

EXPRESSIONS AS STATEMENTS

An **inequality** describes a relationship between two quantities that are not or may not be equivalent. One of the following symbols is used to identify the relationship.

Less than <

Less than or equal to \leq

Greater than >

Greater than or equal to \geq

Match each inequality in Column A with the word expression it represents in Column B.

Column A	Column B
_____ 1. $7 - n > 10$	a. twenty nine decreased by a number is greater than five
_____ 2. $n \leq 16 \div 4$	b. eight times a number, decreased by four is less than or equal to sixty-six
_____ 3. $(n + 12) > 15$	c. nine squared decreased by a number is less than fifty
_____ 4. $n^2 + 6 < 44$	d. seven decreased by a number is greater than ten
_____ 5. $n \times 7 \geq 50$	e. fourteen more than the product of three and a number is less than seventy-two
_____ 6. $29 - n > 5$	f. twelve more than a number is greater than fifteen
_____ 7. $8n - 4 \leq 66$	g. a number is less than or equal to the quotient of sixteen and four
_____ 8. $\sqrt{n} > 2$	h. six more than a number squared is less than forty-four
_____ 9. $(30 \div n) \geq 6$	i. a number times seven is greater than or equal to fifty
_____ 10. $9^2 - n < 50$	j. sixteen more than a number divided by eleven is greater than or equal to twenty-five
_____ 11. $(n \div 11) + 16 \geq 25$	k. the square root of a number is greater than two
_____ 12. $(3 \times n) + 14 < 72$	l. thirty divided by a number is greater than or equal to six

USES OF VARIABLES

A **variable** is a symbol that represents a number. Variables are used in equations to represent unknown values. For example, the equations below give the formula for converting between Fahrenheit and Celsius temperatures. The variable F represents the Fahrenheit temperature and the variable C represents the Celsius temperature.

$$F = \frac{9}{5}C + 32 \quad C = \frac{5}{9}(F - 32)$$

Use the equations to complete the chart.

Fahrenheit Temperature	Celsius Temperature
212° F	1. _____
2. _____	30° C
68° F	3. _____
4. _____	55° C
14° F	5. _____
6. _____	25° C
23° F	7. _____
8. _____	5° C
95° F	9. _____
10. _____	40° C
32° F	11. _____
12. _____	15° C
104° F	13. _____
14. _____	10° C
5° F	15. _____

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REPRESENTATION OF PATTERNS AND FUNCTIONS

A **function** is a relationship between or among numbers. In one type of function, the value of one number, or the **independent variable**, determines the value of another number, or the **dependent variable**.

Eric builds birdhouses that are sold at craft fairs. He earns \$4.65 on each birdhouse he sells. Complete the table to determine how much Eric earns for selling different numbers of birdhouses.

Birdhouses Sold	Profit Earned
1	\$4.65
2	\$9.30
3	1. _____
4	2. _____
5	3. _____
6	4. _____

Birdhouses Sold	Profit Earned
7	5. _____
8	6. _____
9	7. _____
10	8. _____
11	9. _____
12	10. _____

- What is the independent variable? _____
- What is the dependent variable? _____
- How many birdhouses must Eric sell to earn at least \$50? _____

A salesperson earns $6\frac{1}{2}\%$ commission on all merchandise she sells. Complete the table to determine her commission on every \$500 in sales.

Merchandise Sold	Commission
\$500	\$32.50
\$1,000	\$65.00
\$1,500	14. _____
\$2,000	15. _____
\$2,500	16. _____

Merchandise Sold	Commission
\$3,000	17. _____
\$3,500	18. _____
\$4,000	19. _____
\$4,500	20. _____
\$5,000	21. _____

- About how much must the salesperson sell, to the nearest \$500, to earn a commission of at least \$250?

DEFINING FUNCTIONS

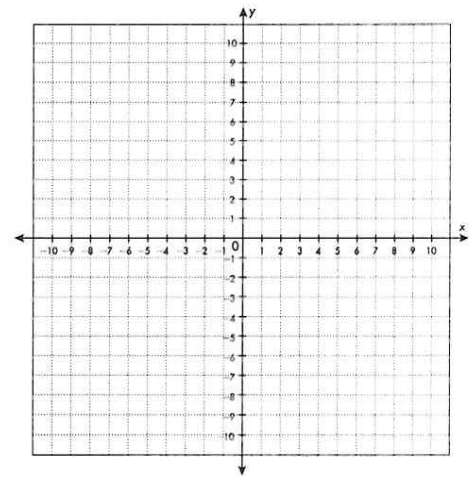
One type of **function** can be represented by an equation in which any value of x has no more than one corresponding value for y . To graph this type of function, you should do the following:

- Make a table for x and y values.
- Select values for the x variable. Calculate the corresponding values for the y variable.
- Each row in the table represents an ordered pair. Plot these points on a coordinate plane.
- Connect the points. If the function can be expressed in the form $y = ax + b$, the points should lie in a straight line.

