Name: ______________________

Middle School: _________________________

Welcome to your first KCHS math class!

SUMMER PACKET ALGEBRA 1 Honors

For this coming school year, you are enrolled in Algebra 1. This packet is meant to review material that you did in Pre-Algebra, as well as prepare you for your Algebra 1 class here at KCHS.

The expectations are as follows:

- **Packet is to be complete by the first week of school.**
- **ALL work must be shown throughout the packet.**
- **Packet will count as a participation grade in Quarter 1**
- **Test on packet will be given within first two week of being at school.**

We are so excited to have you here at Catholic and look forward to meeting you!

Go IRISH!

Table of Contents:

Evaluating Expressions

Example #1:

Evaluate the expression when $x = 5$

Directions: Rewrite each expression substituting the 5 for the x.

a. $5x = 5(5) = 25$

b. $-2x = -2(5) = -10$

c. $5x - 15 = 5(5) - 15 = 25 - 15 = 10$

Example #2

Evaluate the expression when x = 3 and y = 4

Directions: Rewrite each expression substituting
the 3 for the x and the 4 for the y.

a. $x + y = 3 + 4 = 7$

b. $2xy = 2(3)(4) = 24$

c. $2(x + y) = 2(3 + 4) = 2(7) = 14$

IT'S A
GREAT
DAY TO
SHOW
YOUR
WORK!

Expression	Substitute and Simplify (Show your Work) X = -2 y = 8 z = 7	Final Answer
$2x^2$		
$3x^2 + y$		
$2(x + z) - y$		
$5z - 6$		
$xy + z$		
$2x + 3y - z$		
$5x - (y + 2z)$		
$\frac{xy}{2}$		
$x^2 + y^2 + z^2$		
$2x(y + z)$		
$5z - (y - x)$		
$2x^2 + 3$		
$4x + 2y - z$		
$\frac{yz}{2}$		

Combining Like Terms and Distributive Property

What is **a term?**	The parts of an algebraic expression that are separated by an addition or subtraction sign are called **terms**.
What is **a like term?**	Terms with the same variable factors are called like terms. 2n and 3n are like terms, but 4x and 3y are NOT like terms because their variable factors x and y are different.

Examples:

Combine ALL like terms to simplify the expression completely.

$$3n - 7m + 2n - 4 \;=\; 5n - 7m - 4$$

$$6r^3 + 5r^2 + p^2 + 3r^2 \;=\; 6r^3 + 8r^2 + p^2$$

$$6(7y + 4) + 3y = 42y + 24 + 3y = 45y + 24$$

$$4xy + 3x^2y - 3xy + 2x^2y = 5x^2y + xy$$

$6n^2 + 5n$	$12r + 5s - 7t + 11r + 9s - 4r$
$8y - 6(3y - 7)$	$16xy + 6x - 4m - (4xy - 3m)$
$-4(r + 6y) + 6y$	$4t - 11y + 6t + 5t^2 + 7t^2$
$4mn - 6n^2 + 2mn$	$3x^2 + 4x - 6x - 2x^2$
$5(7 + 3x) - 12$	$6p - 4f^2 + 3b + 7p + 7f - 2b$
$8a + 4b + 6 - (3a + 2b + 4)$	$-6a(4b + c)$

1. Carl mowed $(2x^2 + 5x - 3)$ yards on Monday, $(4x - 7)$ yards on Tuesday, and $(3x^2 + 10)$ yards on Wednesday.

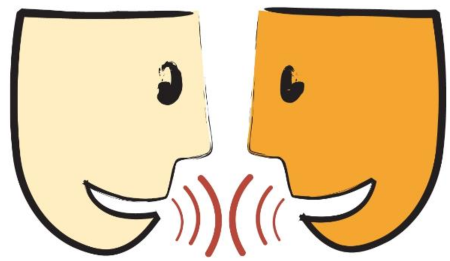
   a. How many yards did he mow in the three days?

   b. If Carl mowed $14x^2 + 12x - 3$ yards total for the entire week, how many yards did he mow for the rest of the week?

Verbal Expressions

Keywords for Translations

Add	Subtract	Multiply	Divide	Inequalities	Variable	=
Plus Sum Longer than Greater than Together Total Increased More than In all And	Decreased Smaller Less than Difference Reduced Differ Fewer Shorter than Minus Diminished	Per For Every For Each Triple Multiplied Of Times Twice Double	One-third Quotient Divided by Each part Half as much Split equally	< is less than > is greater than ≤ is less than or equal to ≥ is greater than or equal to	A number Some number Quantity	Same as Equals Is Total Was Result Outcome Answer



Examples:

1. The difference of x and 7 is divided by 4 more than x.

   a. $(x-7) \div (4+x)$

2. 4 times the difference of x and 7

   a. $4(x-7)$

3. 3 times a number squared

   a. $3x^2$

1. One half of the sum of twenty and a number is greater than or equal to forty.

2. Eighteen plus 3 times the quantity of x minus 8.

3. The difference of x and 6 divided by the quantity of 4 and x.

4. 5 less than the product of three and a number plus 10.

5. Three times the sum of x and 4 minus 5.

6. Two thirds of a number squared.

7. 12 less than the product of a number y and 12

8. 18 is taken away from three times the sum of x and 12

For the following expressions, write a verbal expression that correctly explains the order of all operations.

