Algebra I Notes

4-1 Using Graphs to Relate Two Quantities

Objectives: To represent mathematical relationships using graphs.

Example 1

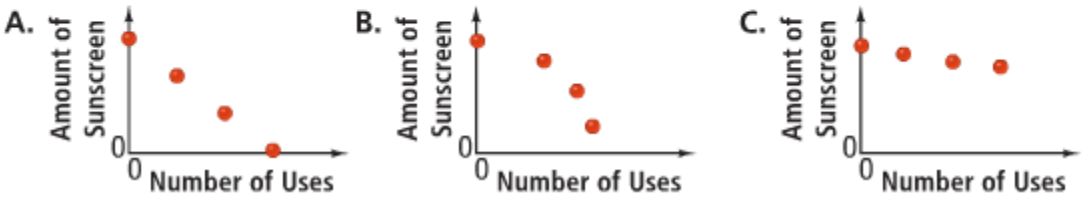
a) Sketch a graph to represent the volume of air in a balloon over time.

b) What are the variables in the graph?

c) Describe how the variables are related at various points on the graph.

Example 2 The table shows the amount of sunscreen left in a can based on the number of times the sunscreen has been used. Which graph could represent the data shown in the table?

Sunscreen				
Number of Uses	0	1	2	3
Amount of Sunscreen (oz)	5	4.8	4.6	4.4



Example 3 Sketch a graph representing your drive to school. Be sure to label each axis and title your graph.

Algebra I Notes

4.2 & 4.3 Patterns & Functions

Objectives:	To identify patterns & functions To evaluate functions

VOCABULARY

FUNCTION - a relation that assigns exactly one value in the range to each value of the domain

LINEAR FUNCTION - a function whose graph is a straight line. *You can express a linear function with a linear equation.*

NON-LINEAR FUNCTION - a function whose graph is not a line or part of a line.

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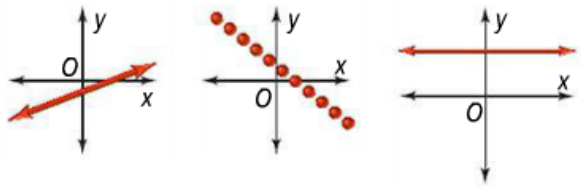
take note

Concept Summary **Linear and Nonlinear Functions**

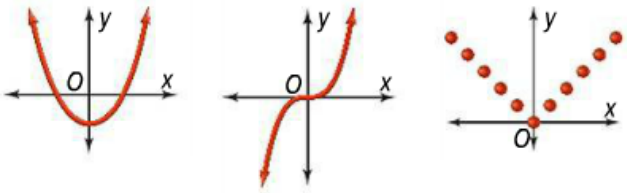
Linear Function

A linear function is a function whose graph is a nonvertical line or part of a nonvertical line.

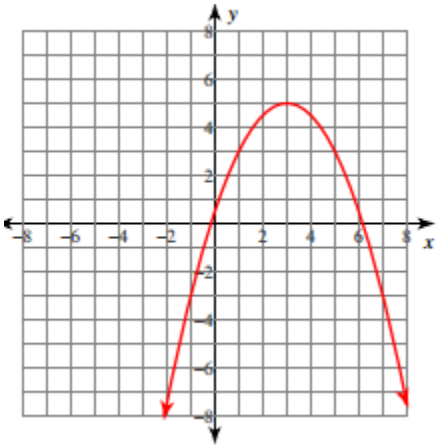


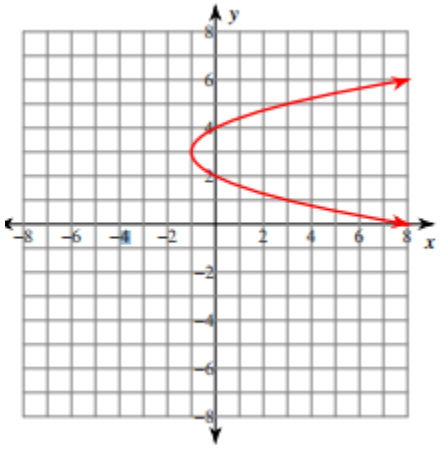
Nonlinear Function

A nonlinear function is a function whose graph is not a line or part of a line.



