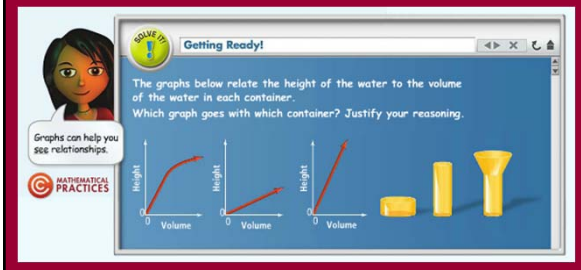
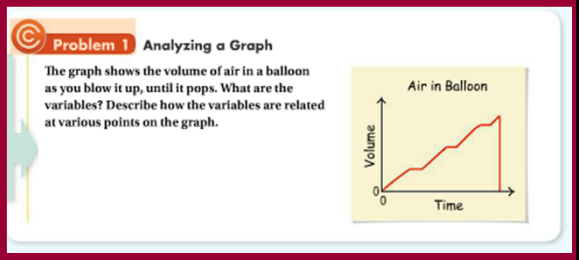
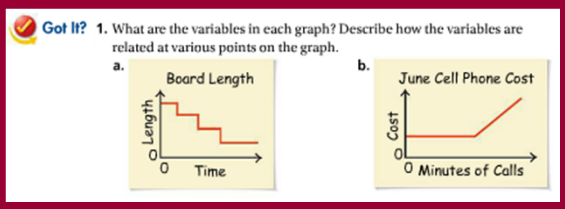
Graphs

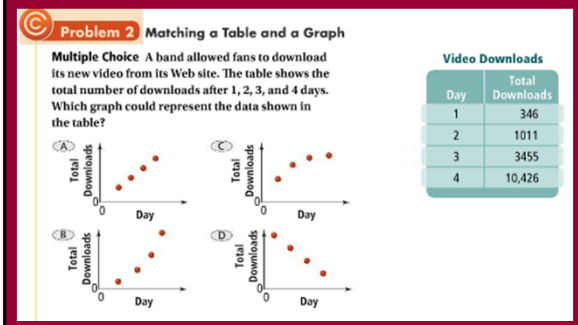
We often use graphs to show how two variables are related.

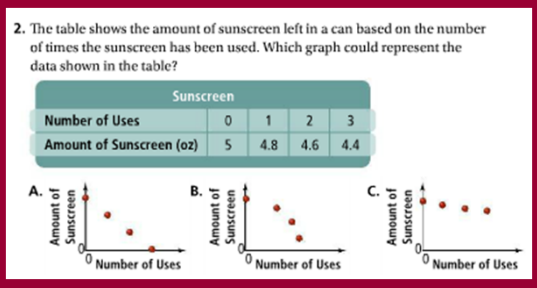
All these examples come straight from your book.











Problem 3 Sketching a Graph STEM

Rocketry A model rocket rises quickly and then slows to a stop as its fuel burns out. It begins to fall quickly until the parachute opens, after which it falls slowly back to Earth. What sketch of a graph could represent the height of the rocket during its flight? Label each section.

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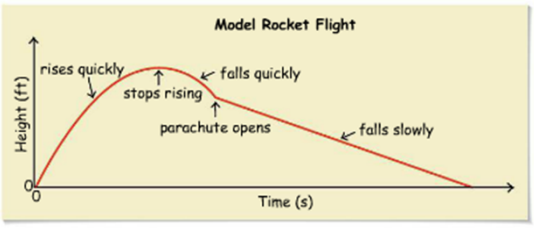
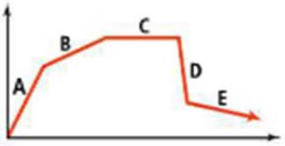
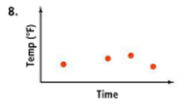


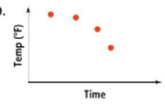
3. Match one of the labeled segments in the graph below with each of the following verbal descriptions: *rising slowly*, *constant*, and *falling quickly*.

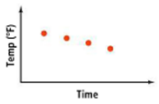


What are the variables in each graph? Describe how the variables are related at various points on the graph.

Match each graph with its related table. Explain your answers.







A.

Time	Temperature (°F)
1 P.M.	91°
3 P.M.	89°
5 P.M.	81°
7 P.M.	64°

B.

Time	Temperature (°F)
1 P.M.	61°
3 P.M.	60°
5 P.M.	59°
7 P.M.	58°

C.

Time	Temperature (°F)
1 P.M.	24°
3 P.M.	26°
5 P.M.	27°
7 P.M.	21°

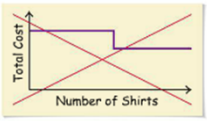
Sketch a graph to represent each situation. Label each section.

