Lesson 4: More Examples of Functions

Classwork

Example 1

Classify each of the functions described below as either discrete or not discrete.

a) The function that assigns to each whole number the cost of buying that many cans of beans in a particular grocery store.

b) The function that assigns to each time of day one Wednesday the temperature of Sammy's fever at that time.

c) The function that assigns to each real number its first digit.

d) The function that assigns to each day in the year 2015 my height at noon that day.

e) The function that assigns to each moment in the year 2015 my height at that moment.

f) The function that assigns to each color the first letter of the name of that color.

g) The function that assigns the number 23 to each and every real number between 20 and 30.6.

h) The function that assigns the word YES to every yes/no question.

i) The function that assigns to each height directly above the North Pole the temperature of the air at that height right at this very moment.

Example 2

Water flows from a faucet into a bathtub at a constant rate of 7 gallons of water every 2 minutes. Regard the volume of water accumulated in the tub as a function of the number of minutes the faucet has be on. Is this function discrete or not discrete?

Example 3

You have just been served freshly made soup that is so hot that it cannot be eaten. You measure the temperature of the soup, and it is $210°\text{F}$. Since $212°\text{F}$ is boiling, there is no way it can safely be eaten yet. One minute after receiving the soup, the temperature has dropped to $203°\text{F}$. If you assume that the rate at which the soup cools is constant, write an equation that would describe the temperature of the soup over time.

Example 4

Consider the function that assigns to each of nine baseball players, numbered 1 through 9, his height. The data for this function is given below. Call the function G.

Player Number	Height
1	$5'11''$
2	$5'4''$
3	$5'9''$
4	$5'6''$
5	$6'3''$
6	$6'8''$
7	$5'9''$
8	$5'10''$
9	$6'2''$

Exercises 1–3

1. At a certain school, each bus in its fleet of buses can transport 35 students. Let B be the function that assigns to each count of students the number of buses needed to transport that many students on a field trip.

   When Jinpyo thought about matters, he drew the following table of values and wrote the formula $B = \frac{x}{35}$. Here x is the count of students, and B is the number of buses needed to transport that many students. He concluded that B is a linear function.

Number of students (x)	35	70	105	140
Number of buses (B)	1	2	3	4

   Alicia looked at Jinpyo's work and saw no errors with his arithmetic. But she said that the function is not actually linear.

   a. Alicia is right. Explain why B is not a linear function.

   b. Is B a discrete function?

2. A linear function has the table of values below. It gives the costs of purchasing certain numbers of movie tickets.

Number of tickets (x)	3	6	9	12
Total cost in dollars (y)	27.75	55.50	83.25	111.00

a. Write the linear function that represents the total cost, y, for x tickets purchased.

b. Is the function discrete? Explain.

c. What number does the function assign to 4? What do the question and your answer mean?

3. A function produces the following table of values.

Input	**Output**
Banana	B
Cat	C
Flippant	F
Oops	O
Slushy	S

a. Make a guess as to the rule this function follows. Each input is a word from the English language.

b. Is this function discrete?

Lesson Summary

Functions are classified as either discrete or not discrete.

Discrete functions admit only individually separate input values (such as whole numbers of students, or words of the English language). Functions that are not discrete admit any input value within a range of values (fractional values, for example).

Functions that describe motion or smooth changes over time, for example, are typically not discrete.

Problem Set

1. The costs of purchasing certain volumes of gasoline are shown below. We can assume that there is a linear relationship between x, the number of gallons purchased, and y, the cost of purchasing that many gallons.

Number of gallons (x)	5.4	6	15	17
Total cost in dollars (y)	19.71	21.90	54.75	62.05

   a. Write an equation that describes y as a linear function of x.

   b. Are there any restrictions on the values x and y can adopt?

   c. Is the function discrete?

   d. What number does the linear function assign to 20? Explain what your answer means.

2. A function has the table of values below. Examine the information in the table to answer the questions below.

Input	Output
one	3
two	3
three	5
four	4
five	4
six	3
seven	5

   a. Describe the function.

   b. What number would the function assign to the word *eleven*?

3. The table shows the distances covered over certain counts of hours traveled by a driver driving a car at a constant speed.

Number of hours driven (x)	3	4	5	6
Total miles driven (y)	141	188	235	282

   a. Write an equation that describes y, the number of miles covered, as a linear function of x, number of hours driven.
   b. Are there any restrictions on the value x and y can adopt?
   c. Is the function discrete?
   d. What number does the function assign to 8? Explain what your answer means.
   e. Use the function to determine how much time it would take to drive 500 miles.

4. Consider the function that assigns to each time of a particular day the air temperature at a specific location in Ithaca, NY. The following table shows the values of this function at some specific times.

12:00 noon	92°F
1:00 p.m.	90.5°F
2:00 p.m.	89°F
4:00 p.m.	86°F
8:00 p.m.	80°F

   a. Let y represent the air temperature at time x hours past noon. Verify that the data in the table satisfies the linear equation $y = 92 - 1.5x$.
   b. Are there any restrictions on the types of values x and y can adopt?
   c. Is the function discrete?
   d. According to the linear function of part (a), what will the air temperature be at 5:30 p.m.?
   e. Is it reasonable to assume that this linear function could be used to predict the temperature for 10:00 a.m. the following day or a temperature at any time on a day next week? Give specific examples in your explanation.