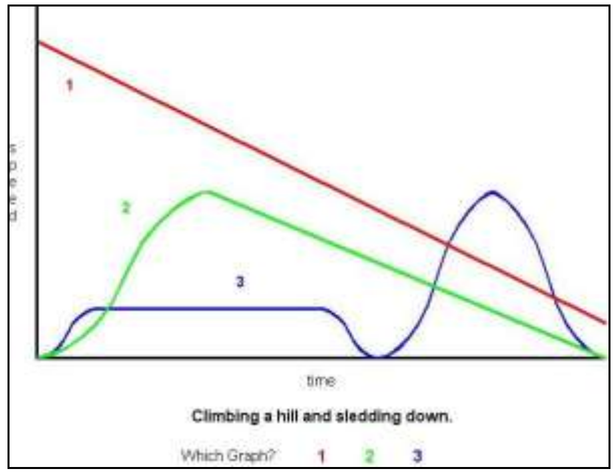


Practice Problems

There are twenty practice problems. Easier problems are grouped toward the beginning, and more challenging ones are placed toward the end.

Each problem includes a set of axes with three line graphs. The axes are labeled to indicate which variables they represent. The axes do not have numerical scale markings.





The three graphs are displayed in different colors and are numbered from one to three.

A brief description of a physical event is displayed below the graphs. The student selects the graph whose shape most closely matches the described event.

If the student makes an incorrect choice, that graph is described in physical terms. Then the student tries again on the same problem. The correct answer must be entered before the student proceeds to the next problem.

The correct graph for each problem is used as an incorrect choice for other problems. Students who choose the wrong graph for a problem will see that same graph in another problem where it is a correct choice.

After the student enters the correct graph, the other two graphs are erased. The correct graph and the physical description remain on the screen until the student clicks the <u>Next Problem</u> button (or presses Enter or Return).

After the student has completed all twenty problems, the student is offered the opportunity to repeat the problems that were not answered correctly on the first try. When the student has answered each problem correctly on the first try, the student is congratulated and told that that he or she has finished the program.

The twenty problems are grouped into three sets based on the level of difficulty. The problems appear in random order within each set. Each student using the program sees all the problems in each set, but in random order.

Here are the three sets of problems:

Description of a physical event	Axis labels
A marble rolling to a stop	speed vs. time
A car slowing down, then speeding up	speed vs. time
A wagon is given a push, then coasts to a stop	speed vs. time
Income from a job with an hourly wage	total income vs. hours worked
A burning candle	length vs. time
Speeding car crashing into a solid wall	speed vs. time
Yo-yo moving up and down rhythmically	height vs. time
Gasoline use during travel on flat land	gas used vs. distance traveled
Airplane circling at constant speed	speed vs. time
Sand castle being washed away by the waves	height vs. time
Water level of a river through seasonal rains and dry spells	water level vs. time
A car stopping at a stop sign, then moving on	speed vs. time
Water draining from a bathtub	depth vs. time
A seat on a Ferris wheel	height vs. time
Growth of a tree over several years	height vs. time
Bicycling up a steep hill and down the other side	speed vs. time
A dog sleeping in the sun	speed vs. time
A wagon rolling down a hill into a tree	speed vs. time
The area of a square	area vs. length of side
Climbing a hill and sledding down	speed vs. time

Preparation

The Introduction included in the program should provide adequate preparation for most students. The Introduction could be a class demonstration by the teacher or could be used by students individually.

Some teachers may want to introduce the topic with a separate classroom activity. This is especially advisable if the students have had no previous experience in interpreting graphs.

Examples similar to those used in the program could be presented to the class, perhaps using an overhead projector with line graph transparencies. Graphs of simple events could be presented and described to illustrate behaviors of increasing, decreasing, or unchanged.

Students could also suggest events from their experience to be graphed. The teacher might ask students to describe what the graph would look like, then sketch the graph on an overhead transparency.

Introductory activities should be kept simple. The program builds interest by presenting more complex situations and new ideas as it progresses. More challenging activities can be saved for follow-up.

