

Functions

What You'll Learn

Scan the lesson. Predict two things you will learn about functions.

- .
- .

Essential Question

HOW can we model relationships between quantities?

Vocabulary

function
function table
independent variable
dependent variable

Common Core State Standards

Content Standards
8.F.1, 8.F.4

Mathematical Practices
1, 2, 3, 4

Vocabulary Start-Up

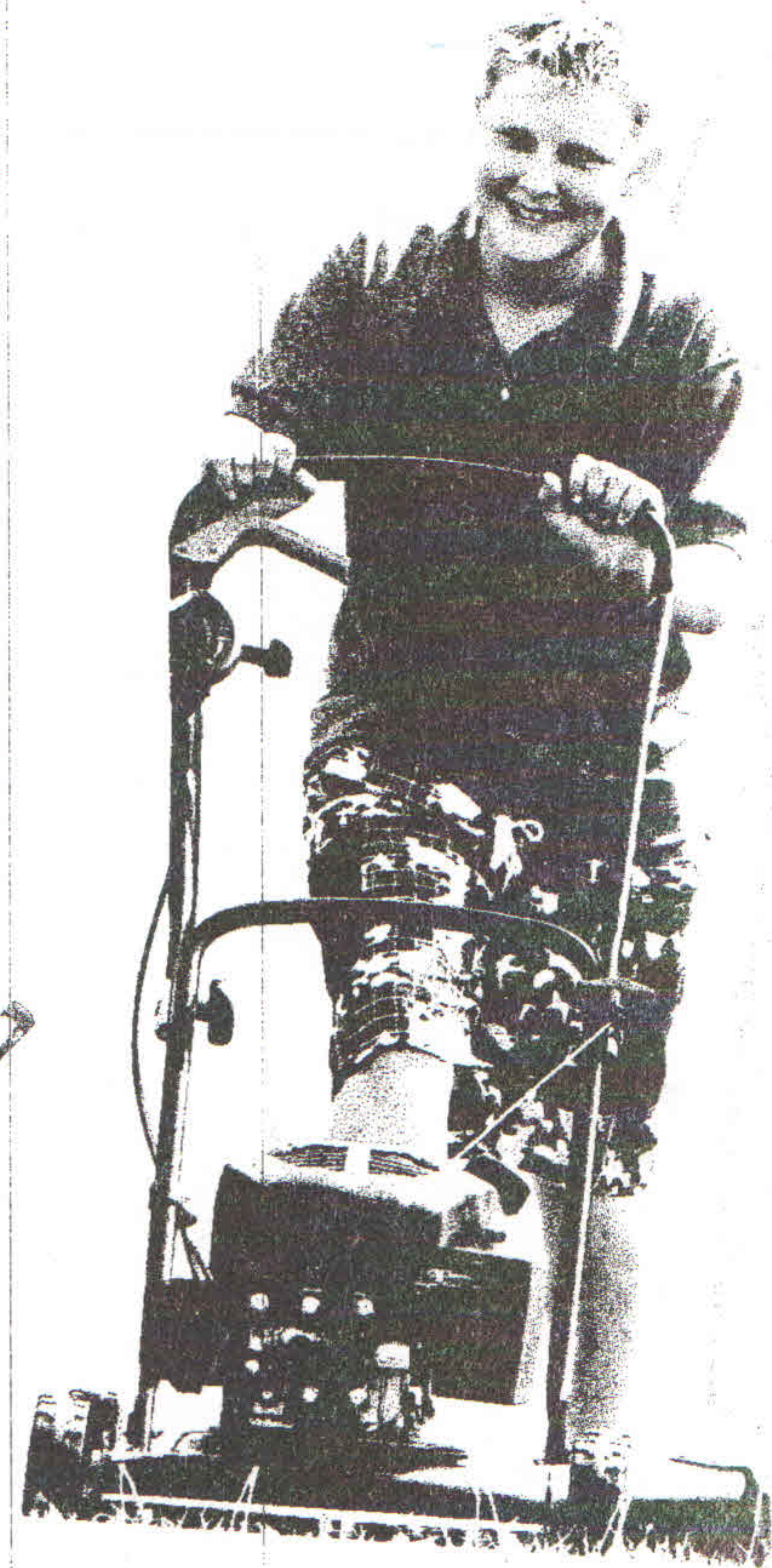
A **function** is a relation in which every member of the domain (input value) is paired with exactly one member of the range (output value). An example of a function is $m = 20n$, where m represents the amount of money earned and n represents the number of lawns mowed. In this example, n is the *independent variable* and m is the *dependent variable*.

Independent Variable
What I think it means

Dependent Variable
What I think it means

For each situation, determine which unknown is the dependent variable and which one is the independent variable.

Independent Variable	Equation	Dependent Variable
number of downloads	The equation $c = 0.99n$ represents the total cost c for n music downloads.	cost
	The equation $d = 4.5h$ represents the number of miles d Amber can run in h hours.	
	The equation $s = g + 3$ represents the final score of the game s after g goals in the final period.	



Functions

To find the value of a function for a certain number, substitute the number for the variable x .

$$f(x) = 15x$$

$f(x)$ is read the function of x , or f of x . It is the output or range.

The input x is any real number. It is the domain.

Example

Tutor

1. Find $f(-3)$ if $f(x) = 2x + 1$.

$$f(x) = 2x + 1$$

Write the function.

$$f(-3) = 2(-3) + 1$$

Substitute -3 for x into the function rule.

$$f(-3) = -6 + 1 \text{ or } -5$$

Simplify.

$$\text{So, } f(-3) = -5.$$

Show your work.