Determine if each graph represents a function or not a function.





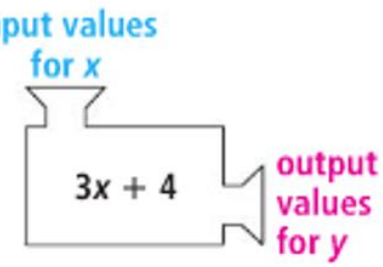
You can think of a function rule as an input-output machine.

DOMAIN – set of input values

RANGE – set of output values

$y = 3x + 4$

output ↑ input ↑



Input	Output
x	*y*
1	7
2	10
3	13

PATTERNS AND FUNCTIONS

Example 1

The table shows the amount of water *y* in a tank after *x* minutes of being drained. Is the relationship a function? Describe the relationship using words and an equation.

CAR WASH GRAND OPENING

Time, *x* (minutes)	Water, *y* (gallons)
0	440
1	428
2	416
3	404

Step 1: To decide if this is a function, determine if each input is paired with exactly one output. If so, then the relationship is a function.

Step 2: To describe the relationship, look at how *y* changes for each change in the *x* value.

In the above relationship, time is ____ at the start, and there are _____ gallons in the tank.

Time, *x*, _____ by ____ each time. Water, *y*, _____ by _____.

Step 3: In words, the amount of water left is _____ minus _____ times the number of minutes.

Step 4: Write information in Step 3 as an equation. _____

PRACTICE

Use the table below . Determin if the relationship is a function. Describe the relationship using words and an equation.

Input, x	Output, y
0	8
1	10
2	12
3	14

CLASSIFYING FUNCTIONS AS LINEAR OR NONLINEAR

Example 2 The area A, in square inches of a pizza is a function of its radius, r, in inches. The cost C, in dollars, of the sauce for a pizza is a function of the weight w, in ounces of sauce used.

LINEAR IF the change in the values of **both** input and output values are constant.

NOT LINEAR IF the change in both the input and output values are not constant.

Determine if each function is linear or nonlinear. If linear, write the equation.

Pizza Area

Radius (in.), r	Area (in.^{2}), A
2	12.57
4	50.27
6	113.10
8	201.06
10	314.16

Sauce Cost

Weight (oz), w	Cost, C
2	$.80
4	$1.60
6	$2.40
8	$3.20
10	$4.00

PRACTICE Determine if each function is linear or nonlinear. If linear write the equation.

1. The number of centimeters is a function of the number of inches as shown in the table below. Is the function linear or nonlinear? Explain.

CONVERTING INCHES TO CENTIMETERS

Inches	Centimeters
1	2.54
2	5.08
3	7.62
4	10.16

2. The table below shows the number of calls made in a phone tree during each level. Is the function linear or nonlinear? Explain.

PHONE TREE

Level, *x*	Number of Calls, *y*
1	2
2	4
3	8
4	16
5	32

3.

Input (x)	Output (y)
1	0
2	3
4	9
8	21

Algebra I Notes

4-4 Graphing a Function Rule

Objectives: To graph equations that represent linear and non-linear functions.

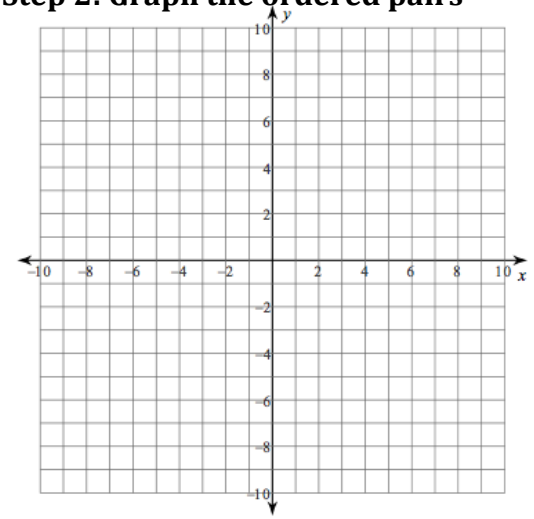
The set of all solutions of an equation forms that equation's graph. A graph may include solutions that do not appear in a table.