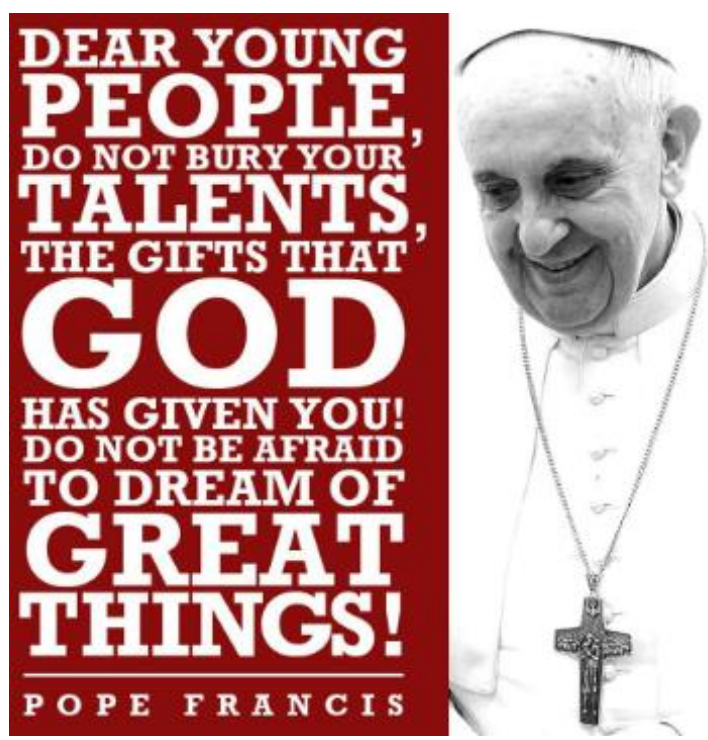
1. $19 + 3(x - 6)$

2. $\frac{1}{3}x - 17 = 19$

3. $x^2 + 15 = 6 - x$

4. $12x = 16$

5. $x + 3(x + 9) = 12$



Two-Step Equations follow the same rules as one-step equations. The goal is to **find the value** of the variable by **isolating** the variable.

We use **Inverse Operations** to do this.

Addition/Subtraction always comes BEFORE Multiplication/Division

Operation	Inverse
+	—
—	+
x	÷
÷	x

Inverse Operations:

Operations that undo each other.

Addition ⇨ Subtraction

Subtraction ⇨ Addition

Multiplication ⇨ Division

Division ⇨ Multiplication

Examples:

$$2x+5=21$$
$$2x+5-5=21-5$$
$$2x=16$$
$$\frac{2x}{2}=\frac{16}{2}$$
$$x=8$$

$$-3x-8=-20$$
$$-3x-8+8=-20+8$$
$$-3x=-12$$
$$\frac{-3x}{-3}=\frac{-12}{-3}$$
$$x=4$$

$$23=\frac{x}{3}+26$$
$$23-26=\frac{x}{3}+26-26$$
$$-3=\frac{x}{3}$$
$$(-3)(3)=\left(\frac{x}{3}\right)(3)$$
$$-9=x$$

1. $14=9-p$

2. $\frac{h}{2}+7=10$

3. $\frac{k-4}{3}=3$

4. $8=\frac{t}{-3}+4$

5. $\frac{p+5}{-2}=9$

6. $1+2s=35$

7. $\frac{x-31}{4}=3$

8. $17-q=6$

Solving Equations with Variables on Both Sides

Before beginning the process of isolating the variable, all like terms must be combined.

What do we do if we have variables on both sides?

Combine all like terms, before solving your equation.

Reminder: Like terms are terms with the same variable factors.

When we bring a like term to the other side of the equal sign, we must use inverse operations.

EXAMPLES:

Variable Terms | Constant Terms

$$9n - 6 = 5n + 18$$
$$-5n \qquad -5n$$
$$4n - 6 = 18$$
$$+6 \qquad +6$$
$$4n = 24$$
$$\boxed{n = 6}$$

Variable Terms | Constant Terms

$$6y + 4 - 3y = -5 + y + 17$$
$$3y + 4 = y + 12$$
$$-y \qquad -y$$
$$2y + 4 = 12$$
$$2y = 8$$
$$\boxed{y = 4}$$

1. $5x - 4 = 3x + 12$

2. $10 - 4x = -9x$

3. $26 - 4s = 9s$

4. $5p - 9 = 2p + 12$

5. $-3r + 10 = 15r - 8$

6. $5t + 16 = 6 - 5t$

7. $7 + 3x - 12x = 3x + 1$

8. $w - 2 + 2w = 6 + 5w$

Solving Equations using Distributive Property

First, we need to **distribute** the value into the parenthesis. From here, we **combine like terms** and **isolate** the variable.

EXAMPLES:

$$4(x+3) - 2 = 6$$

$$4x + 12 - 2 = 6$$

$$\begin{array}{rcl} 4x \cancel{+10} & = & 6 \\ \cancel{-10} & & -10 \\ \hline \dfrac{\cancel{4}x}{\cancel{4}} & = & \dfrac{-4}{4} \end{array}$$

$$\boxed{x = -1}$$

$$3(x-6) = 10$$

$$\begin{array}{rcl} 3x \cancel{-18} & = & 10 \\ \cancel{+18} & & +18 \\ \hline \dfrac{\cancel{3}x}{\cancel{3}} & = & \dfrac{28}{3} \end{array}$$

$$\boxed{x = \frac{28}{3}}$$

$$-4(x-3) = 15$$

$$\begin{array}{rcl} -4x \cancel{+12} & = & 15 \\ \cancel{-12} & & -12 \\ \hline \dfrac{\cancel{-4}x}{\cancel{-4}} & = & \dfrac{3}{-4} \end{array}$$

$$\boxed{x = -\frac{3}{4}}$$

Most of the time, equations will have 1 solution.

With that being said, some equations can have....

INFINITE SOLUTIONS or NO SOLUTION.

If two sides don't equal each other, there is no solution.

$$5(x + 12) = 7 + 5x$$
$$5x + 60 = 7 + 5x$$
$$60 \neq 7$$
$$\therefore \quad \textbf{No Solution}$$

If two sides are identical, there are infinite solutions

$$2(2x + 2) = 4x + 4$$
$$4x + 4 = 4x + 4$$
$$\therefore \quad \infty \ \textbf{Solutions}$$

1. $10(g+5)=2(g+9)$

2. $-9(t-2)=4(t-15)$

3. $\frac{2}{3}(3x+9)=-2(2x+6)$

4. $2(2t+4)=\frac{3}{4}(24-8t)$

5. $10(2y+2)-y=2(8y-8)$

6. $2(4x+2)=4x-12(x-1)$

7. $5(1+2m)=\frac{1}{2}(8+20m)$

8. $3(4g+6)=2(6g+9)$

9. $12y+6=6(2y+1)$

9. $2(h+1)=5h-7$

Graphing in Slope-Intercept Form

Slope Intercept Form: $y = mx + b$

Slope: the steepness of a line.

