

EXPRESSIONS AS STATEMENTS

A **numerical expression** uses numerals and operation signs to represent a value. An **algebraic expression** uses numerals, operation signs, and variables to represent a value.

Word Expression	Numerical Expression	Word Expression	Algebraic Expression
Six more than seventeen	$17 + 6$	Marie's age two years ago	$m - 2$ (m is her age today)
Five times the difference between three and ten	$5 \times (10 - 3)$	Each share of the cost of dinner split evenly among five friends	$d \div 5$ (d is the total cost of the dinner)
Twice the sum of eight and three	$2 \times (8 + 3)$	Twelve more than the product of 9 and a number	$(9 \times n) + 12$ (n is the number)

Match each numerical or algebraic expression in Column A with the word expression it represents in Column B.

Column A	Column B
_____ 1. $(3 \times 4) + 8$	a. four less than five squared
_____ 2. $n \div 5$	b. nine times a number, increased by four
_____ 3. $2 \times (n + 7)$	c. the square root of forty-nine, decreased by five
_____ 4. $5^2 - 4$	d. eight more than the product of three and four
_____ 5. $(40 \div n) - 2$	e. two less than the quotient of forty and a number
_____ 6. $(12 \times 6) + 9$	f. one less than a number squared
_____ 7. $(2 \times n) + 13$	g. twice the sum of a number and seven
_____ 8. $\sqrt{49} - 5$	h. nine more than the product of twelve and six
_____ 9. $6 \times (24 \div 3)$	i. a number divided by five
_____ 10. $n^2 - 1$	j. six times the quotient of twenty-four and three
_____ 11. $(42 \div 7) + 10$	k. twice a number, increased by thirteen
_____ 12. $9 \times n + 4$	l. ten more than the quotient of forty-two and seven

USES OF VARIABLES

A **variable** is a symbol that represents a number. Sometimes variables represent a specific number. Other times variables represent a range of values.

Variable Represents a Specific Value		Variable Represents a Range of Values	
$m + 25 = 72$ $m + 25 - 25 = 72 - 25$ $m = 47$	There is only one value for m .	$b + 3 > 5$ $b + 3 - 3 > 5 - 3$ $b > 2$	The value of b is any number greater than 2.

Find the value of the variable.

1. $r + 17 = 51$ _____	2. $s - 14 = 64$ _____	3. $81 \div n = 9$ _____
4. $38 + k = 112$ _____	5. $a - 93 = 47$ _____	6. $y \times 5 = 85$ _____
7. $c \div 46 = 7$ _____	8. $p - 28 = 55$ _____	9. $h \times 4 = 76$ _____
10. $m \times 9 = 117$ _____	11. $a - 44 = 189$ _____	12. $r + 68 = 205$ _____

Find the range for the variable.

13. $a + 6 < 10$ _____	14. $r - 5 < 20$ _____	15. $x - 3 > 12$ _____
16. $7y < 49$ _____	17. $w \div 6 > 15$ _____	18. $n - 7 > 7$ _____

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**.

A salesperson earns \$3.50 commission on every gift card he sells. He wants to figure out how much commission he will earn for any given number of cards he will sell.

1. What is the independent variable or number that determines the value of another number?

2. What is the dependent variable?

Complete the table that represents this function.

Number of Gift Cards Sold	Amount of Commission Earned
1	\$3.50
2	\$7.00
3	3. _____
4	4. _____
5	5. _____

Number of Gift Cards Sold	Amount of Commission Earned
6	6. _____
7	7. _____
8	8. _____
9	9. _____
10	10. _____

11. How many cards must he sell to earn at least \$25.00 in commissions? _____

Kevin earns \$6.75 an hour. Complete the table below to determine how much he earns for different numbers of hours worked.

Number of Hours Worked	Amount Earned
1	\$6.75
2	\$13.50
3	12. _____
4	13. _____

Number of Hours Worked	Amount Earned
5	14. _____
6	15. _____
7	16. _____
8	17. _____

18. How much does Kevin earn for an 8-hour workday? _____

DEFINING FUNCTIONS

A **function** can be represented by an equation that describes how a change in one or more variables results in a change in another variable.