Using the Program

The emphasis in the program is on visualizing the general relationship between two variables. Specific numerical values are not used here.

Initially, students tend to overlook the labels on the axes. They often choose a graph that seems to be a picture of the described event. For example, given a bicyclist going over a hill, a graph that looks like a hill might be chosen. This is appropriate if the axes are labeled elevation vs. time, but it is inappropriate when the axes are labeled speed vs. time. Some of the incorrect choices in the problems are intentionally made to look like a picture of something in the event.

Some problems are intended to raise ideas that might not occur to students. For example, a graph of the speed of a sleeping dog helps students recognize that a graph that is constant zero is meaningful.

Follow-Up

1. Give students several graphs, and ask them to write a description of an event to match the graph. The axes could be labeled in the first problems; the student could be asked to choose labels for the axes in the later problems. Use Worksheet 1 or create other exercises.

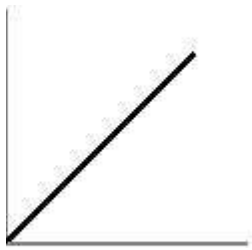
2. Ask students to describe two different physical events that match a given graph. Use Worksheet 2 or create similar exercises.

3. Show a description and a correct graph on the board (or use the activities above). Ask the students what made the example tricky, or what traps they learned to avoid.

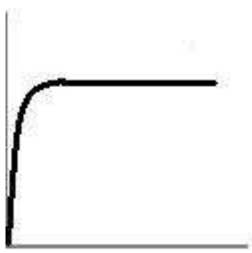
Worksheet 1 -- Relating Graphs to Events:
Make an Event for a Graph

For each graph below, write a brief description of an event that fits the graph. Label the axes appropriately.

Description



1.



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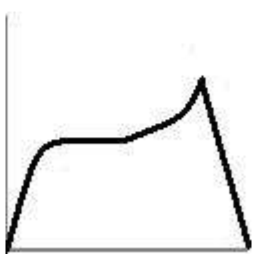

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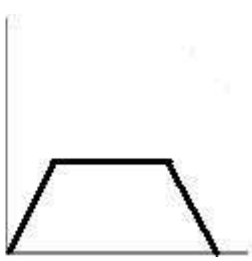


4.

ANSWERS Worksheet 1 -- Relating Graphs to Events
Make an Event for a Graph

Many answers are possible. Here are some:

1. Water level in a bathtub increasing while the faucet is open (height vs. time)

2. Growth of a human from infant to middle age (height vs. time)

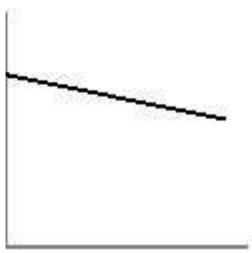
   A car accelerating fast, then holding constant speed (speed vs. time)

3. Running a race: a fast start, followed by a constant pace, then faster near the end, and come to a stop (speed vs. time)

4. Leave a starting point, arrive at a destination, stay there for a while, then return to the starting point (distance from starting point vs. time)

Worksheet 2 -- Relating Graphs to Events: Make Two Events for a Graph

For each of these graphs, write descriptions of two different events that fit the graph. Label the axes. (You can label the axes differently for the two events.)



1. first event: ______________________________

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second event:

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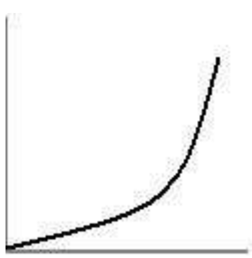

2. first event:

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second event:

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ANSWERS Worksheet 2 -- Relating Graphs to Events
Make Two Events for a Graph

Many answers are possible.

1. Water draining from a tank (depth vs. time)

   Object rolling to a stop (speed vs. time)

   Height of a burning candle (height vs. time)

2. Speed of an object dropped from a tower (speed vs. time)

   Area of a square as the length of a side increases (area vs. length of side)

   Bicycle rolling down a steep hill, before reaching bottom (speed vs. time)