

A <u>relation</u> is a pairing of numbers in one set, call the <u>domain</u>, with numbers in another set, called the <u>range</u>. A relation is often represented as a set of ordered pairs (x, y). In this case, the domain is the set of x-values and the range is the set of y-values.

A function is a special type of relation in which each value in the domain is paired with exactly one value in the range.

## PROBLEM 1: IDENTIFYING FUNCTIONS USING MAPPING DIAGRAMS

Identify the domain and range of each relation. Represent the relation with a mapping diagram. Is the relation a function?

relation à function:	( )-4(-1-7()-5(3-
a) {(-2, 0.5), (0, 2.5), (4, 6.5), (5, 2.5)} Domain Range -2 0.5 2.5 4 -2 -2 -2 -2 -2 -2 -2 -2 -2 -2	b) $\{(6,5), (4,3), (6,4), (5,8)\}$ Function 4 5 6 7 7 7 7 7 7 7 7 7 7 7 7 7
c) {(4.2, 1.5), (5, 2.2), (7, 4.8), (4.2, 0)}	d) {(-1, 1), (-2, 2), (4, -4), (7, -7)}
DR	DR
$4.2 + 0 \\ 5 + 0 \\ 5 - 0.2 \\ 7 + 4.8 $ Not a Function	-2 -1 -4

Another way to decide if a relation is a function is to analyze the graph of the relation using the vertical line test. If any vertical line passes through more than one point of the graph, then for some domain value there is more than one range value. So the relation is not a function.

### **PROBLEM 2: IDENTIFYING FUNCTIONS USING THE VERTICAL LINE TEST**

Is the relation a function?



You have seen functions represent as equations involving x and y, such as y = -3x + 1. Below is the same equation written using *function notation*.

f(x) = -3x + 1

Notice that f(x) replaces y. It is read "f of x." The letter f is the name of the function, not a variable. Function notation is used to emphasize that the function value f(x) depends on the independent variable x. Other letters besides f can also be used, such as g and h.

# **PROBLEM 3: EVALUATING A FUNCTION**

 $\omega(x) = 250x$ 

W(8)=250(8) W(8)=2000

a) The function w(x) = 250x represents the number of words w(x) you can read in x minutes. How many words can you read in 8 min? y=250x X=8; y=250(8

2060 words

b) Light travels about 186,000 mi/s. The function d(t) = 186,000t gives the distance d(t), in miles, that light travels in t seconds. How far does light travel in 30 s?



c) You are buying orange juice for \$4.50 per container and have a gift card worth \$7. The function f(x) = 4.50x - 7 represents your total cost f(x) if you buy x containers of orange juice and use the gift card. How much do you pay to buy 4 containers of orange juice?

 $f(x) = 4.50 \times -7$  f(4) = 4.50(4) - 7f(4) = 11

Use the functions f(x) = 2x and  $g(x) = x^2 + 1$  to find the value of each expression.



$$f) f(5) - 2[g(1)] \qquad h) f(g(3)) \qquad j \end{pmatrix} g(f(3))$$

$$2(5) - 2[(1)^{3} + 1] \qquad f'(3^{2} + 1) \qquad g(2(3))$$

$$10 - 2[7] \qquad f'(9+1) \qquad g(6)$$

$$10 - 1 \qquad f'(10) \qquad 6^{2} + 1$$

$$2(10) \qquad 36 + 1$$

$$20 \qquad 37$$

**PROBLEM 4: FINDING THE RANGE OF A FUNCTION** *Find the range of the function for the given domain.* 

a) 
$$f(x) = -1.5x + 4; \{1, 2, 3, 4\}$$
  
x  $f(x) = -1.5x + 4; \{1, 2, 3, 4\}$   
x  $f(x) = -1.5(x) + 4$   $f(x)$   
y  $f(x) = -1.5(x) + 4$  1  
y  $f(x) = -1.5(x) + 4$  1  
y  $f(x) = -1.5(x) + 4$  -0.5  
y  $f$ 

b) 
$$g(x) = 8x - 3; \left\{-\frac{1}{2}, \frac{1}{8}, \frac{1}{4}, \frac{3}{4}\right\}$$

d) 
$$f(x) = x^{2}; \{-2, -1, 0, 1, 2\}$$
  
 $\times \quad f(x) = x^{2} \quad f(x)$   
 $-2 \quad f(-3) = (-2)^{2} \quad 4$   
 $-1 \quad f(-1) = (-1)^{2} \quad 1$   
 $0 \quad f(0) = (0)^{2} \quad 0$   
 $1 \quad f(1) = (1)^{2} \quad 1$   
 $2 \quad f(2) = (2)^{2} \quad 4$ 