We graph slope by $\frac{Rise}{Run}$

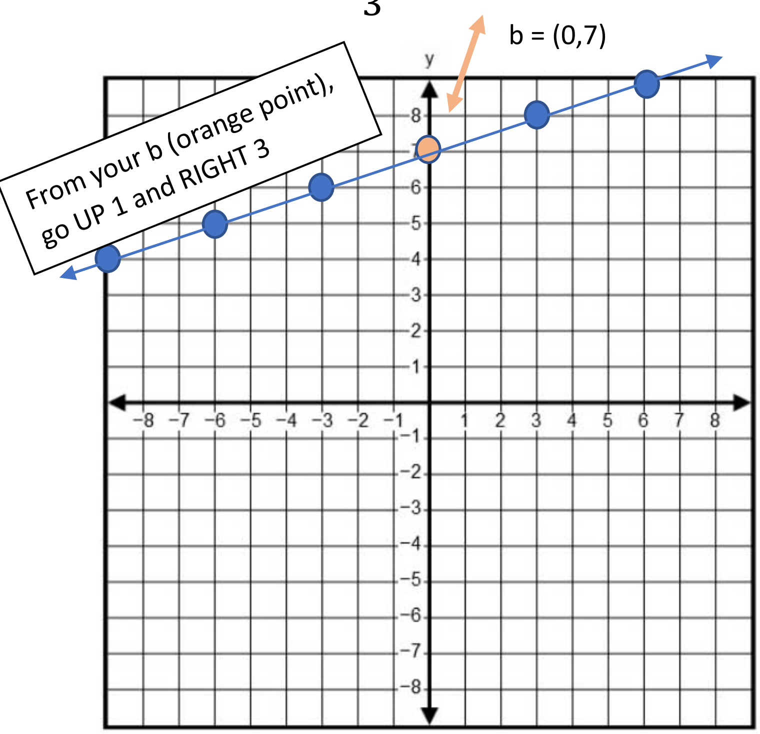
We rise UP and run RIGHT

Y-intercept: where the line crosses the y-intercept.

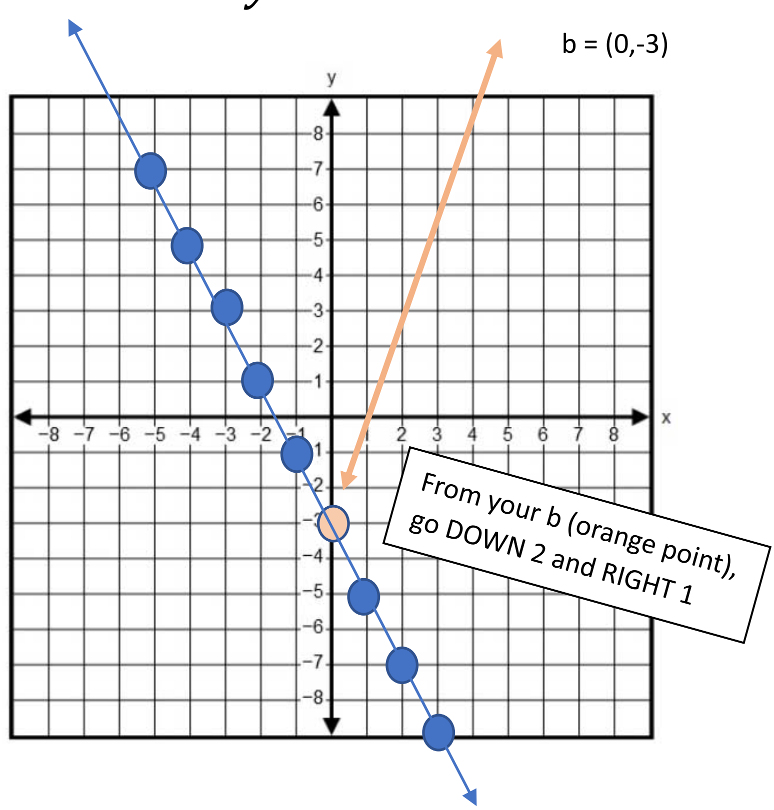
Examples:

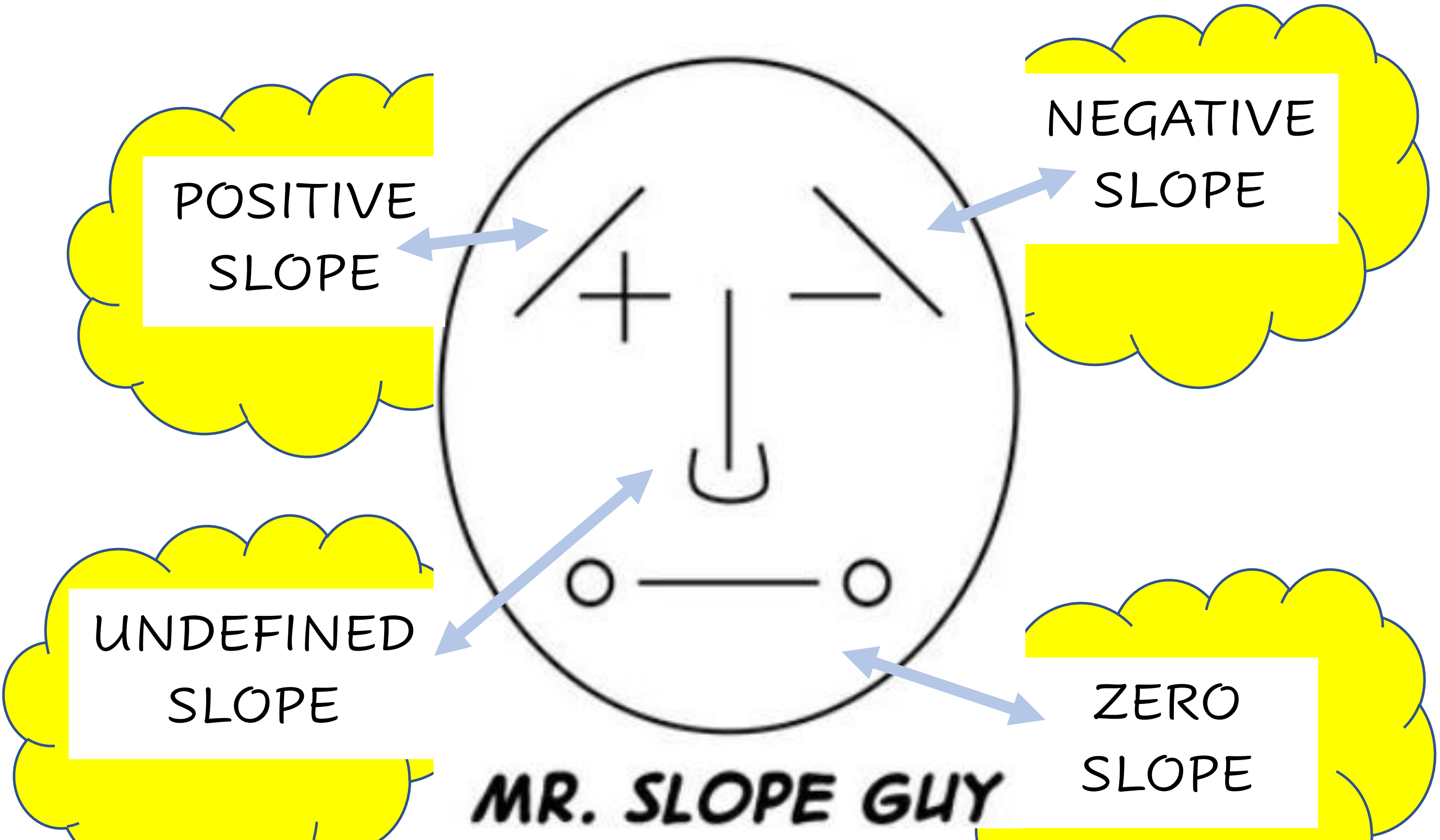
Remember -2 as a fraction is $\frac{-2}{1}$

$$y = \frac{1}{3}x + 7$$



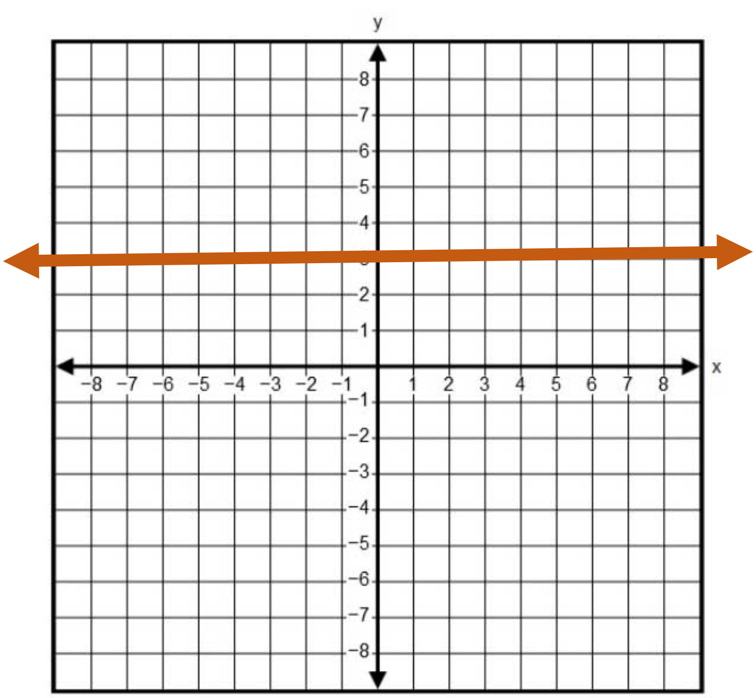
$$y = -2x - 3$$



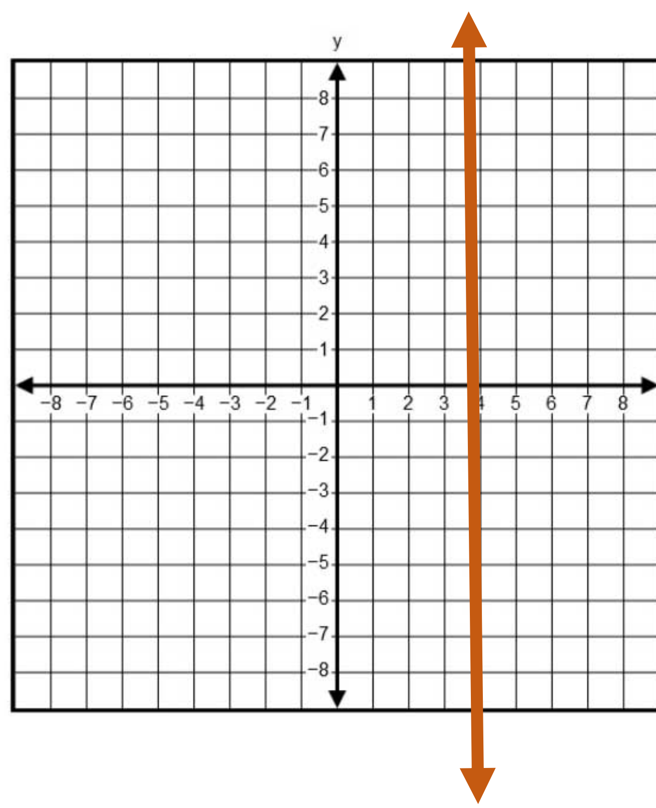


EXAMPLES:

$y = 4$

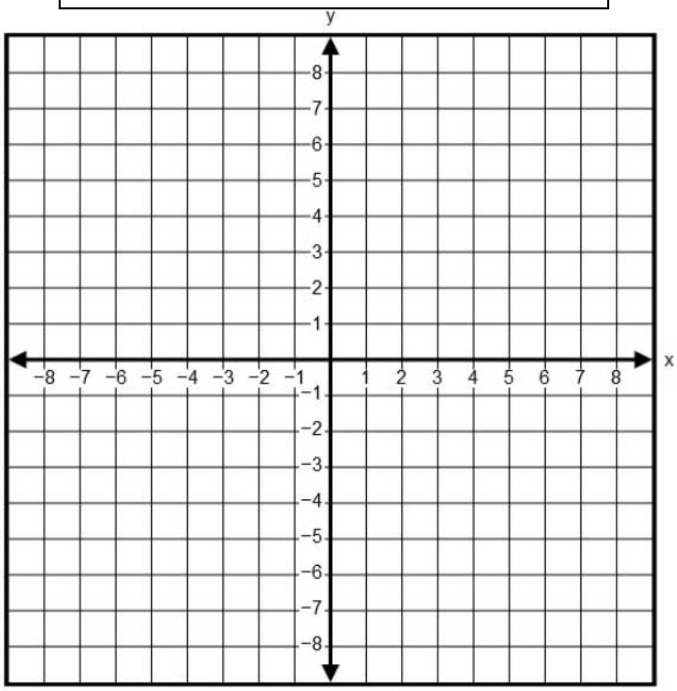


$x = 4$

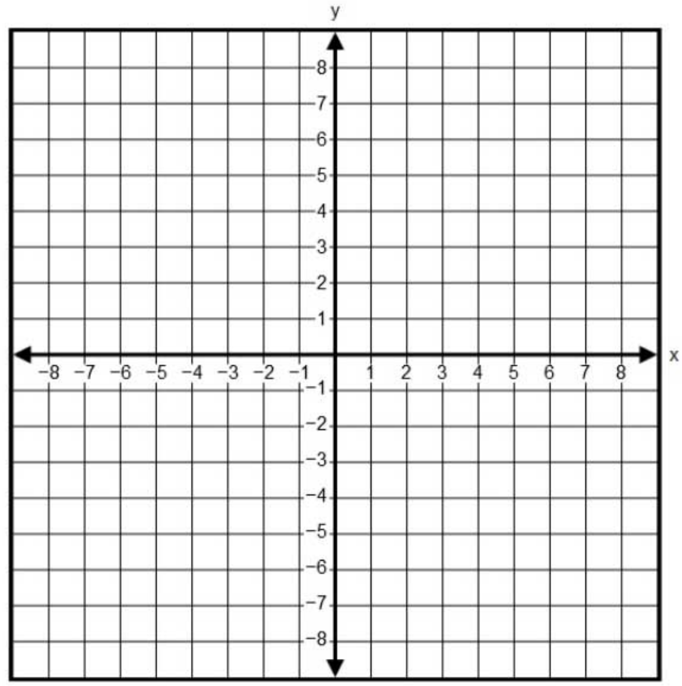


Directions: For the following examples, graph the equations.