Example 1 Graph $y = -2x + 1$ using a table

Step 1: Make a table of values

x	$y = -2x + 1$	(x, y)
-2		
-1		
0		
1		
2		

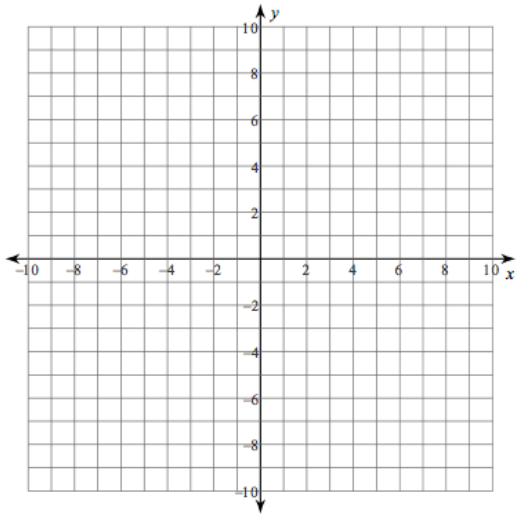
Step 2: Graph the ordered pairs



Step 3: Connect all the points with a line to represent all the solutions!

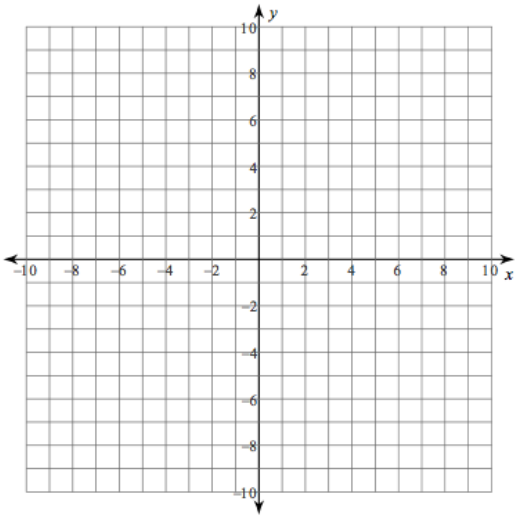
Example 2 Graph $y = \frac{1}{2}x - 1$ using a table

x	$y = \frac{1}{2}x - 1$	(x, y)



Example 3 Graph $y = -\frac{2}{3}x + 1$

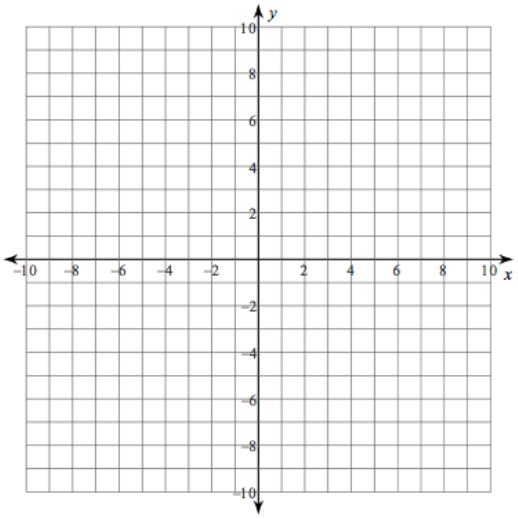
x	$y = -\frac{2}{3}x + 1$	(x, y)



GRAPHING NON-LINEAR FUNCTION RULES

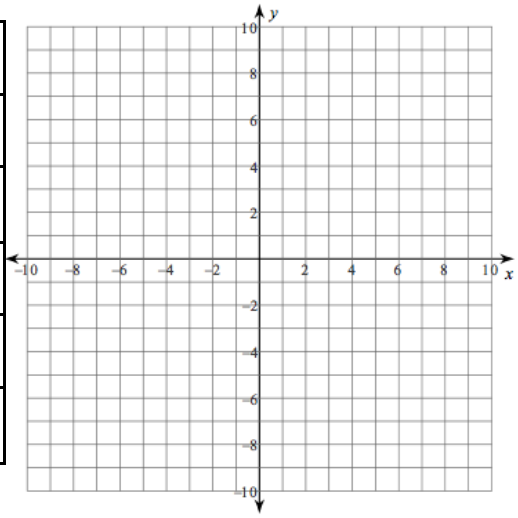
Example 4 Graph $y = |x| + 2$

x	$y = \|x\| + 2$	(x, y)