Got It? Do these problems to find out.

a. _____

Find each function value.

a. $f(2)$ if $f(x) = x - 4$

b. $f(11)$ if $f(x) = \frac{1}{2}x + 5$

b. _____

Function Tables

Watch

You can organize the input, rule, and output into a **function table**. The variable for the domain is called the **independent variable** because it can be any number. The variable for the range is called the **dependent variable** because it depends on the domain.

Example

Tutor

2. Choose four values for x to make a function table for $f(x) = x + 5$. Then state the domain and range of the function.

Substitute each domain value x into the function rule. Then simplify to find the range value.

The domain is $\{-2, -1, 0, 1\}$.

The range is $\{3, 4, 5, 6\}$.

Domain	Rule	Range
x	$f(x) = x + 5$	$f(x)$
-2	$-2 + 5$	3
-1	$-1 + 5$	4
0	$0 + 5$	5
1	$1 + 5$	6

Got It? Do this problem to find out.

- c. Choose four values for x to complete the function table for the function $f(x) = x - 7$. Then state the domain and range of the function.

Show your work.

x	$f(x) = x - 7$	$f(x)$



Examples

Tutor

There are approximately 770 peanuts in a jar of peanut butter. The total number of peanuts $p(j)$ is a function of the number of jars of peanut butter j .

3. Identify the independent and dependent variables.

Since the total number of peanuts depends on the number of jars of peanut butter, the number of peanuts $p(j)$ is the dependent variable and the jars of peanut butter j is the independent variable.

4. What values of the domain and range make sense for this situation? Explain.

Only whole numbers make sense for the domain because you cannot buy a fraction of a jar. The range values depend on the domain values, so the range will be multiples of 770.

5. Write a function to represent the total number of peanuts. Then determine the number of peanuts in 7 jars of peanut butter.

Words	The number of peanuts	equals	770 times	the number of jars
Function	$p(j)$	=	$770 \cdot$	j

The function $p(j) = 770j$ represents the situation.

To find the number of peanuts in 7 jars of peanut butter, substitute 7 for j .

$$p(j) = 770j \quad \text{Write the function.}$$

$$p(j) = 770(7) \text{ or } 5,390 \quad \text{Substitute 7 for } j.$$

There are 5,390 peanuts in 7 jars of peanut butter.

STOP and Reflect

What are the similarities and difference among the terms domain, range, independent variable, and dependent variable? Explain below.

Got It? Do these problems to find out.

d. _____

A scrapbooking store is selling rubber stamps for \$4.95 each. The total sales $f(n)$ is a function of the number of rubber stamps n sold.

- d. Identify the independent and dependent variables.
- e. What values of the domain and range make sense for this situation? Explain.
- f. Write a function to represent the total sales. Then determine the total sales for 5 stamps.

Show your work.

e. _____

f. _____

Guided Practice

Check



- 1. Find $f(4)$ if $f(x) = x - 6$. (Example 1)
- 2. Choose four values for x to make a function table for $f(x) = 8 - x$. Then state the domain and range of the function. (Example 2)

x	$8 - x$	$f(x)$

Show your work.

- 3. A hot air balloon can hold 90,000 cubic feet of air. It is being inflated at a rate of 6,000 cubic feet per minute. The total cubic feet of air $a(t)$ is a function of the time in minutes t . (Examples 3 - 5)
 - a. Identify the independent and dependent variables.

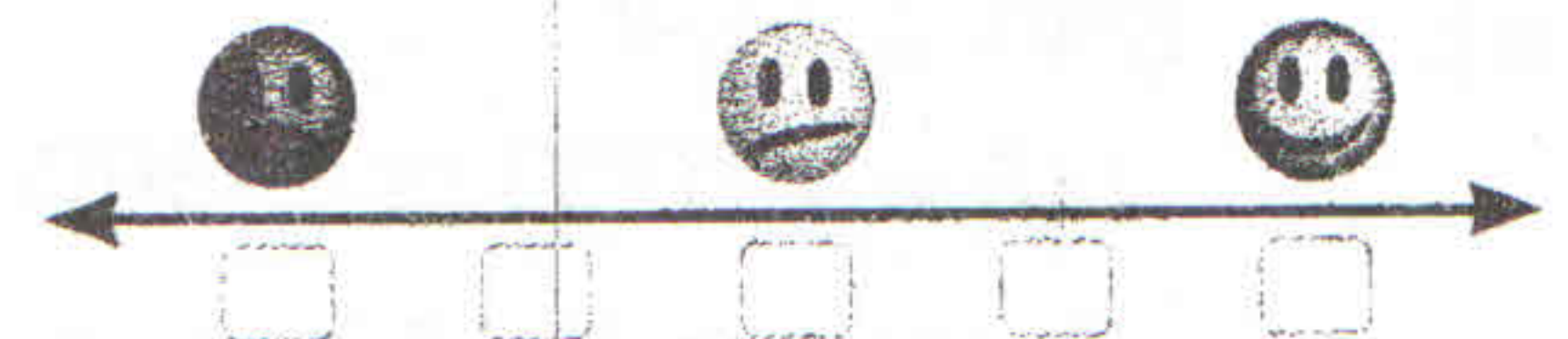
b. What values of the domain and range make sense for this situation? Explain.

c. Write a function to represent the total amount of air. Then determine the total amount of air in 6 minutes.

- 4. **Building on the Essential Question** How does the domain affect the range in a function?

Rate Yourself!

How confident are you about functions? Check the box that applies.



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