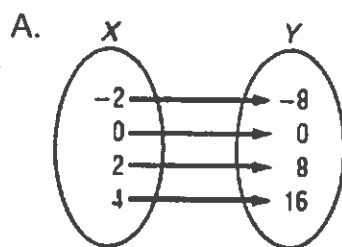


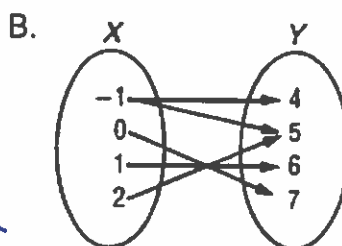
Lesson 4-6 Functions

A relation is a function if each element of the domain is paired with exactly 1 element in the range. (No x-values are repeated.)

Mapping



This is a function because the mapping shows each element of the domain (the x-values) has exactly 1 arrow pointing to a y-value.



This is not a function because -1 in the domain is paired with 4 and 5.

C.

x	y
-7	-12
-4	-9
2	-3
5	0

This is a function because every x-value is is paired with exactly one y-value.

D.

x	y
3	2
1	-2
2	-4
3	-1

This is not a function because 3 in the domain is paired with 2 and -1.

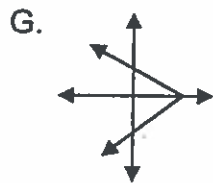
Ordered Pairs

E. $\{(-5, 2), (-2, 5), (0, 7), (0, 9)\}$ This is not a function because 0 is paired with 7 and 9

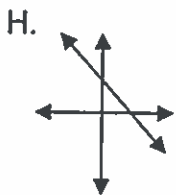
F. $\{(3, 0), (1, 2), (4, 0), (5, -1)\}$ This is a function because every x has a unique y (only 1 value per x).

102 Lesson 4-6 Functions

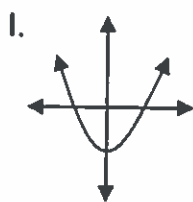
Vertical Line Test – If a graph represents a function, no vertical line can be drawn that intersects the graph more than once.



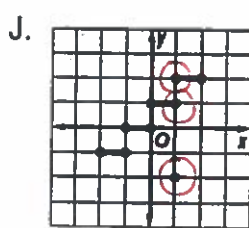
not a function



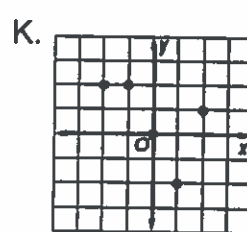
function (linear)



function (quadratic)



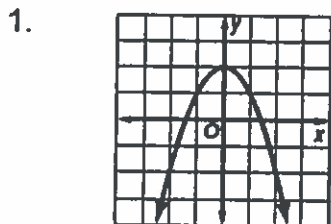
not a function



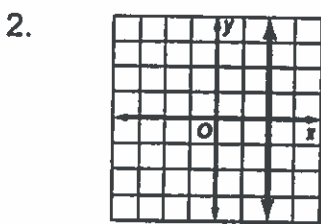
function

PRACTICE:

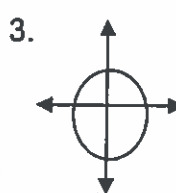
Determine if each relation is a function.



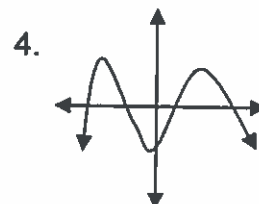
function



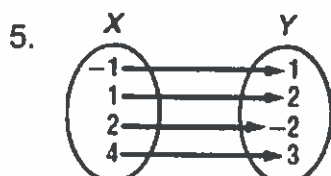
not a function



not a function



function

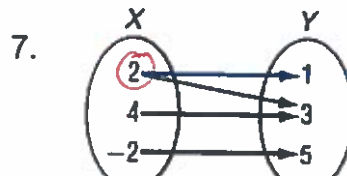


function

6.

x	-1	1	2	4
y	1	2	-2	3

function



not a function

8.

x	3	4	4	5
y	-1	2	3	6

not a function

9. $\{(3, 0), (-2, -2), (7, -2), (-2, 0)\}$
not a function

10. $-2x + 4y = 0$
function

11. $x^2 + y^2 = 8$
not a function (circle)

12. $x = -4$
not a function (vertical line)

HINT: If an equation has both x^2 and y^2 , it is NOT a function (It's a circle or an ellipse.) If an equation only has " $x = \underline{\quad}$ " and no y -term, it is NOT a function. (It is a vertical line.)