#### PROBLEM 5: IDENTIFYING A REASONABLE DOMAIN AND RANGE

a) You have 3 qt of paint the trim in your house. A quart of paint covers 100 ft<sup>i</sup>. The function A(q) = 100q represents the area A(q), in square feet, that q quarts of paint cover. What domain and range are reasonable for the function?

IND. VARIABLEDEP. VARIABLE
$$A(6) = 100(6)$$
guarts of paintarea of paint cover $= 0$ DomainRange $= 0$  $0 + 0.3$  guarts of paint $0 + 0.300$  GH2 of paint cover $= 300$  $0 = 8 = 3$  $0 = A(g) \leq 300$  $= 300$  $g \in [0,3]$  $A(g) \in [0,303]$  $A(g) \in [0,303]$ b) If you have 7 qt of pain, what domain and range are reasonable for the area of paint cover?

Domain Range 
$$A(7) = 100(7)$$
  
 $6 + 67 guarts 6 + 6700 ft^2 = 700$ 

c) A car can travel 32 mi for each gallon of gasoline. The function d(x) = 32x represents the distance d(x), in miles, that the car can travel with x gallons of gasoline. The car's fuel tank holds 17 gallons of gasoline. What is a reasonable domain and range?

Domain Range 
$$d(o)=32(o)$$
  
 $6 + 0 + 7 gal$   $0 + 0 + 544 miles$   $d(r)=32(r)$   
 $= 544$ 

d) There are 98 International Units (IUs) of vitamin D in 1 cup of milk. The function V(c) = 98c represents the amount V(c) of vitamin D, in IUs, you get from c cups of milk. You have a 16-cup jug of milk.

# Homework 4 - 6

Identify the domain and range of each relation. Use a mapping diagram to determine whether the relation is a function.

- **1.**  $\{(3, 6), (5, 7), (7, 7), (8, 9)\}$ **2.**  $\{(0, 0.4), (1, 0.8), (2, 1.2), (3, 1.6)\}$
- **3.** { (5, -4), (3, -5), (4, -3), (6, 4) } **4.** {(0.3, 0.6), (0.4, 0.8), (0.3, 0.7), (0.5, 0.5)}

#### Use the vertical line test to determine whether the relation is a function.



- 7. The function w(x) = 60x represents the number of words w(x) you can type in x minutes. How many words can you type in 9 minutes?
- **8.** Sound travels about 343 meters per second. The function d(t) = 343t gives the distance d(t) in meters that sound travels in *t* seconds. How far does sound travel in 8 seconds?

4-6 Homework (continued)

Find the range of each function for the given domain.

**9.** 
$$f(x) = -3x + 2$$
;  $\{-2, -1, 0, 1, 2\}$   
**10.**  $f(x) = x^3$ ;  $\{-1, -0.5, 0, 0.5, 1\}$ 

**11.** 
$$f(x) = 4x + 1; \{-4, -2, 0, 2, 4\}$$
  $f(x) = x^2 + 2; \{0, \frac{1}{4}, \frac{1}{2}, \frac{3}{4}, 1\}$ 

# Find a reasonable domain and range for each function. Then graph the function.

**13.** A high school is having a pancake breakfast fundraiser. They have 3 packages of pancake mix that each feed 90 people. The function N(p) = 90p represents the number of people N(p) that p packages of pancake mix feed.

14. A charter boat travels at a maximum rate of 25 miles per hour. The function d(x) = 25x represents the distance d(x), in miles, that the boat can travel in x hours. The charter boat travels a maximum distance of 75 miles from the shore.

**15. Reasoning** If  $f(x) = x^2 - 3$  and f(a) = 46, what is the value of *a*? Explain.

**16. Open-Ended** What is a value of x that makes the relation  $\{(2, 4), (3, 6), (x, 8)\}$  a function?

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