Summer Work Packet For
Students Entering Grade 8 Algebra 1

May 2025

To my math students,

I have prepared a summer work packet for you to help you better prepare for your upcoming course, Algebra 1. As academic standards become more rigorous, I would like my students to be able to demonstrate and communicate an in-depth understanding of the topics taught in mathematics. My goal is not only to have the students master a particular skill, but also to be able to apply these skills in real-life situations.

As you prepare to take Algebra 1 in your eighth grade year, this booklet covers *some* of the many skills that you have been exposed to during your last 3 years of math at St. Cecilia. These skills continue to be used in the study of Algebra 1 and the more confident and proficient you are with them, the easier it will be to learn new concepts.

This is NOT a test! If you encounter some material that is not familiar to you, or you do not remember how to do a particular problem(s) – don't panic. You many use any resource (i.e. a family member, friend, your notes from this past year, Khan Academy) to help you.

When working through these problems, your focus should be on not only getting the correct answer, but also developing good habits. The following are some things that should sound familiar to you:

- Show and label all your work – even when a calculator is used
- Keep your work neat and organized
- Don't cram your work on the paper if there is not enough room – use another piece of paper!
- Use pencil so you can neatly erase any corrections
- Write complete sentences when answering word problems
- **It is ok to be wrong** - just be able to explain where you went wrong, and don't erase what you have done. I look forward to a great school year with you.

The complete packet is due when you return to school on August 20, 2025. Enjoy your summer!

Miss Julie Poux
Miss Julie Poux

Note* This work is not optional.**
Remember…there's no crying in math. Use your resources.

Rename Fractions, Percents, and Decimals

Hints/Guide

To Convert fractions into decimals, we start with a fraction, such as $\frac{3}{5}$, and divide the numerator (the top number of the fraction) by the denominator (the bottom number of the fraction). So:

$$5\overline{)3.0}\quad 0.6$$

and the fraction $\frac{3}{5}$ is equivalent to the decimal 0.6

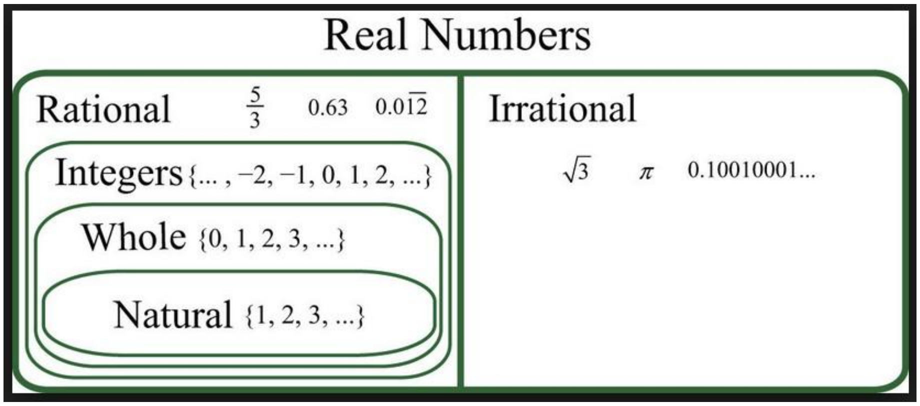
To convert a decimal to a percent, we multiply the decimal by 100 (percent means a ratio of a number compared to 100). A short-cut is sometimes used of moving the decimal point two places to the right (which is equivalent to multiplying a number by 100), so 0.6 · 100 = 60 and $\frac{3}{5} = 0.6 = 60\%$

To convert a percent to a decimal, we divide the percent by 100,
60% is the same as 60 ÷ 100, which is 0.6, so 60% = 0.6
To convert a fraction into a percent, we can use proportions to solve, so

$\frac{3}{3} = \frac{x}{100}$ and using cross products to solve, 5x = 300 or x = 60%

Exercises: Complete the chart

	Fraction	**Decimal**	**Percent**
1.		0.04	
2.			125%
3.	$\frac{2}{3}$		
4.		1.7	
5.			0.6%
6.	$3\frac{2}{3}$		
7.		0.9	
8.			70%
9.	$\frac{17}{25}$		
10.		0.007	



The **Real** number system is made up of two main sub5groups **Rational numbers** and **Irrational numbers.**

The set of rational numbers includes several subsets: **natural numbers, whole numbers, and integers.**

- **Real Numbers -** any number that can be represented on a number-line.
  - **Rational Numbers -** a number that can be written as the ratio of two integers (this includes decimals that have a definite end or repeating pattern)

    Examples: 2, -5, $-\frac{3}{2}$, $\frac{1}{3}$, 0.253. $0.\overline{3}$

    - **Integers -** positive and negative whole numbers and 0
      Examples: $-5, -3, 0, 8$ …
    - **Whole Numbers** – the counting numbers from 0 to infinity
      Examples: { 0, 1, 2, 3, 4, ….}
    - **Natural Numbers -** the counting numbers from 1 to infinity
      Examples: { 1, 2, 3, 4… }
  - **Irrational Numbers –** Non-terminating, non-repeating decimals (including π, and the square root of any number that is not a perfect square.)