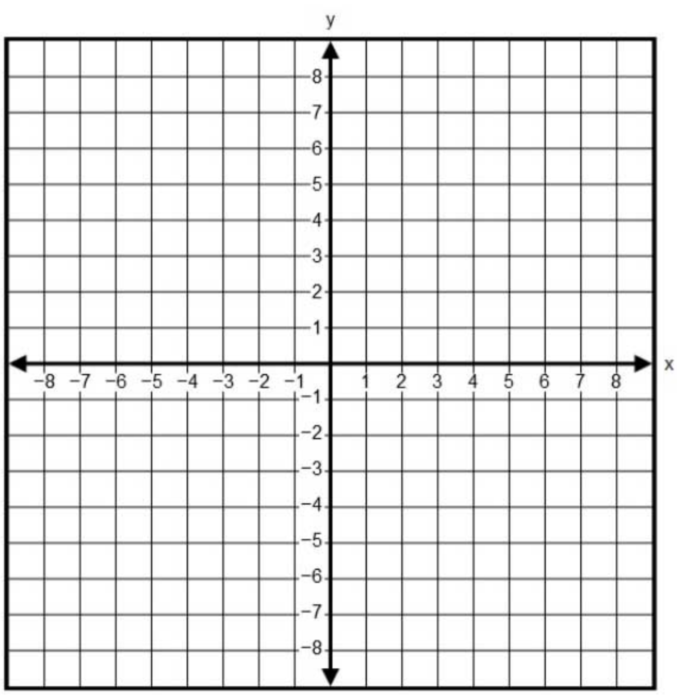
$$y = \frac{1}{3}x - 2$$



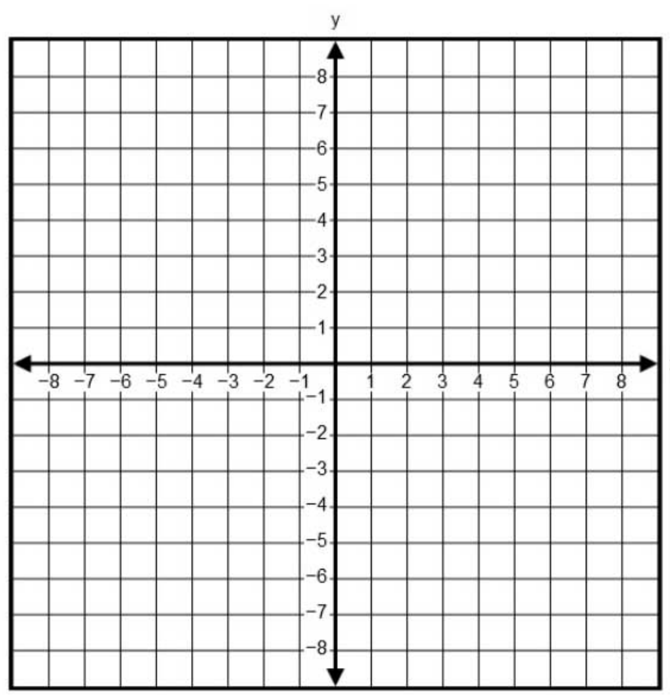
$$y = \frac{2}{5}x - 3$$



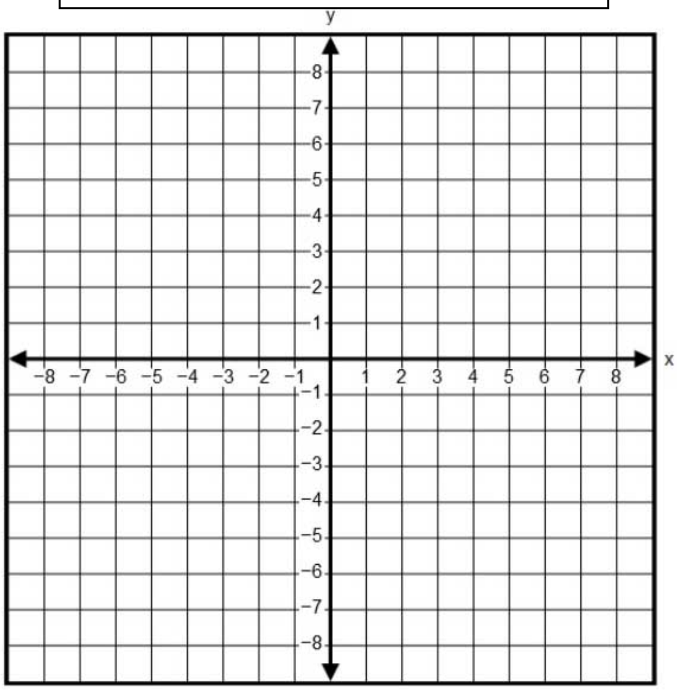
$$y = -2x - 2$$



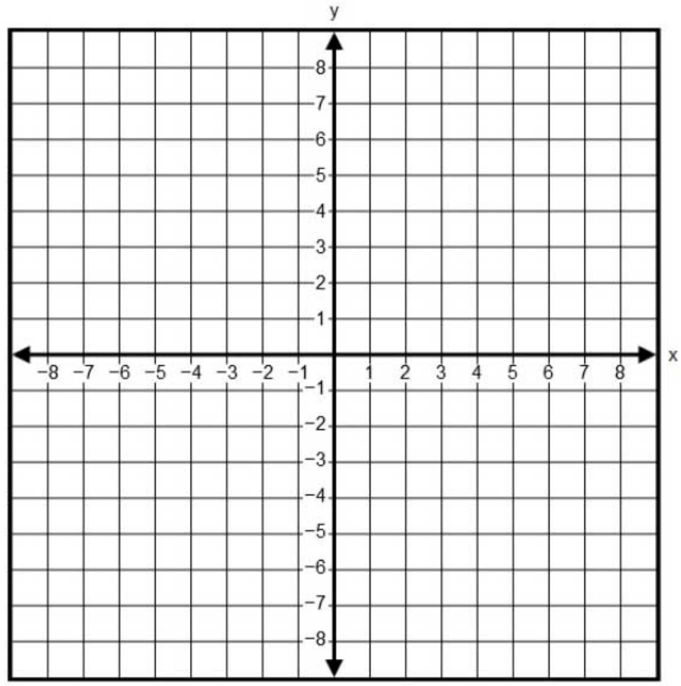
$$y = \frac{1}{4}x$$



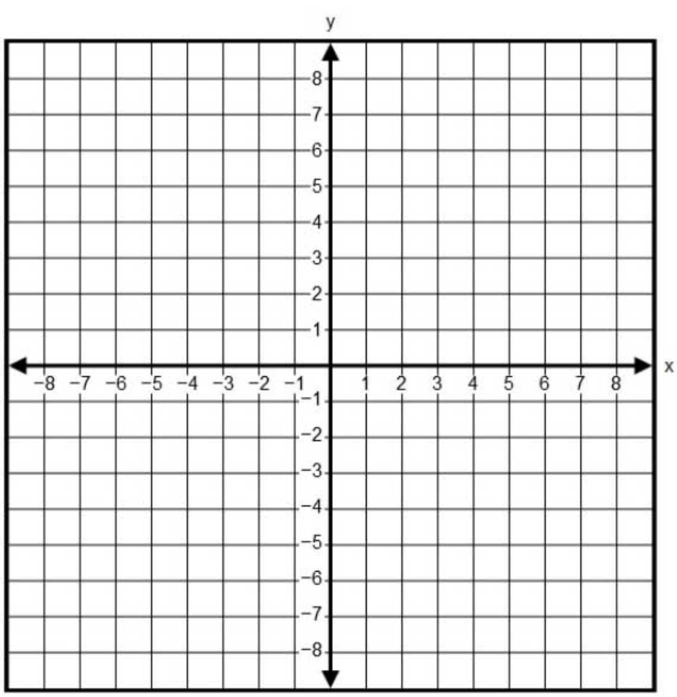
$y = 6$



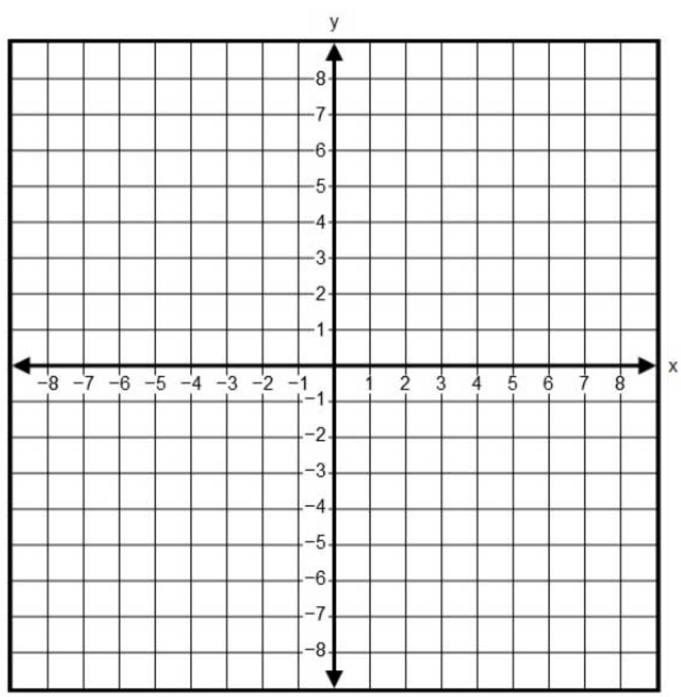
$y = 3x + 4$