Graph the function $y = 4x - 1$.

1. Complete the table.
2. Plot each ordered pair on the coordinate plane.
3. Draw a line through the points.

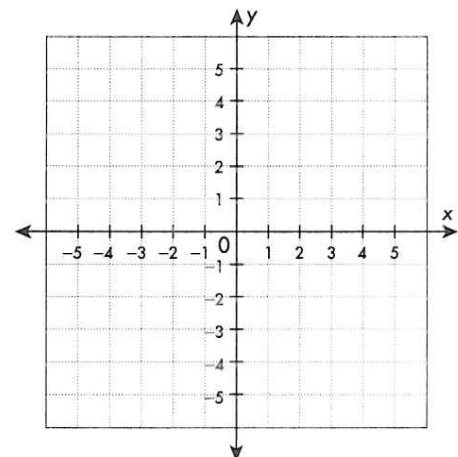
x	y
2	_____
1	_____
0	_____
-1	_____
-2	_____



Graph the function $y = 2 + x$.

4. Complete the table.
5. Plot each ordered pair on the coordinate plane.
6. Draw a line through the points.

x	y
2	_____
1	_____
0	_____
-1	_____
-2	_____



Challenge

Write an equation for a function for which the graph of y against x is not a straight line.

SOLVING LINEAR EQUATIONS

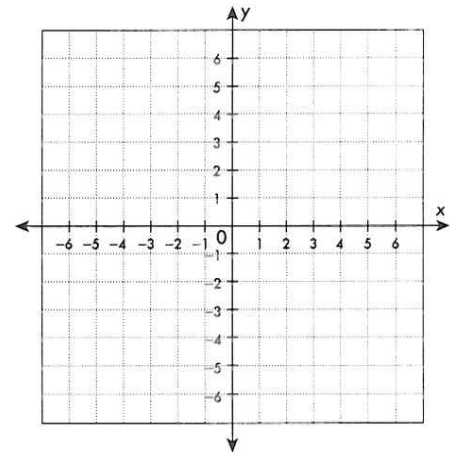
Two or more linear equations graphed on the same coordinate plane make up a system of equations. If the graphs of the equations intersect, then they have a common solution. The coordinates of a point of intersection represent a solution of the system. Graphs of pairs of linear equations can determine a common solution to the two equations, if a common solution exists.

Graph the equations to find the solution of the system. $y = x + 1$ $y = 2x - 2$

1. Complete the tables.

x	y
2	_____
1	_____
0	_____
-1	_____
-2	_____

x	y
2	_____
1	_____
0	_____
-1	_____
-2	_____



2. Plot each ordered pair on the coordinate plane.

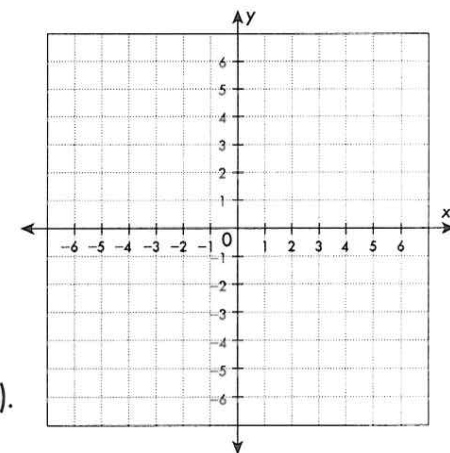
3. Draw a line through each set of points (one line for each equation). Find the point of intersection. Which ordered pair names this point? _____

Graph the equations to find the solution of the system. $y = 4 - x$ $y = x + 2$

4. Complete the tables.

x	y
2	_____
0	_____
-2	_____

x	y
2	_____
0	_____
-2	_____



5. Plot each ordered pair on the coordinate plane

6. Draw a line through each set of points (one line for each equation). Find the point of intersection. Which ordered pair names this point? _____

Challenge

Find a pair of linear equations that does not have a common solution.