11. hours of daylight each day over the course of one year

12. your distance from the ground as you ride a Ferris wheel

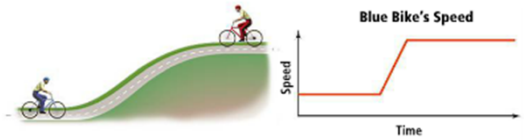
13. your pulse rate as you watch a scary movie

15. Error Analysis T-shirts cost $12.99 each for the first 5 shirts purchased. Each additional T-shirt costs $4.99 each. Describe and correct the error in the graph at the right that represents the relationship between total cost and number of shirts purchased.



18. Reasoning The diagram at the left below shows a portion of a bike trail.

a. Explain whether the graph below is a reasonable representation of how the speed might change for the rider of the blue bike.



b. Sketch two graphs that could represent a bike's speed over time. Sketch one graph for the blue bike, and the other for the red bike.

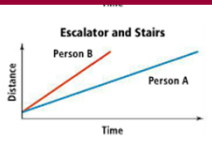
17. Skiing Sketch a graph of each situation. Are the graphs the same? Explain.

a. your speed as you travel on a ski lift from the bottom of a ski slope to the top

b. your speed as you ski from the top of a ski slope to the bottom

Challenge **19. Track** The sketch at the right shows the distance three runners travel during a race. Describe what occurs at times A, B, C, and D. In what order do the runners finish? Explain.

20. Reasoning The graph at the right shows the vertical distance traveled as Person A walks up a set of stairs and Person B walks up an escalator next to the stairs. Copy the graph. Then draw a line that could represent the vertical distance traveled as Person C rides the escalator standing still. Explain your reasoning.



21. The graph at the right shows your distance from home as you walk to the bus stop, wait for the bus, and then ride the bus to school. Which point represents a time that you are waiting for the bus?

(A) A (C) C

(B) B (D) D

One of the most common things we do in algebra is to identify and understand patterns.

Terms used when identifying patterns:

- Independent variable
  - Input – what you start with
  - You choose or are given the values you use for it

- Dependent variable
  - Output – end result
  - The value **depends** on the input

Most often we use “x” for the independent variable and “y” for the dependent variable.

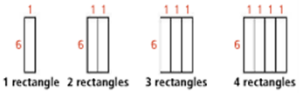
So the value of “y” depends on what value we are given for “x”.

We can represent patterns in a variety of ways

- words
- pictures
- tables
- equations
- graphs

Problem 1 Representing a Geometric Relationship

In the diagram below, what is the relationship between the number of rectangles and the perimeter of the figure they form? Represent this relationship using a table, words, an equation, and a graph.



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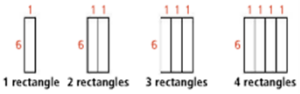

Step 1 Make a table. Use x as the independent variable and y as the dependent variable.
Let x = the number of rectangles.
Let y = the perimeter of the figure.
Write each pair of input and output values x and y as an ordered pair (x, y).

Number of Rectangles, x	Perimeter, y	Ordered Pair (x, y)
1	$2(1) + 2(6) = 14$	$(1, 14)$
2	$2(2) + 2(6) = 16$	$(2, 16)$
3	$2(3) + 2(6) = 18$	$(3, 18)$
4	$2(4) + 2(6) = 20$	$(4, 20)$

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Step 2 Look for a pattern in the table. Describe the pattern in words so you can write an equation to represent the relationship.

Words Multiply the number of rectangles in each figure by 2 to get the total length of the top and bottom sides of the combined figure. Then add 2(6), or 12, for the total length of the left and right sides of the combined figure to get the entire perimeter.

Equation $y = 2x + 12$

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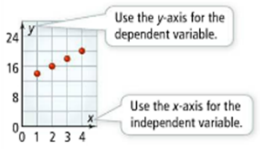
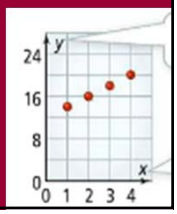
Step 3 Use the table to make a graph.

With a graph, you can see a pattern formed by the relationship between the number of rectangles and the perimeter of the combined figure.



This is called a **linear relationship** because the perimeter changes by the **same amount** for each rectangle that is added.

The points are all on a line.



A **function** is a relationship where each possible value of the independent variable gives just one value for the dependent variable.

- 1 output for each input
- Just one “y” for each “x”
- You never get more than one answer

The relationship between rectangles and perimeter can be called a **linear function**.

Examples of patterns that are **not** functions:

x	y
1	1
1	-1
4	2
4	-2
9	3
9	-3

x	y
9	1
9	2
10	2
10	3
12	4
12	5
12	6

Examples of functions that are not linear:

x	y
1	1
2	8
3	27
4	64
5	125

x	y
1	5
2	-5
3	5
4	-5
5	5
6	-5
7	5

x	y
1	104.00
2	108.16
3	112.49
4	116.99
5	121.67
6	126.53
7	131.59
8	136.86
9	142.33
10	148.02