$y = 2x + 3$ ← Function expressed as an equation

- If x is 1, then y is $2(1) + 3$ or 5
- If x is 0, then y is $2(0) + 3$ or 3
- If x is -1 , then y is $2(-1) + 3$ or 1

Complete the tables to show some values of x and y in each function.

1. $y = x - 5$

x	y
1	_____
0	_____
-1	_____

2. $y = 3x - 4$

x	y
3	_____
2	_____
0	_____

3. $y = 4 - x$

x	y
2	_____
0	_____
-2	_____

4. $x = y + 3$

x	y
_____	3
_____	1
_____	-1

5. $x = 6 - 2y$

x	y
_____	2
_____	-1
_____	-3

6. $x = 4 - y$

x	y
_____	4
_____	0
_____	-4

7. $y = \frac{1}{2}x + 2$

x	y
4	_____
-2	_____
-4	_____

8. $y = -3x + 1$

x	y
2	_____
0	_____
-1	_____

9. $y = 7 - 2x$

x	y
3	_____
0	_____
-2	_____

10. $x = \frac{1}{3}y - 3$

x	y
_____	-3
_____	0
_____	3

11. $x = 12 - \frac{2}{3}y$

x	y
_____	-6
_____	-3
_____	0

12. $x = \frac{5}{8} - \frac{1}{4}y$

x	y
_____	-8
_____	0
_____	6

SOLVING LINEAR EQUATIONS

Find the value of y in the equation $y - 9 = -5$. To solve linear equations, use inverse operations to isolate the variable on one side of the equation—use subtraction and addition with each other.

$$y - 9 = -5$$

$$y - 9 + 9 = -5 + 9 \leftarrow \text{Add 9 to each side of the equation.}$$

$$y = 4$$

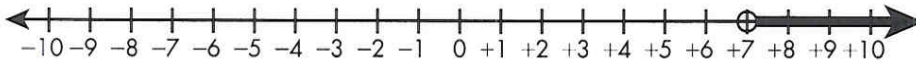
Solve.

1. $b - 9 = 21$ _____	2. $r + 17 = -5$ _____	3. $12 + c = 55$ _____
4. $47 - h = 3$ _____	5. $x - 8 = -10$ _____	6. $19 + g = -7$ _____
7. $w + -4 = 18$ _____	8. $n + 63 = 16$ _____	9. $11 + f = -35$ _____
10. $75 + z = 104$ _____	11. $m - 28 = -4$ _____	12. $136 + p = 53$ _____
13. $-23 + j = 15$ _____	14. $d + 88 = 121$ _____	15. $101 + k = -12$ _____
16. $15 - b = -6$ _____	17. $y - (-4) = 10$ _____	18. $29 + z = -8$ _____
19. $m - 3.5 = 6$ _____	20. $n + \frac{1}{8} = 1\frac{3}{4}$ _____	21. $-18 - c = -5$ _____

SOLVING INEQUALITIES AND NON-LINEAR EQUATIONS

You can graph the solution set of an inequality on a number line.

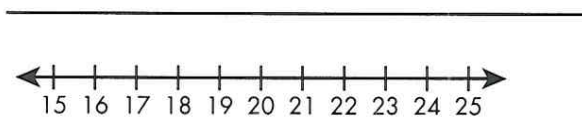
$$\begin{aligned}
 x + 8 &> 15 \\
 x + 8 - 8 &> 15 - 8 \\
 x &> 7
 \end{aligned}$$



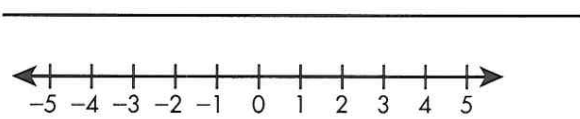
The open circle shows that 7 is not part of the solution set since x is greater than 7. If 7 were part of the solution set, then the graph would have a closed (filled) circle at 7.

Solve each inequality. Graph the solution set.