Lesson 4-6 Functions

FUNCTION VALUES:

Equations that are function can be written in function notation.

EQUATION: $y = 3x + 8$ FUNCTION NOTATION: $f(x) = 3x + 8$

In a function, x represents the elements of the domain and $f(x)$ represents the elements of the range. To solve a problem in function notation, substitute the value in the parentheses (next to the "f") for every "x" in the problem and simplify.

L: If $f(x) = 3x - 4$, find $f(4)$

$$\begin{aligned}
 f(4) &= \underline{3(4) - 4} \\
 &= \underline{12 - 4} \\
 &= \underline{8}
 \end{aligned}$$

M. If $f(x) = 3x - 4$, find $f(-5)$

$$\begin{aligned}
 f(-5) &= \underline{3(-5) - 4} \\
 &= \underline{-15 - 4} \\
 &= \underline{-19}
 \end{aligned}$$

N. If $k(m) = m^2 - 4m + 5$, find $k(-3)$

$$\begin{aligned}
 k(-3) &= \underline{(-3)^2 - 4(-3) + 5} \\
 &= \underline{9 + (+12) + 5} \\
 &= \underline{26}
 \end{aligned}$$

O. If $k(m) = m^2 - 4m + 5$, find $k(6z)$

$$\begin{aligned}
 k(6z) &= \underline{(6z)^2 - 4(6z) + 5} \\
 &= \underline{36z^2 - 24z + 5}
 \end{aligned}$$

Note: Must square both the 6 and the z.

If $h(x) = 3x^2 - 4$, find each value:

P. $h(2)$

$$\begin{aligned}
 &\underline{3(2)^2 - 4} \\
 &\underline{3(4) - 4} \\
 &\underline{12 - 4 = 8}
 \end{aligned}$$

only the 2 is squared

Q. $h(3d)$

$$\begin{aligned}
 &\underline{3(3d)^2 - 4} \\
 &\underline{3(9d^2) - 4} \\
 &\underline{27d^2 - 4}
 \end{aligned}$$

Note: Square the 3 and d, then multiply by 3.

Lesson 4-6 Functions

Try these: (Be careful to use the correct function rule)

PRACTICE:

If $f(x) = 2x - 4$ and $g(x) = x^2 - 4x$, find each value.

1. $f(4)$

$$\begin{aligned} f(4) &= 2(4) - 4 \\ &= 8 - 4 \\ &= 4 \end{aligned}$$

2. $g(2)$

$$\begin{aligned} g(2) &= 2^2 - 4(2) \\ &= 4 - 8 \\ &= -4 \end{aligned}$$

3. $f(-5)$

4. $g(-3)$

5. $f(0)$

6. $g(0)$

7. $f(3) - 1$

8. $f\left(\frac{1}{4}\right)$

9. $g\left(\frac{1}{4}\right)$

10. $f(a^2)$

11. $f(k + 1)$

12. $g(2c)$

13. $f(3x)$

14. $f(2) + 3$

15. $g(-4)$

Lesson 4-6 Functions

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Finding the range of a Function

The domain of $f(x) = \frac{1}{2}x + 3$ is $\{-4, -2, 0, 2, 4\}$. Find the range.

x	$\frac{1}{2}x + 3$	$f(x)$
-4	$\frac{1}{2}(-4) + 3 = -2 + 3 = 1$	1
-2	$\frac{1}{2}(-2) + 3 = -1 + 3 = 2$	2
0	$\frac{1}{2}(0) + 3 = 0 + 3 = 3$	3
2	$\frac{1}{2}(2) + 3 = 1 + 3 = 4$	4
4	$\frac{1}{2}(4) + 3 = 2 + 3 = 5$	5

Work the problem 5 times!

