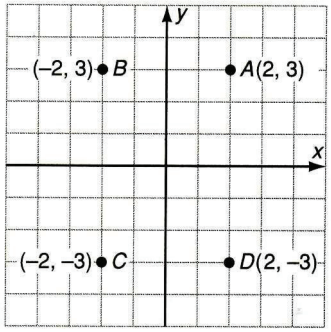
GRAPHING FUNCTIONS

Ordered pairs can be placed, or **plotted,** on a **coordinate graph**. This can be useful in our study of functions.

Each member of an ordered pair is called a **coordinate**. The first coordinate of the ordered pair is the *x* value and is measured on the horizontal axis, the **x-axis**. In function vocabulary, this is the member of the **domain**.

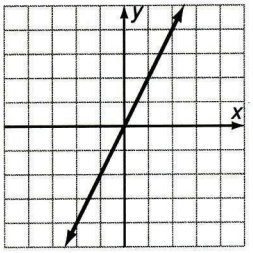
The second coordinate of the ordered pair is the y value and is measured on the vertical axis, the **y-axis**. In function vocabulary, this is said to be the **corresponding member** of the **range.**

The ordered pairs A (2,3); B(-2,3);C(-2,-3); and D(2,-3) are graphed below.

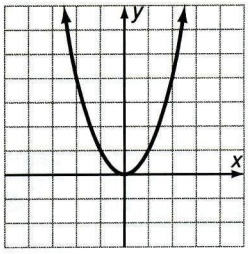


If the domain is increased so that it includes all real numbers, the number of ordered pairs will be infinite. To get an idea of the possible ordered pairs, we can graph some ordered pairs of the function and then connect them in sequence from left to right. Below are graphs of the functions $f(x)=2x, f(x)=x^2$, and $f(x)=x+1$ that we found earlier. These rules can also be written as $y=2x, y=x^2, y=x+1.$ In this case we say that *y is a function of x.*

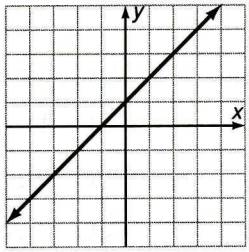
{(−1,−2), (1,2), (2,4), (3,6), (4,8)}
$f(x) = 2x$



{(−1,1), (1,1), (2,4), (3,9), (4,16)}
$f(x) = x^2$

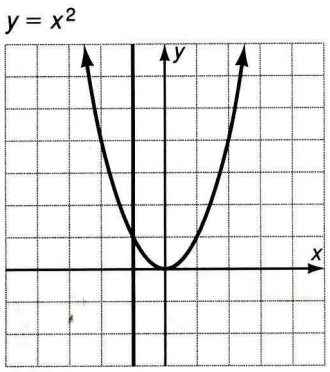


{(−1,0), (1,2), (2,3), (3,4), (4,5)}
$f(x) = x + 1$



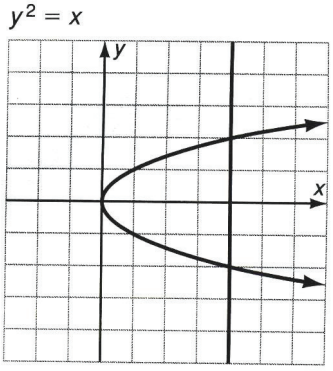
We can determine whether a graph is or is not a function by using the **vertical line test**. A function is defined as a relation in which one and only one value of the range (*y*) corresponds to each value of the domain *(x*). If a graph is a function and we draw a vertical line anywhere on the coordinate grid, that line will intersect the graph **at no more than one point**. All points on the vertical line will have the same *x* value. Therefore, only one *y* value is part of the graph of a function. If there is more than *y* value, the graph is not a function. Look at the following examples.

EXAMPLE 1



The graph above passes the vertical line test, because any vertical line will intersect the graph at only one point. Therefore $y = x^2$ is a function.

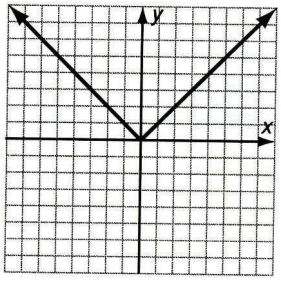
EXAMPLE 2



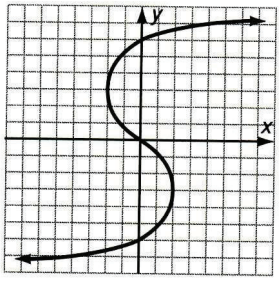
This graph does not pass the vertical line test, because the vertical line intersects the graph at more than one point. Therefore, $y^2 = x$ is *not* a function**.**

Using the vertical line test, determine which of the following graphs are functions:

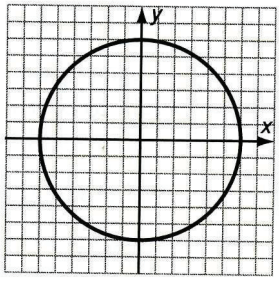
1.



2.



3.



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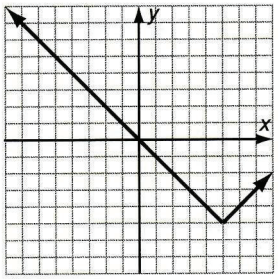
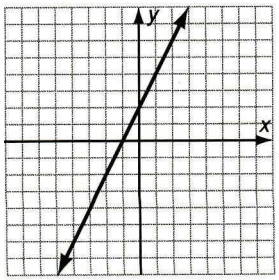
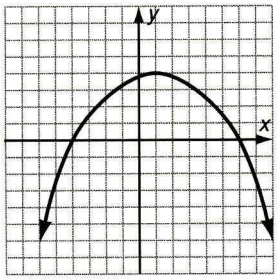
1.