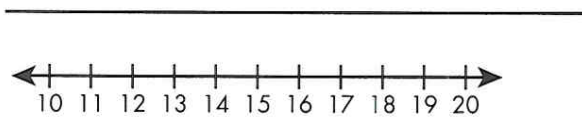
1. $y - 6 \leq 13$



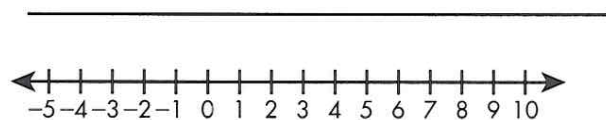
2. $b + 9 > 11$



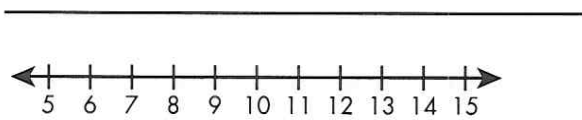
3. $18 > c + 5$



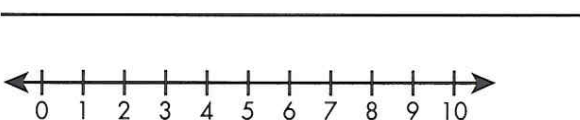
4. $s - 3 < 2$



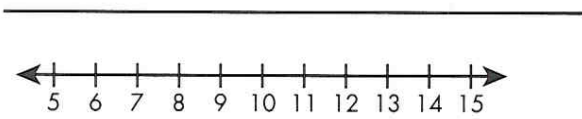
5. $w - 6 \leq 4$



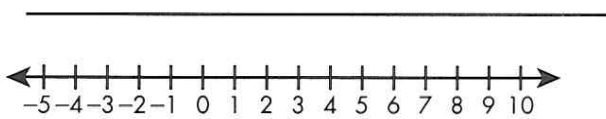
6. $8 + k > 14$



7. $d + 11 < 20$



8. $j + 9 \geq 11$



SPECIAL VALUES OF PATTERNS, RELATIONSHIPS, AND FUNCTIONS

Slope is a measure of how steep a line is. You can find the slope of a straight line if you know the coordinates of any two points on the line.

$$\text{Slope} = \frac{\text{difference of the } y\text{-coordinates}}{\text{difference of the } x\text{-coordinates}} = \frac{y_2 - y_1}{x_2 - x_1}$$

The coordinates of two points on a straight line are (2, 2) and (-1, -4).

What is the slope of the line?

- Find the difference of the y-coordinates. $-4 - 2 = -6$
- Find the difference of the x-coordinates. $-1 - 2 = -3$
- Express the differences as a ratio. $\frac{-6}{-3}$

The slope of the line is $\frac{6}{3}$, which equals $\frac{2}{1}$, or 2.

Use the coordinates to find the slope of the straight line containing the points.

1. (4, -2) (-3, 1) _____	2. (1, 5) (4, 3) _____	3. (-2, 1) (3, -1) _____
4. (5, 2) (1, 3) _____	5. (-1, -2) (3, 1) _____	6. (-2, -2) (1, -1) _____
7. (6, -2) (-3, -1) _____	8. (-4, -5) (1, -2) _____	9. (0, 3) (-3, 1) _____
10. (-6, 1) (2, -2) _____	11. (3, -4) (1, -3) _____	12. (6, 5) (2, 4) _____
13. (1, 1) (5, 2) _____	14. (-1, -1) (0, 2) _____	15. (3, -4) (-3, 0) _____
16. (1, -4) (-2, -1) _____	17. (-4, -5) (4, 2) _____	18. (-6, 3) (-4, -4) _____

BASIC OPERATIONS ON ALGEBRAIC EXPRESSIONS

An **algebraic expression** is a mathematical statement with operations that involve both numbers and variables. A **coefficient** is a number that appears next to a variable. It represents the number to multiply the variable by to determine that part of the value of the expression.

If $x = 5$ and $y = 2$, what is the value of the expression $3x + 7y$?

- Substitute 5 for x and 2 for y in the expression. $\longrightarrow 3(5) + 7(2)$
- Multiply. $\longrightarrow 15 + 14$
- Add. $\longrightarrow 29$

The value of the expression is 29.

Evaluate the expression. Let $a = 4$, $b = -2$, $c = 5$, and $d = -3$.