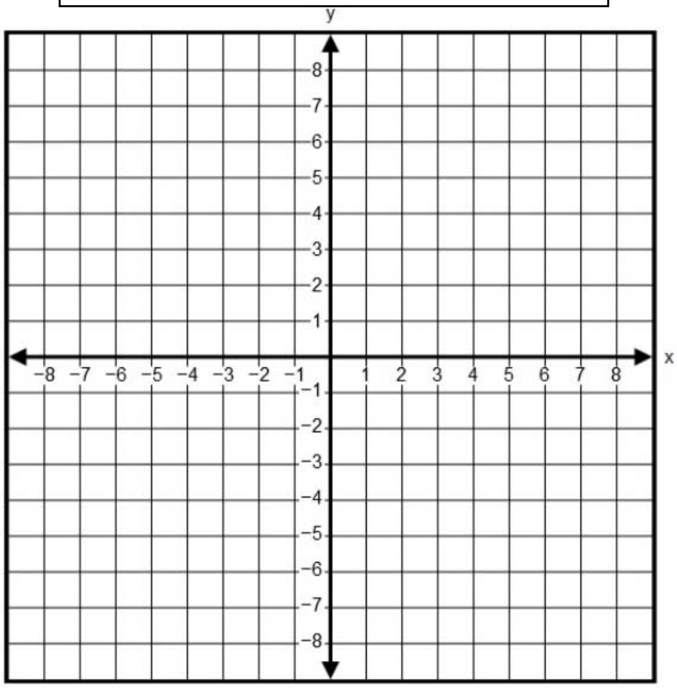
$y = -\frac{5}{6}x - 3$



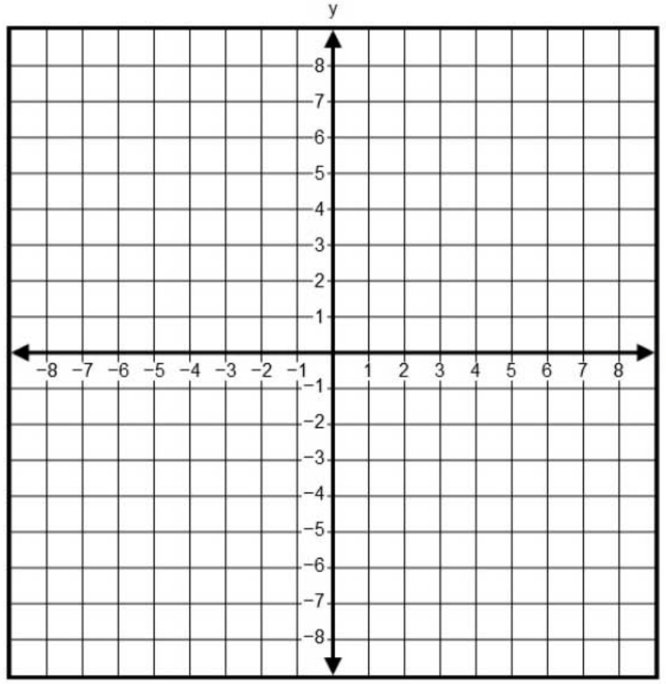
$y = \frac{4}{3}x$



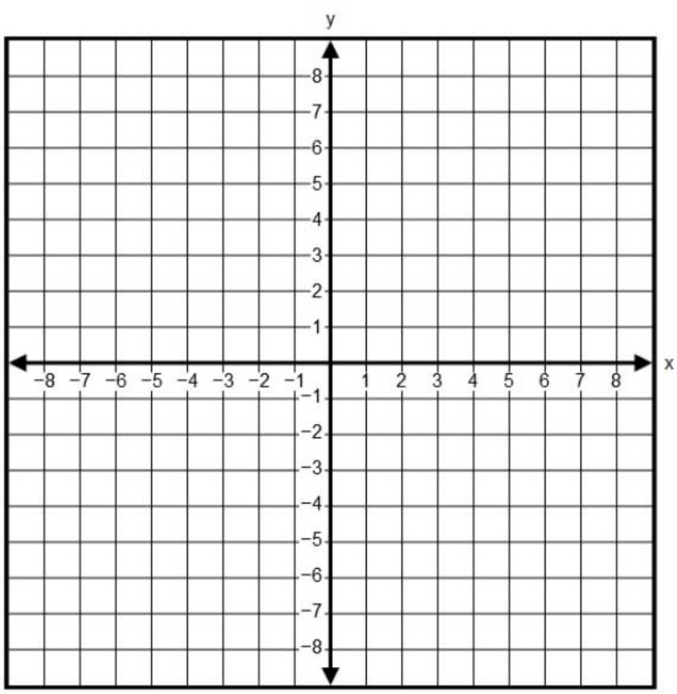
$y = 3x$



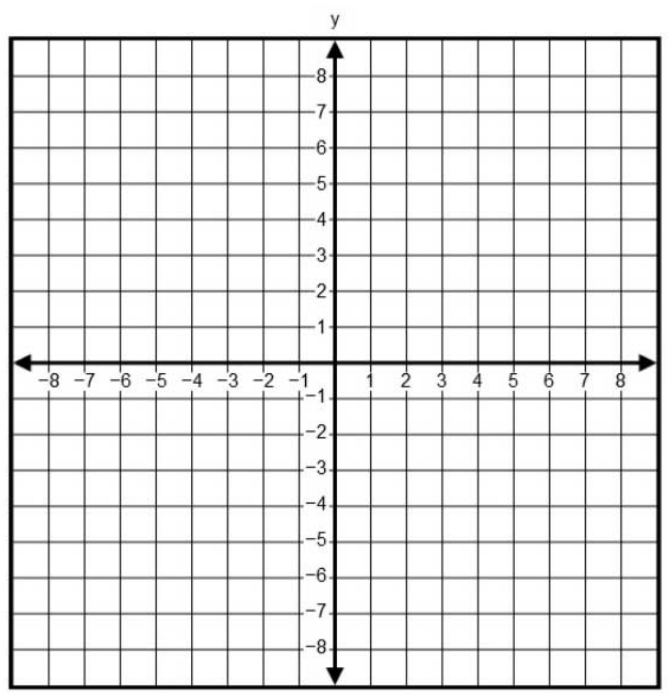
$y = -8$



$x = 4$



$y = -\frac{2}{7}x - 4$



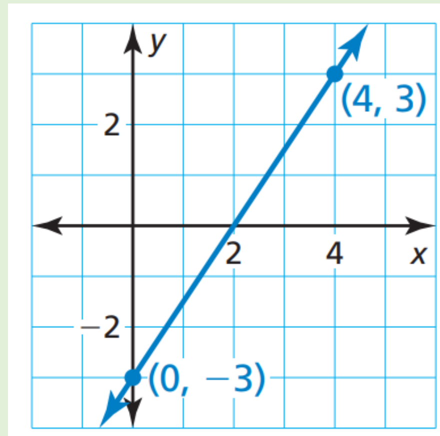
Slope Intercept Form: $y = mx + b$

Given a slope and a y-intercept, write an equation.