    Examples: 2π, $\sqrt{3}$, $\sqrt{23}$, 3.21211211121111….

Practice: Name all the sets to which each number belongs.

1. -4.2 ________________________________ 2. $3\sqrt{5}$ ______________________________

3. $\frac{5}{3}$ ________________________________ 4. 9 ________________________________

5. $\sqrt{16}$ ______________________________ 6. $-\frac{8}{2}$ ________________________________

Laws of Exponents

Hints/Guide:

There are certain rules when dealing with exponents that we can use to simplify problems.

They are:

Multiplying powers with the same base	$a^m a^n = a^{m+n}$
Dividing powers with the same base	$\frac{a^m}{a^n} = a^{m-n}$
Power to a power	$(a^m)^n = a^{m \cdot n}$
Negative powers	$a^{-n} = \frac{1}{a^n}$
Zero power	$a^0 = 1$

Here are some examples of problems simplified using the above powers:

$4^3 \cdot 4^5 = 4^9$ $\quad (4^3)^3 = 4^9$ $\quad \frac{4^5}{4^3} = 4^2$ $\quad 4^{-4} = \frac{1}{4^4} = \frac{1}{256}$ $\quad 4^0 = 1$

Exercises: Simplify the following problems using exponents (Do not multiply out).

1. $5^2 \cdot 5^4 =$
2. $7^{-3} \cdot 7^5 =$
3. $(12^4)^3 =$
4. $(6^5)^2 =$
5. $5^9 \div 5^4 =$
6. $10^3 \div 10^{-5} =$
7. $7^{-3} =$
8. $3^{-4} =$
9. $124^0 =$
10. $-9^0 =$
11. $(3^5 \cdot 3^2)^3$
12. $5^3 \cdot 5^4 \div 5^7$

Find Percent of a Number

Hints/Guide:

To determine the percent of a number, we must first convert the percent into a decimal by dividing by 100 (which can be short-cut by moving the decimal point in the percentage two places to the left), then multiplying the decimal by the number.

Percent Equation ⇒ is = % (of) or Percent Proportion ⇒ $\frac{\%}{100} = \frac{is}{of}$

For example:

4.5% of 240 start with formula: is = % (of)
= 4.5% · 240
= 0.045 · 240
= 10.8

Answer: 4.5% of 240 is 10.8.

or

$$\frac{\%}{100} = \frac{is}{of}$$

$$\frac{4.5}{100} = \frac{x}{240}$$

$$100x = 4.5(240)$$

$$\frac{100x}{100} = \frac{1080}{100}$$

$$x = 10.8$$

SHOW ALL WORK.

1. 7.5% of 42 is what number?	2. 18 is what percent of 120?
3. 12% of what number is 54?	4. 8% of 20 is what number?
5. 96 is what percent of 80?	6. 3.75 is 5% of what number?

Solving Equations

Hints/Guide:

As we know, the key in equation solving is to isolate the variable. In equations with variables on each side of the equation, we must combine the variables first by adding or subtracting the amount of one variable on each side of the equation to have a variable term on one side of the equation. Then, we must undo the addition and subtraction, then multiplication and division.

To solve an equation with the same variable on each side, write an equivalent equation that has the variable on just one side of the equation. Then solve.

Example **Solve $4(2a - 1) = -10(a - 5)$.**

$4(2a - 1) = -10(a - 5)$	Original equation
$8a - 4 = -10a + 50$	Distributive Property
$8a - 4 + 10a = -10a + 50 + 10a$	Add 10a to each side.
$18a - 4 = 50$	Simplify.
$18a - 4 + 4 = 50 + 4$	Add 4 to each side.
$18a = 54$	Simplify.
$\frac{18a}{18} = \frac{54}{18}$	Divide each side by 18.
$a = 3$	Simplify.

The solution is 3.

Practice: Solve each equation.

1. $5 + 3r = 5r - 19$

2. $8x + 12 = 4(3 + 2x)$

3. $-5x - 10 = 2 - (x + 4)$

4. $6(-3m + 1) = 5(-2m - 2)$

5. $3(d - 8) - 5 = 9(d + 2) + 1$

6. Explain two ways you could solve 20 = 5(-3+x)

Algebraic Inequalities

Hints/Guide:

An inequality is a statement containing one of the following symbols:

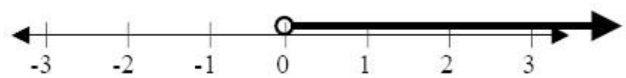
$<$ is less than $>$ is greater than $\leq$ is less than or equal to $\geq$ is greater than or equal to

An inequality has many solutions, and we can represent the solutions of an inequality by a set of numbers on a number line.