Example 5 Graph $y = x^2 - 3$

x	$y = x^2 - 3$	(x, y)



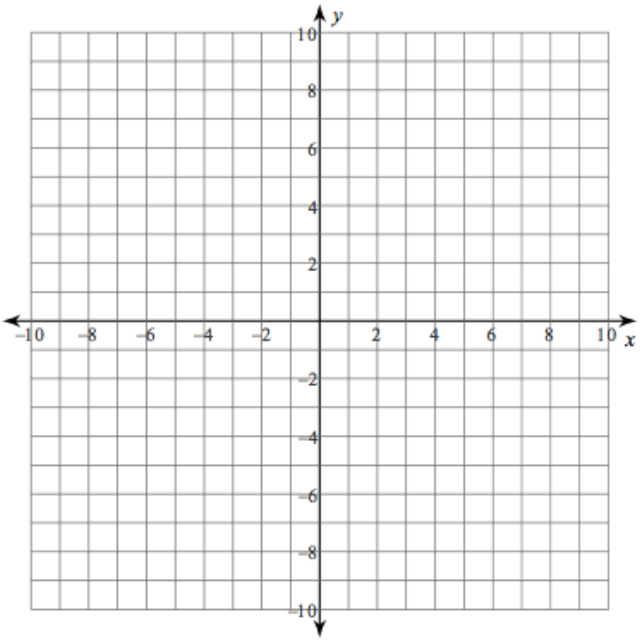
Algebra I Notes

4-5 Writing a Function Rule

Objectives:	To write equations that represent functions.

Warm-Up Graph the function $y = -\frac{2}{3}x + 4$

x	$y = -\frac{2}{3}x + 4$	(x, y)



Write a function rule (equation) to represent each sentence.

1. Five less than one-fourth of x is y.

2. Seven more than the quotient of a number n and four is nine.

3. P is nine more than half of q.

4. Eight more than five times a number is -27.

5. 1.5 more than the quotient of a and four is b.

6. The price p of an ice cream is $3.95 plus $0.85 for each topping t on the ice cream.

7. The babysitter's earnings e are a function of the number of hours n worked at a rate of $7.25 per hour.

8. The price p of a club's membership is $30 for an enrollment fee and $12 per week w to be a member.

9. A hot dog d costs $1 more than one-half the cost of a hamburger h.

10. Jose is 3 years younger than 3 times his brother's age. Write a rule that represents Jose's age j as a function of this brother's age b. How old is Jose if his brother is 5?

11. Write a function rule for the area of a rectangle whose length is 4 inches more than its width. What is the area of the rectangle when its width is 8 inches.

12. Write a function rule for the area of a triangle with a base 2 meters less than 4 times its height. What is the area of the triangle when its height is 8 meters?

13. Write a rule that is an example of a nonlinear function that fits the following description: ***When b is 49, a is 7, and a is a function of b.***

Algebra I Notes

4.6 Formalizing Relations & Functions

Objectives:	To determine whether a relation is a function To find domain and range and use function notation

Warm-Up Write a function rule that represents each situation.

1. A plumber's fees f are $75 for a house call and $60 per hour h for each hour worked.

2. The area of a rectangle with length 3 feet more than two times its width. What is the area of the rectangle when its width is 4 feet?

Vocabulary:

RELATION - any set of ordered pairs. **[**ex: {(0,0), (2,3), (2,-7)}**]**

FUNCTION - a special relation in which each input has exactly one output

DOMAIN *(of relation or function):* the possible values for the ***input*** of a relation or function.

RANGE *(of relation or function)***:** the possible values for the ***output***, or depended variable, of a relation or function

VERTICAL LINE TEST - a method used to determine if a relation is a function or not. *(If a vertical line passes through a graph more than once, it is NOT a function.)*

FUNCTION NOTATION to write a rule in function notation use *f(x)* instead of *y*

[ex. *y=2x-5* ➔ *f(x)=2x-5* **]**

Example 1

i. Identify the domain and range of each relation.
ii. Represent the relation with a mapping diagram.
iii. Determine if the relation a **function** or **not a function**.