SOLVING INEQUALITIES AND NON-LINEAR EQUATIONS

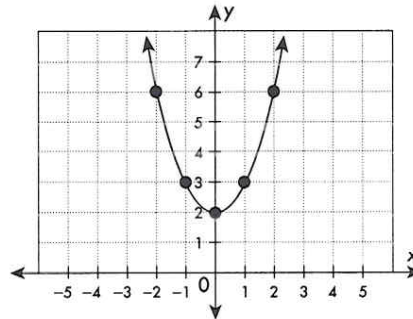
If an equation that represents a function has a variable with an exponent other than 1, the function is nonlinear. The graphs of many non-linear functions are curves.

Graph the non-linear equation $y = x^2 + 2$.

Make a table of ordered pairs.

x	y
-2	6
-1	3
0	2
1	3
2	6

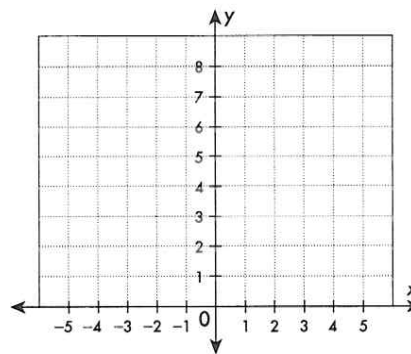
Graph the ordered pairs.



Graph each non-linear equation.

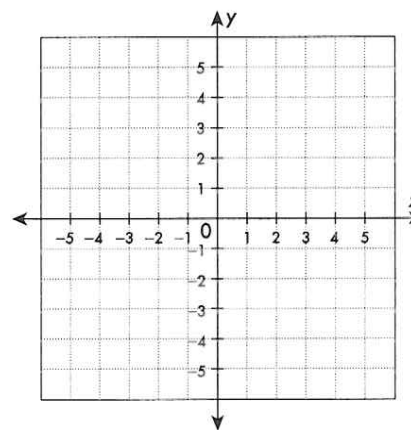
1. $y = x^2 + 3$

x	y
-2	_____
-1	_____
0	_____
1	_____
2	_____



2. $y = 2x^2 - 4$

x	y
-2	_____
-1	_____
0	_____
1	_____
2	_____



SPECIAL VALUES OF PATTERNS, RELATIONSHIPS, AND FUNCTIONS

The **slope-intercept** form of an equation is:

$$y = mx + b$$

\swarrow \nwarrow
 m is the slope b is the y-intercept

Express each equation in slope-intercept form. Then identify the slope and y-intercept.

1. $2x - 4y = 8$

Slope _____

y-intercept _____

2. $3x + 4y = 12$

Slope _____

y-intercept _____

3. $2x + 3y = 6$

Slope _____

y-intercept _____

4. $x - 3y = 3$

Slope _____

y-intercept _____

5. $4x + 2y = 6$

Slope _____

y-intercept _____

6. $8x - 2y = 4$

Slope _____

y-intercept _____

7. $2x + 8y = 16$

Slope _____

y-intercept _____

8. $x - 6y = 18$

Slope _____

y-intercept _____

9. $6x - 3y = 15$

Slope _____

y-intercept _____

10. $3x + 9y = 6$

Slope _____

y-intercept _____

11. $x - 2y = -4$

Slope _____

y-intercept _____

12. $10x - 5y = 20$

Slope _____

y-intercept _____

BASIC OPERATIONS ON ALGEBRAIC EXPRESSIONS

An algebraic term contains a number and a variable. The number is called the **coefficient** of the variable. You can combine like terms, that is, terms that have the same variable.

If $x = -2$ and $y = 3$, what is the value of the expression $5(3x - 2y) + 6x$?

- | | |
|---|------------------------------------|
| • Use the Distributive Property to eliminate the parentheses. | $5(3x - 2y) + 6x = 15x - 10y + 6x$ |
| • Combine like terms. | $15x - 10y + 6x = 21x - 10y$ |
| • Substitute -2 for x and 3 for y . | $= 21(-2) - 10(3)$ |
| • Multiply. | $= -42 - 30$ |
| • Subtract. | $= -42 + (-30)$ |
| Result | -72 |

The value of the expression is -72 .

Simplify. Then find the value of each expression if $a = -4$, $b = 3$, and $c = 5$.

1. $4(2a - 3c) + 3a$ _____	2. $7b + 2a - c + 5a$ _____	3. $8(a - b) + 4b$ _____
4. $5c - 2b + 2c - 3b$ _____	5. $4(2c - b) + 6b$ _____	6. $5a - 3c + 9a + 4c$ _____
7. $7b - 2(a + b)$ _____	8. $6(c - 2b) + 4c$ _____	9. $3(b - 2c) + 5b$ _____
10. $9a + 4(2c - 3a)$ _____	11. $4b - 2(3c - 2b)$ _____	12. $5(3a - 2b + 4c)$ _____
13. $5a - 6(3b + 2c)$ _____	14. $12b + 7c - 8(a - b)$ _____	15. $6(2b + \frac{5}{2}c) - 3(b - 12a)$ _____

RECTANGULAR COORDINATE SYSTEM FOR PROBLEMS

Miguel is 2 years younger than Ramon. The sum of their ages is 10. How old is each?

