Lesson 1: The Concept of a Function

Classwork

Example 1

Suppose a moving object travels 256 feet in 4 seconds. Assume that the object travels at a constant speed, that is, the motion of the object can be described by a linear equation. Write a linear equation in two variables to represent the situation, and use the equation to predict how far the object has moved at the four times shown.

Number of seconds in motion (x)	Distance traveled in feet (y)
1	
2	
3	
4	

Example 2

The object, a stone, is dropped from a height of 256 feet. It takes exactly 4 seconds for the stone to hit the ground. How far does the stone drop in the first 3 seconds? What about the last 3 seconds? Can we assume constant speed in this situation? That is, can this situation be expressed using a linear equation?

Number of seconds (x)	Distance traveled in feet (y)
1	
2	
3	
4	

Exercises 1–6

Use the table to answer Exercises 1–5.

Number of seconds (x)	Distance traveled in feet (y)
0.5	4
1	16
1.5	36
2	64
2.5	100
3	144
3.5	196
4	256

1. Name two predictions you can make from this table.

2. Name a prediction that would require more information.

3. What is the average speed of the object between 0 and 3 seconds? How does this compare to the average speed calculated over the same interval in Example 1?

$$\text{Average Speed} = \frac{\text{distance traveled over a given time interval}}{\text{time interval}}$$

4. Take a closer look at the data for the falling stone by answering the questions below.
   a. How many feet did the stone drop between 0 and 1 second?

   b. How many feet did the stone drop between 1 and 2 seconds?

   c. How many feet did the stone drop between 2 and 3 seconds?

   d. How many feet did the stone drop between 3 and 4 seconds?

   e. Compare the distances the stone dropped from one time interval to the next. What do you notice?

5. What is the average speed of the stone in each interval 0.5 second? For example, the average speed over the interval from 3.5 seconds to 4 seconds is

$$\frac{\text{distance traveled over a given time interval}}{\text{time interval}} = \frac{256-196}{4-3.5} = \frac{60}{0.5} = 120;\ 120 \text{ feet per second}$$

Repeat this process for every half-second interval. Then answer the question that follows.

   a. Interval between 0 and 0.5 second:

   b. Interval between 0.5 and 1 second:

   c. Interval between 1 and 1.5 seconds:

   d. Interval between 1.5 and 2 seconds:

e. Interval between 2 and 2.5 seconds:

f. Interval between 2.5 and 3 seconds:

g. Interval between 3 and 3.5 seconds:

h. Compare the average speed between each time interval. What do you notice?

6. Is there any pattern to the data of the falling stone? Record your thoughts below.

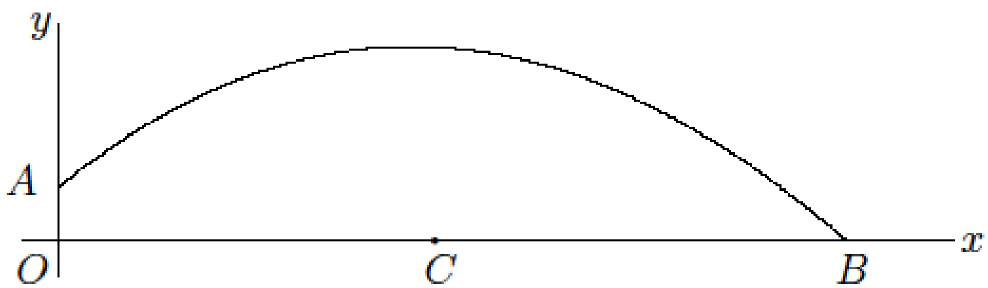
Time of interval in seconds (t)	1	2	3	4
Distance stone fell in feet (y)	16	64	144	256

Lesson Summary

A *function* is a rule that assigns to each value of one quantity a single value of a second quantity. Even though we might not have a formula for that rule, we see that functions do arise in real-life situations

Problem Set

A ball is thrown across the field from point A to point B. It hits the ground at point B. The path of the ball is shown in the diagram below. The x-axis shows the horizontal distance the ball travels in feet, and the y-axis shows the height of the ball in feet. Use the diagram to complete parts (a)–(f).



a. Suppose point A is approximately 6 feet above ground and that at time $t = 0$ the ball is at point A. Suppose the length of OB is approximately 88 feet. Include this information on the diagram.

b. Suppose that after 1 second, the ball is at its highest point of 22 feet (above point C) and has traveled a horizontal distance of 44 feet. What are the approximate coordinates of the ball at the following values of t: $0.25, 0.5, 0.75, 1, 1.25, 1.5, 1.75$, and 2.

c. Use your answer from part (b) to write two predictions.

d. What is happening to the ball when it has coordinates $(88, 0)$?

e. Why do you think the ball is at point $(0, 6)$ when $t = 0$? In other words, why isn't the height of the ball 0?

f. Does the graph allow us to make predictions about the height of the ball at all points?