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CHAPTER 4 Sequences as Discrete Functions

KEY CONCEPT

Discrete Functions

In Chapter 1, you made data plots given a finite set of domain values corresponding to a distinct set of range values. These non-continuous graphs were **discrete functions.**

A **sequence** is a discrete function whose domain is the set of positive integers. Example 1 examines the graph of a sequence.

EXAMPLE 1

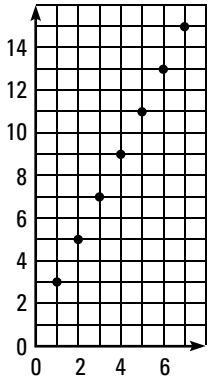
Graph sequences

Graph the function defined by this sequence.

x	1	2	3	4	5	…
$2x + 1$	3	5	7	9	11	…

Solution:

This graph represents a discrete function since its points are not connected by a straight line or curve and each member of the domain corresponds to exactly one member of the range. ■



Linear functions differ from discrete functions since the domain of linear functions is the set of real numbers and not positive integers. Example 2 examines the difference between the graphs of both function types.

EXAMPLE 2

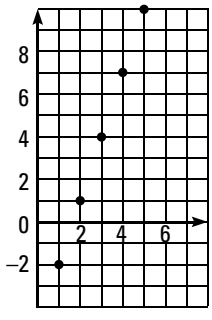
Compare graphs of sequences and linear functions

Compare the sequence defined by $3x - 5$ and the function $y = 3x - 5$ by graphing each.

Solution:

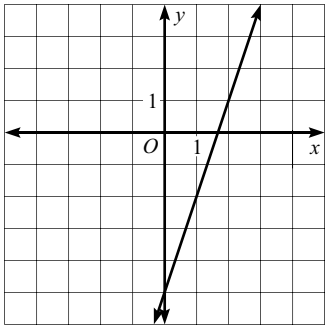
The table of values shows the first 5 terms in the sequence.

x	1	2	3	4	5	…
$3x - 5$	−2	1	4	7	10	…



The graph of the sequence at the left shows non-connected points and only positive integer values for the domain.

The graph of the linear function at the right shows a continuous set of points connected by a straight line and all real numbers for the domain. ■



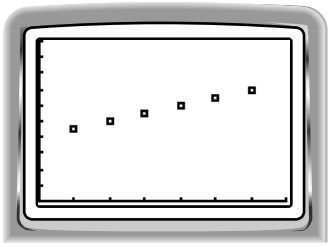
EXAMPLE 3 Graph sequences using a graphing calculator

Use a graphing calculator to graph the first six terms of the sequence defined by $\frac{1}{2}x + 4$.

Solution:

Enter $1-6$ into L_1. Then enter $\frac{1}{2} L_1 + 4$ into L_2.

Set Stat Plots, Plot1 to On, and Type to be a scatter plot. Be sure the Window is set for the appropriate domain and range shown in each list. Then graph. ■



Graphs of sequences and scatter plots appear to be similar since they both depict discrete data with positive domain values. Scatter plots differ, though, in several ways. While the domain of sequences is restricted to the set of positive integers, scatter plots can have domains that include any real number. Also, scatter plots may or may not be functions since some domain values could correspond to more than one range value.

EXAMPLE 4 Compare graphs of sequences and scatter plots

Make a plot of the data in each table. Then explain whether each plot represents a function.

a.

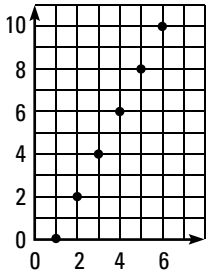
1	2	3	4	5	6
0	2	4	6	8	10

b.

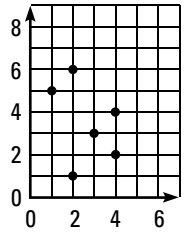
2	4	3	4	1	2
1	2	3	4	5	6

Solution:

a. This plot represents a function. Each member of the domain corresponds to exactly one member of the range.



b. This plot does not represent a function. Some members of the domain correspond to more than one member of the range. ■



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CHAPTER 4

Sequences as Discrete Functions *continued*

Practice

1. **Writing** Describe the differences between a sequence and a linear function.

2. **Writing** Describe the differences between the graph of a sequence and a scatter plot.

Sketch a graph of each sequence and linear function.

3. sequence defined by $x - 3$; linear function $y = x - 3$

4. sequence defined by $-x + 5$; linear function $y = -x + 5$

Use a graphing calculator to plot the first eight terms in each sequence.

5. $4x + 2$

6. $-2x + 6$

7. $\frac{1}{3}x$

8. $\frac{x + 3}{2}$

Sketch a graph of the data. Then explain whether or not the graph represents a function.

9.

2	5	8	11	14	17
3	5	8	3	5	8

10.

5	7	4	7	3	2
0	2	4	6	8	10

11.

6	5	4	3	2	1
1	2	3	4	5	6

12.

1	2	3	4	5	6
4	4	4	4	4	4

Problem Solving

13. A sequence starts with 8 and subtracts 2 to get each following term. Sketch a graph of the first six terms of this sequence.

14. Alyssa kept track of the money she earned each day she worked last week.

Hours Worked	5	2.5	6	3	5
$ Earned	40	24	48	30	35

Plot this data on a graph. Then explain whether or not the graph represents a function.

15. Marcus read 5 pages of a book the first day of vacation. Each following day, he read 5 more pages than the previous day. Explain whether or not the graph of $y = 5x$ can be used to show the number of pages Marcus read each day of vacation.

Activity

16. Find the shoe sizes and heights, in inches, of fifteen people. Plot the data showing the relationship between shoe size and height on a graph using a graphing calculator. Then explain whether or not the data represents a function.