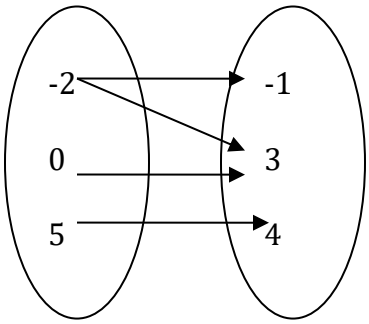
a. {(-1, -2), (3, 6), (-5, -10), (4, 3)}

b. {(2, 8), (-1, 5), (0, 8), (2, 3), (-2, 3)}

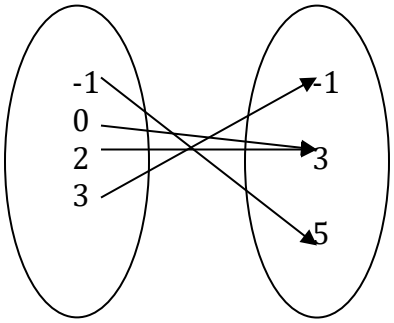
Example 2

Determine whether each relation is a function. Explain why or why not.

a.



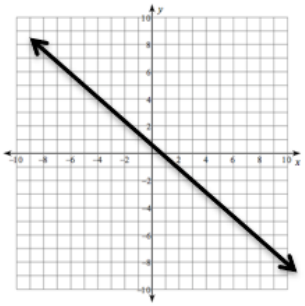
b.



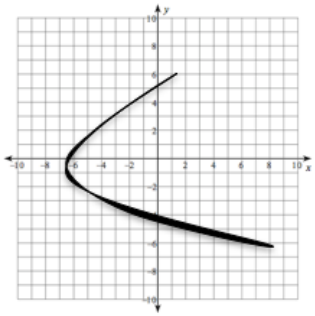
Example 3

Use the vertical line test to determine whether each graph is a function.

a.



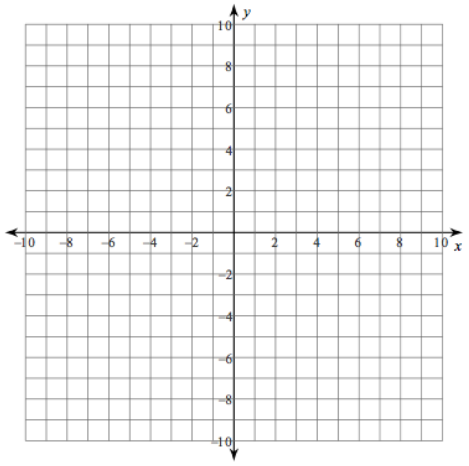
b.

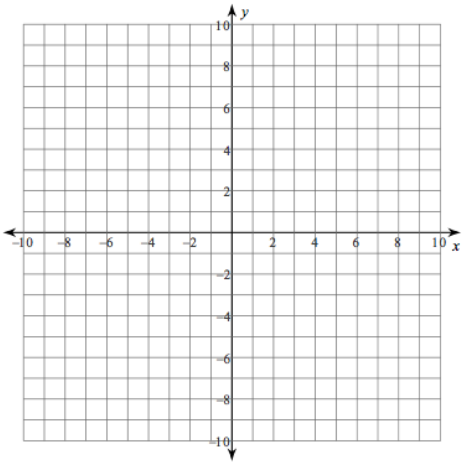


Example 4
Use the vertical line test to determine whether each graph is a function.

a. {(-4, 2), (- 3, 1), (0, -2), (- 4, - 1), (1, 2) }

b. {(4, 2), (1, 2), (0,1), (-2, 2), (3, 3)}





Evaluating a Function
Functions represented as equations involving x and y, such as $y = -3x + 1$ can be re-written using function notation: $f(x) = -3x + 1$

Example 5 Given f(x) = 3x + 5, find:

a. f (-4)

b. f (0)

Example 6 Given $g(x) = \frac{1}{2}x^2 - 6$, find:

a. g (-2)

b. g (3)

Example 7

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 minutes?

a. According to the function, what is your rate for reading, in words per min?

b. If you read 1250 words, how many minutes did you read? Explain?