$$\text{Range} = \{1, 2, 3, 4, 5\}$$

Identifying a Reasonable Domain and Range

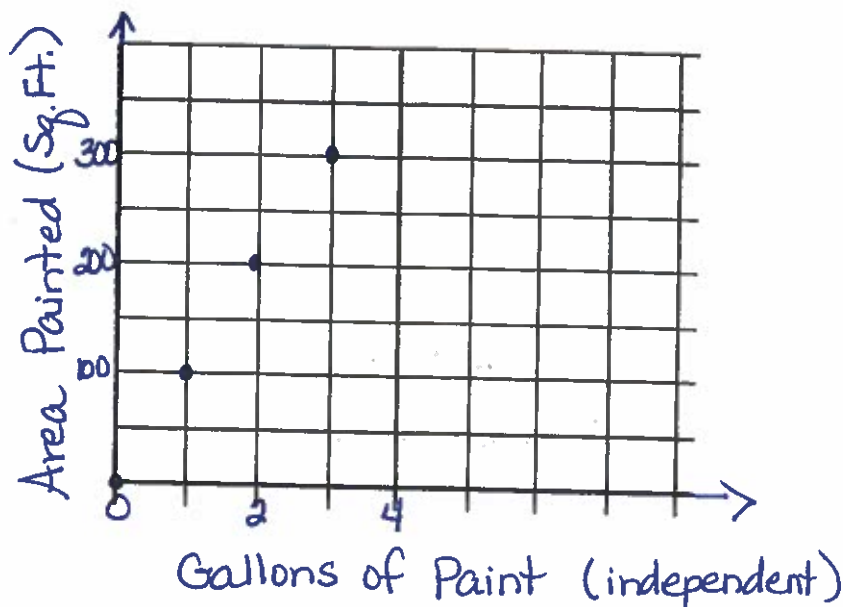
You have 3 qt. of paint to paint the trim in your house. A quart of paint covers 100 ft^2 . The function $A(q) = 100q$ represents the area $A(q)$ in square feet, the q quarts of paint cover. What domain and range are reasonable for the function? What is the graph of the function?

$$\text{Domain: } \{0, 1, 2, 3\}$$

HINT: Find the least and greatest amount of paint you can use and area of trim you can over. Use these values to make a graph.

$A(q) = 100q$

q	$A(q)$
0	$100 \cdot 0 = 0$
1	$100 \cdot 1 = 100$
2	$100 \cdot 2 = 200$
3	$100 \cdot 3 = 300$



106 Lesson 4-6 Functions

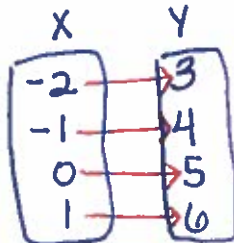
PRACTICE

1. Identify the domain and range of the relation $\{(-2, 3), (-1, 4), (0, 5), (1, 6)\}$.

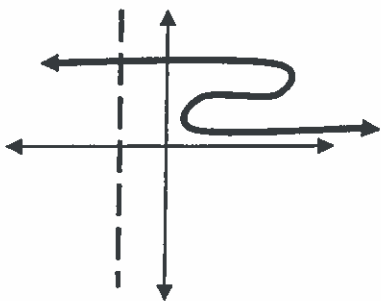
Represent the relation with a mapping diagram. Is the relation a function?

Domain: $\{-2, -1, 0, 1\}$

Range: $\{3, 4, 5, 6\}$



2. Write $y = 2x + 7$ using function notation. $f(x) = 2x + 7$

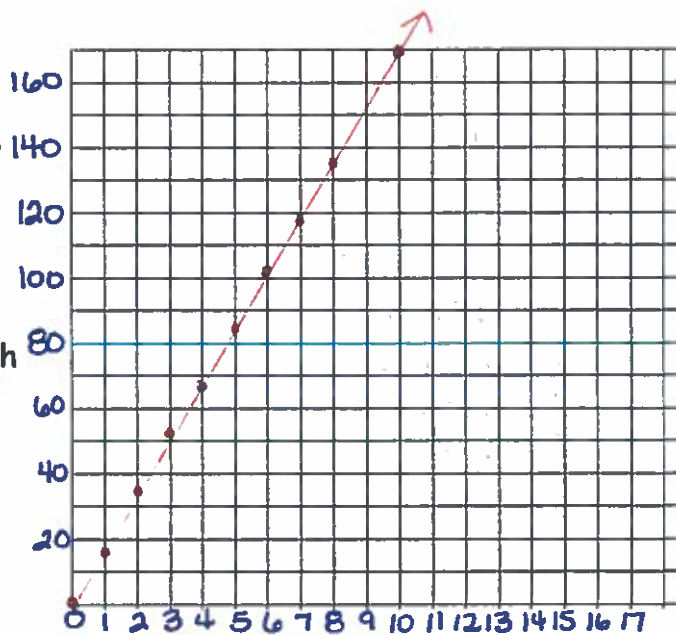


3. A student drew the dashed line on the graph shown and concluded that the graph represented a function. Is the student correct? Explain.
No. The graph fails the vertical line test on the positive side of the x-axis.