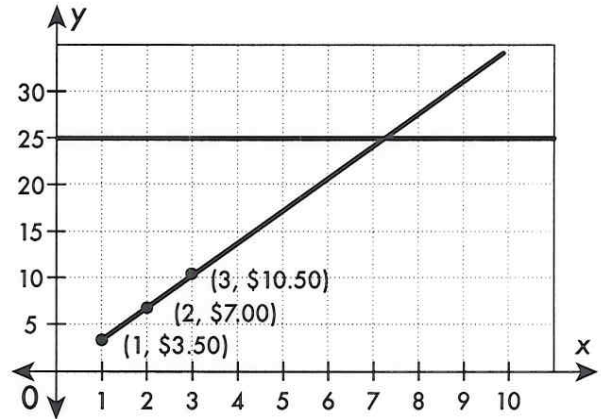
1. $3a - d$ _____	2. $2c + 5b$ _____	3. $6(c + d)$ _____
4. $7b - 3d$ _____	5. abc _____	6. $9d - 4b$ _____
7. $-2(c + d)$ _____	8. $(b + d)5$ _____	9. $10c - 2a$ _____
10. $-4(d + a)$ _____	11. $11(a - b)$ _____	12. $4b \times 3c$ _____
13. $7ab - 3d$ _____	14. $\frac{ac}{b}$ _____	15. $6c - (b + a)$ _____
16. $8a + 6cb$ _____	17. $8\frac{dc}{ab}$ _____	18. $4b + 3c - 12d$ _____

RECTANGULAR COORDINATE SYSTEM FOR PROBLEMS

Rosa is making photo albums to sell at a craft fair. She makes \$3.50 profit on each album she sells. Rosa paid \$25 to rent a booth at the fair. What is the least number of albums she must sell to cover this cost with her profits on the albums?

1. You can represent this information on a coordinate plane. Let x represent the number of albums sold. Let y represent her profit on the albums.

x	y
1	\$3.50
2	_____
3	_____

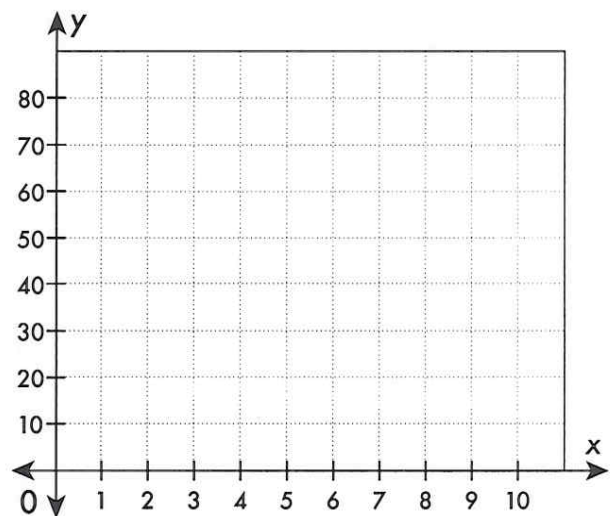


2. Plot the ordered pairs on a coordinate plane. Then draw a line through the points.
3. What is the amount of money Rosa paid to rent a booth at the fair? _____
Draw a horizontal line through this value on the y -axis.
4. Find the point where the two lines intersect. This shows the number of albums Rosa must sell to cover the cost of booth rental. What is the least number of albums she must sell? (Remember: She cannot sell a fraction of an album.) _____

Luke needs to save \$78 for a trip. He can put \$13 in his account each week. How long will it take Luke to save the money?

5. You can represent this information on a coordinate plane. Let x represent the number of weeks he saved. Let y represent the amount of money in his account.

x	y
1	\$13.00
2	_____
3	_____



6. Plot the ordered pairs on a coordinate plane. Then draw a line through the points.
7. What is the amount of money Luke needs for the trip? _____
Draw a horizontal line through this value on the y -axis.
8. How long will it take him to save enough for the trip? _____