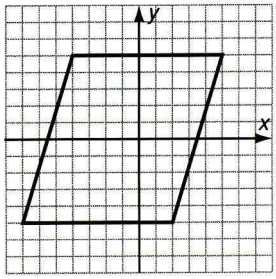
2.



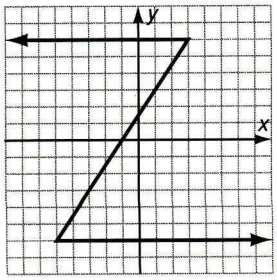
3.



4.



5.



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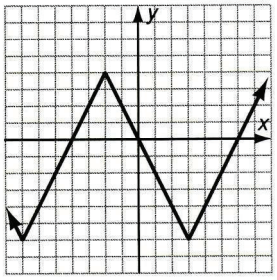

APPLICATIONS OF FUNCTIONS

Functions are used in real-world problems. For example, suppose that your school club is selling candy bars to raise money. You might use the following table to find the cost of more than 1 candy bar:

Number of candy bars	Cost
1	$0.80
2	$1.60
3	$2.40
4	$3.20
5	$4.00

You can also write a rule or **formula**, letting a variable such as *x* represent the number of candy bars. Then \$0.80*x* would represent the total cost of *x* candy bars:

$$f(x) = \$0.80x \quad \text{or} \quad y = \$0.80x$$

Another kind of function is a repairman's or repairwoman's rate. Suppose this person charges an initial fee of \$25 to come to your home and then \$30 per hour until the job is completed:

Let *h*= numbers of hours worked

$f(h) =$ total cost of the job

$$f(h) = \$25 + \$30h$$

Or

$$y = \$25 + \$30h$$

Any formula is really a form of a function. For example, the area A of a circle depends on the radius of the circle: A= πr^2. We can say that the area is a function of the radius or A is a function of *r*.

EXAMPLE 1: The rental rate for a car is \$25 per day and \$0.20 per mile. Write an equation representing the cost of renting this car for 1 day**.**

Answer: Let x=number of miles driven and y=cost of renting the car for 1 day. Then: y = \$25 + \$0.20x

EXAMPLE 2: The pressure on the bottom of a water tank is 62.4 times the depth of the water in the tank. Write an equation to represent this.

Answer: Let *d*= depth of water and *p*=pressure. Then: *p = 62.4d*

Try these:

1. Cost C of printing a booklet at \$1.25 plus \$0.15 per page.

2. Perimeter P or an equilateral triangle.

3. Cost C of renting a rug cleaner at \$10 plus \$0.75 per hour.

1. Which of the following relations is a function?

   A. {(3, 5), (2, 6), (1, 7), (0, 6), (1, 8)}

   B. {(4, 5), (4, 6), (4, 7), (4, 8)}

   C. {(1, 6), (2, 6), (3, 6), (4, 6), (5, 6)}

   D. {(2, 6), (6, 2), (1, 2), (2, 1)}

2. Which relation is a function?

   A. {(1 in., Jacksonville), (2.5 in., Daytona), (2 in., Tampa), (1 in., West Palm Beach)}

   B. {(Levy, Bronson), (Liberty, Bristol), (Polk, Bartow), (Dade, Miami)}

   C. {(22, 750; Plant City), (22, 242; Winter Park), (24, 830; Key West), (24, 830; Jupiter)}

   D. {(Orlando, 81°), (Orlando, 83°), (Orlando, 89°), (Orlando, 93°)}

3. Which is NOT a function?

   A. {(0, −1), (−1, −2), (−2, −3), (−3, −4)}

   B. {(7, −3), (8, −3), (−3, 8), (3, 7)}

   C. {(4, 5), (5, 4), (4, 6), (6, 4)}

   D. {(3, 9), (2, 8), (1, 7), (0, 6)}

4. A function is described by the equation $3n - 1 = m$. What value of m completes the table?

n	0	2	5	6	11
m	−1	5	14	?	32

   A. 15 **C.** 17

   B. 16 **D.** 24

5. Find the number that completes this table.

x	1	2	3	4	5	6	7	8
y	1	1	2	3	5	8	?	21

   A. 12 **C.** 16

   B. 13 **D.** 20

6. Which decimal represents this visual pattern?

   △ ▽ ◁ ◁

   A. 0.3333333 . . .

   B. 0.12331233 . . .

   C. 0.32132132 . . .

   D. 0.31313131 . . .

7. Find the missing number.

c	1	2	3	5	?	10	12
v	1	4	9	25	64	100	144

8. Find the missing number.

f	−2	−1	0	1	2	3	6
h	−8	−1	0	1	8	27	?

9. The expression $4(x + 1)$ defines y. Find the missing number.

x	0	3	7	8	11	20	25
y	4	16	32	36	?	84	104

10. Find the total number of ⊗'s needed to represent the 6th "term."

⊗ ⊗ ⊗ ⊗ ⊗ ⊗ ⊗ ⊗ ⊗ ⊗ ⊗ ⊗ ⊗ ⊗ ⊗