4. 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. Find a reasonable domain and range for the function, then graph the function.

Domain: $0 \leq x \leq 17$

Range: $0 \leq y \leq 544$
 (0 · 32) (17 · 32)

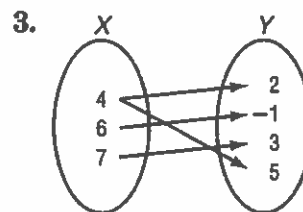
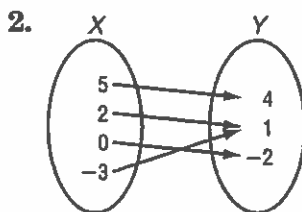
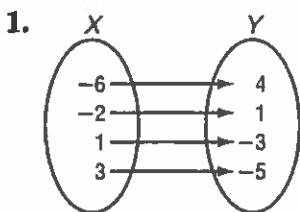


4-6

Skills Practice

Functions

Determine whether each relation is a function.



4.

x	y
4	-5
-1	-10
0	-9
1	-7
9	1

5.

x	y
2	7
5	-3
3	5
-4	-2
5	2

6.

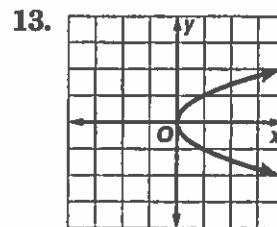
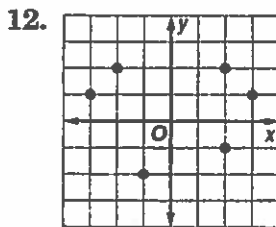
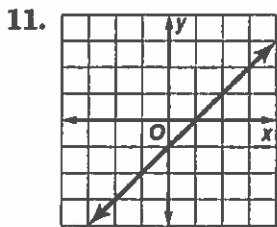
x	y
3	7
-1	1
1	0
3	5
7	3

7. $\{(2, 5), (4, -2), (3, 3), (5, 4), (-2, 5)\}$

8. $\{(6, -1), (-4, 2), (5, 2), (4, 6), (6, 5)\}$

9. $y = 2x - 5$

10. $y = 11$



If $f(x) = 3x + 2$ and $g(x) = x^2 - x$, find each value.

14. $f(4)$

15. $f(8)$

16. $f(-2)$

17. $g(2)$

18. $g(-3)$

19. $g(-6)$

20. $f(2) + 1$

21. $f(1) - 1$

22. $g(2) - 2$

23. $g(-1) + 4$

24. $f(x + 1)$

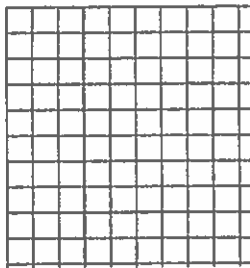
25. $g(3b)$

PRACTICE Lesson 4-4

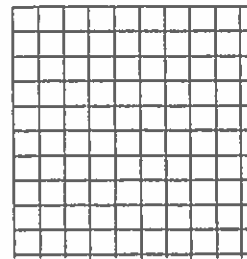
For each table, determine whether the relationship is a function. Then represent the relationship using words, an equation, and a graph.

1

x	y
0	2
1	3
2	4
3	5

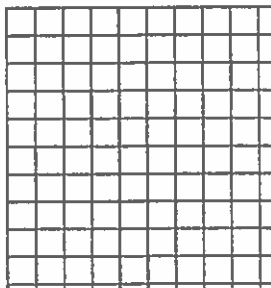


x	y
0	5
1	7
2	9
3	11



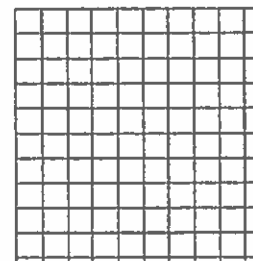
3.

x	y
0	-2
1	-1
2	0
3	1



4.

n	m
0	1
1	-2
2	-5
3	-8



5. **Reasoning** Graph the set of ordered pairs (0, 6), (1, 4), (2, 2), (3, 0). Determine whether the relationship is a linear function. Explain how you know.