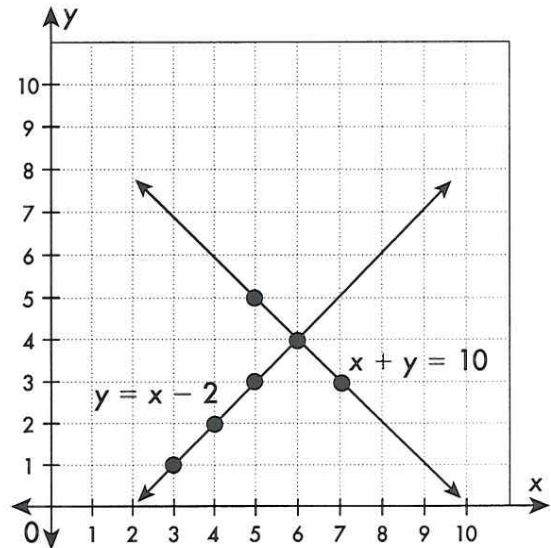
1. You can write two equations to represent the situation.

Let x = Ramon's age Then $y = x - 2$
 y = Miguel's age $x + y = 10$

2. You can make a table of values for each equation.

$y = x - 2$	
x	y
3	1
4	2
5	3

$x + y = 10$	
x	y
5	5
6	4
7	3



3. Plot the ordered pairs for each equation on a coordinate plane. Then draw lines through the points.
4. Find the point where the two lines intersect. This shows Ramon's age and Miguel's age. What is Ramon's age? What is Miguel's age? _____

Rita is older than Danielle. The sum of their ages is 28. The difference between their ages is 8. How old is each?

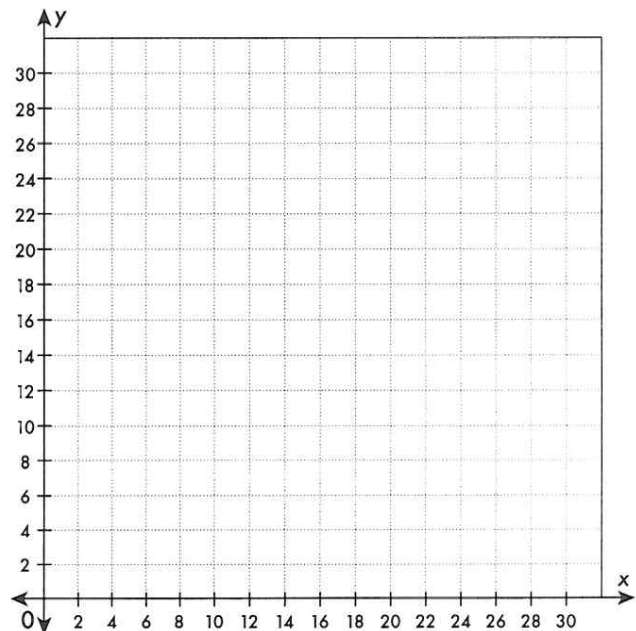
5. Write two equations to represent the situation.

Let x = Danielle's age. Let y = Rita's age.

6. Make a table of values for each equation.

7. Plot the ordered pairs on a coordinate plane. Then draw a line through the points.

8. What is Rita's age? What is Danielle's age?



GRAPHIC SOLUTIONS OF SIMPLE SYSTEMS OF EQUATIONS

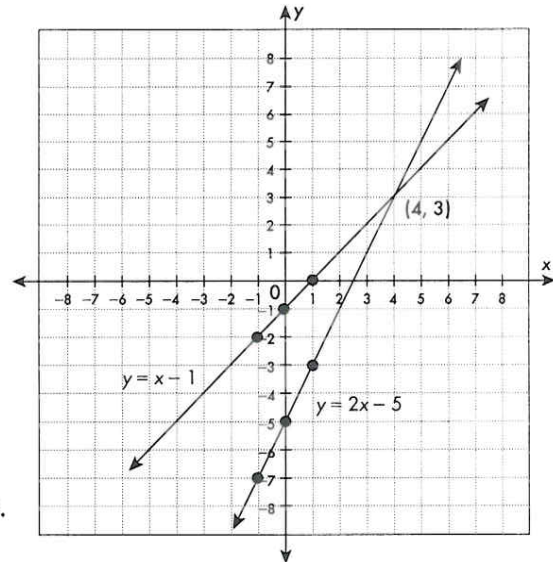
A **system of equations** is two or more equations to be solved for values of the variables satisfying both or all of them. The equations can be graphed on the same coordinate plane. The point where the graphs of the equations intersect represents a **solution**.