Slope = -3 Y-intercept = $\frac{1}{2}$

Answer: $y = -3x + \frac{1}{2}$

Given a graph, write an equation.



Answer: $y = \frac{3}{2}x - 3$

Given two points, write an equation.

$(0, -5), (8, 4)$

$$m = \frac{4 - -5}{8 - 0} = \frac{9}{8}$$

Pick any point to plug back into the equation to find b.

$$-5 = \frac{9}{8}(0) + b$$

$$-5 = b$$

Answer: $y = \frac{9}{8}x - 5$

Give it a try!

Directions: Write an equation in slope-intercept form.

1. Slope: 2 & y-intercept: 9

2. Slope: -3 & y-intercept: 0

3. Slope: $\frac{2}{3}$ & y-intercept: -6

4. $(3,1),\ (0,10)$

5. $(2,-4),\ (0,-4)$

6. $(0,3),\ (-5,2.5)$

Writing Equations in Point-Slope Form

What is point slope form?

$$y_2 - y_1 = m(x_2 - x_1)$$

Write the equation of a line given the y-intercept and another point

$$b = 2, (2,5)$$

$$\left(\underbrace{0}_{x_1}, \underbrace{2}_{y_1}\right), \left(\underbrace{2}_{x_2}, \underbrace{5}_{y_2}\right)$$

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

$$m = \frac{5-2}{2-0} = \frac{3}{2}$$

$$y - y_1 = m(x - x_1)$$

$$y - 2 = \frac{3}{2}(x - 0)$$

$$y - 2 = \frac{3}{2}x$$

$$y = \frac{3}{2}x + 2$$

Write an equation in slope-intercept form given two point

$$(4, -3), (3, -6)$$

$$\left(\underbrace{4}_{x_1}, \underbrace{-3}_{y_1}\right), \left(\underbrace{3}_{x_2}, \underbrace{-6}_{y_2}\right)$$

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

$$m = \frac{-6-(-3)}{3-4} = \frac{-6+3}{3-4} = \frac{-3}{-1} = 3$$

$$y - y_1 = m(x - x_1)$$

$$y - (-3) = 3(x - 4)$$

$$y + 3 = 3x - 12$$

$$y = 3x - 15$$

Let's Try it!

Directions: Using Point Slope Form, write your Slope-Intercept Form equation.

1. (2,1); $m = 2$

2. (7,-4); $m = -6$

3. (-6,6); $m = \frac{3}{2}$

4. (7,2); (2,12)

5. (1,-9); (-3,-9)

6. (-2,5); (-4,-5)

GCF's

A GCF is the Greatest Common Factor of 2 terms.

To find a GCF, you find the largest integer that evenly divides into all the terms.

Examples:

GREATEST COMMON FACTOR

Find the GCF:

$10x^3, 25x^4$

GCF: $5x^3$

$10y^3, 20y$

GCF: $10y$

Find the GCF:

12, 28 GCF: 4

36, 100 GCF: 4

-45, 104 GCF: 1

Try it!

1. $20, 48$

2. $30, 84, 126$

3. $14, 30$

4. $36x^2, 48x$

5. $12x, 22x^3$

6. $12y, 24y$

7. $17, 25$

8. $8p, 8q$

Problem Solving

1. What are two numbers that multiply to 16 but add to 10?
2. What are two numbers that multiply to -85 but add to 22?
3. What are two numbers that multiply to 42 but add to 23?
4. What are two numbers that multiply to 14 but add to -5?
5. What are two numbers that multiply to 114 but add to 35?
6. What are two numbers that multiply to 36 but add to 12?
7. What are two numbers that multiply to -17 but add to -16?
8. What are two numbers that multiply to 46 but add to 25?
9. What are two numbers that multiply to 38 but add to 21?

Word Problems

1. Paul wants to fence in his garden to prevent this dog from digging it up. He has 66 meters of fencing. If Paul wants the length of the garden to be twice the width, what will the dimensions of the garden be? Assume Paul wants to use all 66 meters of fencing.

2. The Jones family is taking a trip from Seattle, WA to San Diego, CA over the course of 3 days. They plan on traveling 200 miles more on the second day than they will on the first day. They will travel 75 miles less on the third day than they will on the first day. To total distance of the trip is 1058 miles. How many miles will they travel each day?

3. The town of Mathville is triangular in shape and has a perimeter of 104 km. The interstate borders the southern part of the town, but town residents want to build two more roads, one on each side of the town. The length of one side of the town is $\frac{1}{2}$ the length of the interstate. The length of the other side is $\frac{2}{3}$ the length of the interstate. Determine the length of road necessary to complete the town's task. That is, determine the length of each of the two sides of the town not bordered by the interstate. HINT: Draw a picture.

4. While planning a vacation to Europe, Cal wanted to go to Dublin, Ireland, London, England and Paris, France. The distance from Dublin to London is 78 more miles than the distance between London and Paris. If the distance between Dublin and Paris is 504 miles, including the stop in London, what is the distance between London and Paris? What is the distance between Dublin and London? H

5. The Maxwell children have hired a caterer to provide food for an anniversary party for their parents. The caterer has quoted a price of $96 per person and is asking for an advance payment of one-fourth of the total bill. If the advance payment is $1200, how many guests are invited to the party.