LESSON 7.4

Relations and Functions

CA Standards AF 1.5

Goal: Use graphs to represent relations and functions.

Vocabulary

Relation: A paring of number in one set with numbers in another set

Domain: The set of all possible input values of a relation

Range: The set of all possible output values of a relation

Input: Each number in the domain of a relation

Output: Each number in the range of a relation

Function: A relation in which for each input x in the domain there is exactly one output y in the range

Linear function: A function whose graph is a line or part of a line

EXAMPLE 1 Analyzing and Representing a Relation

Use the information in the table that shows the ages and weights of five toddlers.

Age (years), x	1	2	2	3	4
Weight (pounds), y	20	22	26	34	40

a. Identify the domain and range of the relation.

b. Represent the relation using a graph.

When you specify a domain or range, you should list each repeated value only once. In part (a), for instance, the domain is 1, 2, 3, 4, not 1, 2, 2, 3, 4.

Solution

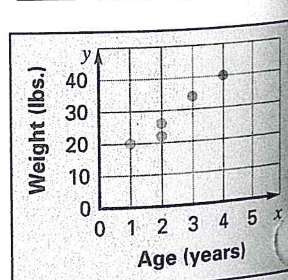
a. The domain of the relation is the set of all inputs, or x-values. The range is the set of all outputs, or y-values.

Domain: 1, 2, 3, 4 Range: 20, 22, 26, 34, 40

b. To represent the relation using a graph, write the ordered pairs given in the table.

(1, 20), (2, 22), (2, 26), (3, 34), (4, 40)

Graph the ordered pairs in a coordinate plane. The graph shows that toddler weight tends to increase with age.



EXAMPLE 2 Identifying a Function

Tell whether the relation represented by the table of toddler ages and weights in Example 1 is a function.

The input 2 has two outputs, 22 and 26. Therefore, the relation is not a function. This makes sense, as two toddlers of the same age do not necessarily weigh the same amount.

Guided Practice **For the relation, (a) identify the domain and range, (b) represent the relation using a graph, and (c) tell whether the relation is a function.**

1. (–5, 2), (–2, 5), (–5, –2), (2, 5)

2.

Input, x	0	1	2	3
Output, y	1	2	3	4

EXAMPLE 3 Multiple Choice Practice

Which graph best represents the total amount you are paid as a function of the number of hours you baby-sit?

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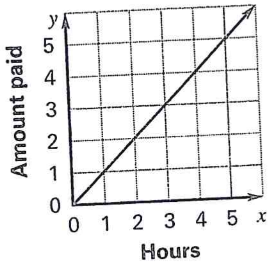

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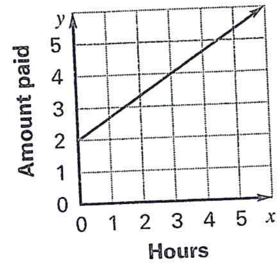

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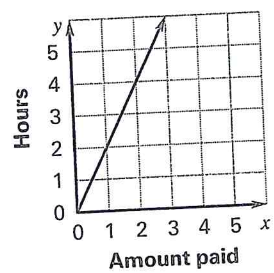

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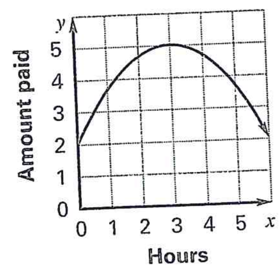

Solution

Because the total amount you are paid is a function of the number of hours you baby-sit, the [ ] values are the number of hours. So, the *x*-axis should be labeled with [hours]. In this situation, it also makes sense that the graph should include (0, 0) because if you baby-sit for 0 hours, you will get paid [$0]. Choice A has the *x*-axis labeled with [hours] and includes [(0, 0)].

Answer: The correct answer is [A]. Ⓐ Ⓑ Ⓒ Ⓓ

Guided Practice **Sketch a graph that could show the temperature of a cup of water as a function of time.**

3.)

EXAMPLE 4 Writing a Linear Function Rule

Mountain Climbing The table shows the height of a mountain climber on a cliff throughout the day.

Time (hours since 8:00 A.M.), x	1	2	3	4
Height (feet), y	75	125	175	225

a. Write a linear function rule that relates x and y.

b. Predict the height of the mountain climber at 2 P.M.

Solution

a. To verify that a linear function models the data, show that the rate of change in height is consistent from time to time.

$$\frac{125 - 75}{2 - 1} = 50; \quad \frac{175 - 125}{3 - 2} = 50; \quad \frac{225 - 175}{4 - 3} = 50$$

So, the height of the mountain climber can be modeled by a linear function $y = mx + b$ where the rate of change m is 50. To find b, substitute an ordered pair from the table, such as (1, 75) into the equation ______.

$75 = 50(1) + b \longrightarrow b = 75 - 50 = 25$

Answer: A linear function rule that relates x and y is $y = 50x + 25$.

b. Because 2 P.M. is 6 hours after 8 A.M., substitute 6 for x in the equation from part (a) to predict the height of the mountain climber at 2 P.M.

$y = 50(6) + 25 = 325$

Answer: The mountain climber will be at a height of 325 feet by 2 P.M.

Guided Practice **Write a function rule that relates x and y.**

Homework

4.

x	−1	1	2	3
y	1	5	7	9