What values of x and y satisfy both of these equations? $y = 2x - 5$; $y = x - 1$

- Make a table of ordered pairs for each equation.

$y = 2x - 5$		$y = x - 1$	
x	y	x	y
-1	-7	-1	-2
0	-5	0	-1
1	-3	1	0

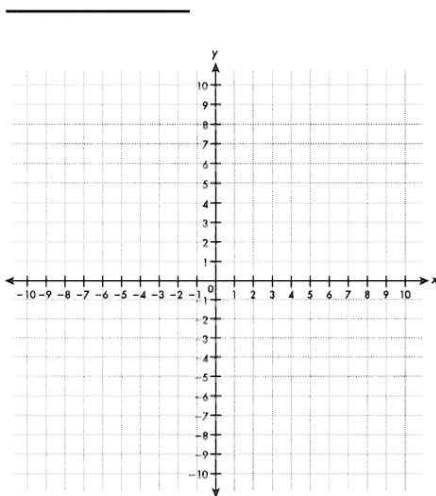
- Write the ordered pairs for each equation.
 $y = 2x - 5$: $(-1, -7)$, $(0, -5)$, $(1, -3)$
 $y = x - 1$: $(-1, -2)$, $(0, -1)$, $(1, 0)$
- Graph the ordered pairs on the same coordinate plane. Find the point where the lines intersect. This is the solution of the system.



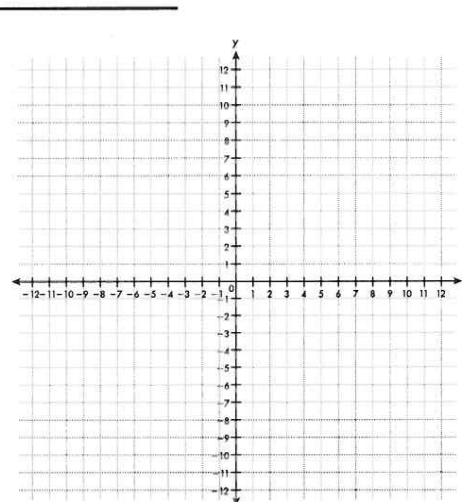
The lines intersect at $(4, 3)$. So, $(4, 3)$ is the solution of the system.

Solve the system of equations by graphing.

1. $y = x + 4$ and $y = 3x - 2$



2. $y = x - 3$ and $y = 3x - 5$



PROPERTIES OF ARITHMETIC AND GEOMETRIC SEQUENCES

An **arithmetic sequence** is made up of terms that change by the same amount. A **geometric sequence** is made up of terms that change by the same ratio.

55, 41, 27, 13, ... ← Arithmetic Sequence → Add -14 to the previous term to get the next term.

$-6, 42, -294, 2,058, \dots$ ← Geometric Sequence → Multiply by -7 .

Find the next two terms in each arithmetic sequence. State the rule used to form the sequence.

1. 19, 13.5, 8, 2.5, _____, _____, ... _____

2. 15.3, 9.1, 2.9, -3.3 , _____, _____, ... _____

3. $-21.2, -17.8, -14.4, -11$, _____, _____, ... _____

4. 19, $-3, -25, -47$, _____, _____, ... _____

5. $-54, -36, -18, 0$, _____, _____, ... _____

6. 77.6, 63.9, 50.2, 36.5, _____, _____, ... _____

7. 4.2, 1.3, $-1.6, -4.5$, _____, _____, ... _____

Find the next two terms in each geometric sequence. State the rule used to form the sequence.

8. 650, 585, 526.5, 473.85, _____, _____, ... _____

9. 50, 70, 98, 137.2, _____, _____, ... _____

10. 20, 34, 57.8, 98.26, _____, _____, ... _____

11. 80, 64, 51.2, 40.96, _____, _____, ... _____

12. 240, 168, 117.6, 82.32, _____, _____, ... _____

13. 0.1, 0.01, 0.001, 0.0001, _____, _____, ... _____

14. 0.5, $-0.25, 0.125, -0.0625$, _____, _____, ... _____