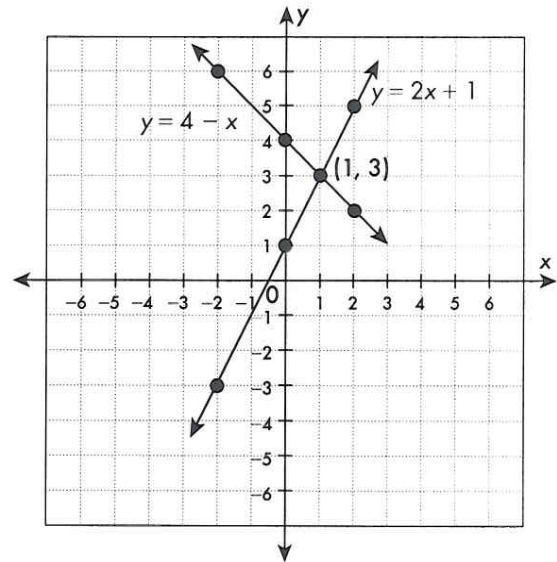
GRAPHIC SOLUTIONS OF SIMPLE SYSTEMS OF EQUATIONS

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? $y = 2x + 1$; $y = 4 - x$

- Make a table of ordered pairs for each equation.

$y = 2x + 1$		$y = 4 - x$	
x	y	x	y
-2	-3	-2	6
0	1	0	4
2	5	2	2



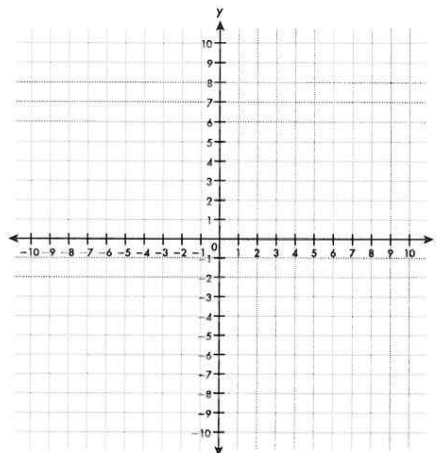
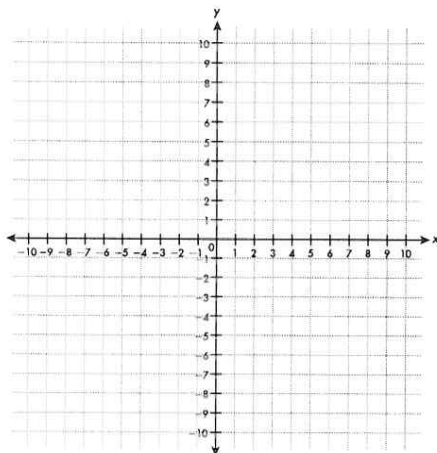
- Write the ordered pairs for each equation.
 $y = 2x + 1$: $(-2, -3)$, $(0, 1)$, $(2, 5)$
 $y = 4 - x$: $(-2, 6)$, $(0, 4)$, $(2, 2)$
- Graph the ordered pairs on the same coordinate plane. Label each line. Find the point where the lines intersect. This is the solution of the system.

The lines intersect at $(1, 3)$. So, $(1, 3)$ is the solution of the system.

Solve the system of equations by graphing.

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

2. $y = x + 2$ and $y = 2x - 2$



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.

1, 11, 21, 31, 41, . . . ← Arithmetic Sequence → Add 10 to a term to get the next term.

500, 400, 320, 256, . . . ← Geometric Sequence → Each term is 80% of the previous term.

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

1. 26, 31, 36, 41, _____, _____, . . . _____

2. 1, 8, 15, 22, _____, _____, . . . _____

3. 82, 74, 66, 58, _____, _____, . . . _____

4. 119, 132, 145, 158, _____, _____, . . . _____

5. 7, 4, 1, -2, _____, _____, . . . _____

6. 8, 12, 16, _____, _____, . . . _____

7. 3, 3.5, 4, _____, _____, . . . _____

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

8. 1, 6, 36, 216, _____, _____, . . . _____

9. 4, 6, 9, 13.5, _____, _____, . . . _____

10. 300, 270, 243, 218.7, _____, _____, . . . _____

11. -18, -36, -72, -144, _____, _____, . . . _____

12. 7, 21, 63, 189, _____, _____, . . . _____

13. 6, -12, 24, -48, _____, _____, . . . _____

14. 8, 4, 2, 1, _____, _____, . . . _____