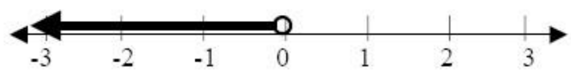
When graphing an inequality, $<$ and $>$ use an open circle ○ $\leq$ and $\geq$ use a closed circle ●

Examples:

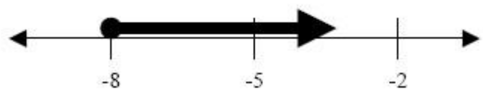
$x > 0$



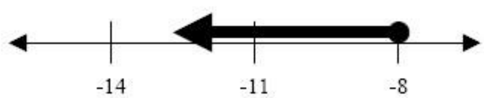
$x < 0$



$x \geq -8$

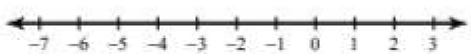


$x \leq -8$



Solve each inequality and graph its solution

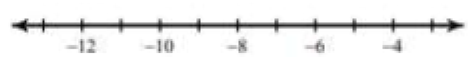
1. $-2r - 2 \leq 4$



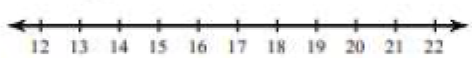
2. $8x + 2 \leq 138$

3. $-2 + \frac{x}{2} > 6$

4. $\frac{x+1}{2} \geq -4$

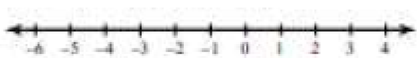


5. $9 + \frac{n}{2} > 16$



6. $-1 - 6x - 6 > -11 - 7x$

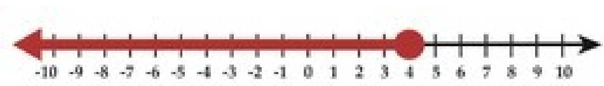
7. $-x < -x + 7(x - 2)$



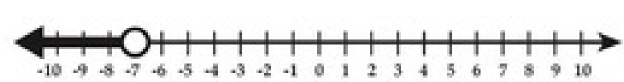
8. $-2(5 + 6n) < 6(8 - 2n)$

Write an inequality to represent the solution set that is shown in the graph.

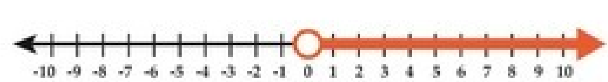
9. ____________________________



10. ____________________________

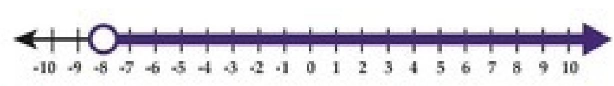


11. ____________________________

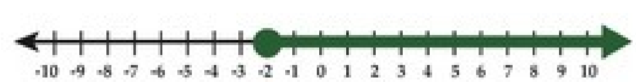


12. ____________________________

13. ____________________________



14. ____________________________



Word Problems

Hints / Guide

Translate each word problem into an algebraic equation, using x for the unknown, and solve. Write a **"let x ="** for each unknown; write an equation; solve the equation; substitute the value for x into the let statements(s) to answer the question.

For Example:

Kara is going to Maui on vacation. She paid $325 for her plane ticket and is spending $125 each night for the hotel. How many nights can she stay in Maui if she has $1200?

Step 1: What are you asked to fine? Let variables represent what you are asked to find.

How many nights can Kara stay in Maui?

Let x = The number of nights Kara can stay in Maui

Step 2: Write an equation to represent the relationship in the problem.

$325 + 125x = 1200$

Step 3: Solve the equation for the unknown

$$\begin{aligned} 325 + 125x &= 1200 \\ -325 \qquad &\quad -325 \\ 125x &= 875 \\ x &= 7 \end{aligned}$$

Kara can spend 7 nights in Maui

Word Problem Practice Set

1. A video store charges a one-time membership fee of $12.00 plus $1.50 per video rental. How many videos can Stewart rent if he spends $21?

2. Bicycle city makes custom bicycles. They charge $160 plus $80 for each day that it takes to build the bicycle. If you have $480 to spend on your new bicycle, how many days can it take Bicycle City to build the bike?

3. Darel went to the mall and spent $41. He bought several t-shirts that each cost $12 and he bought 1 pair of socks for $5. How many t-shirts did Darel buy?

Volume/ Surface Area

Hints/Guide:
The formulas we need to know are:

Volume of a rectangular prism: $V = lwh$

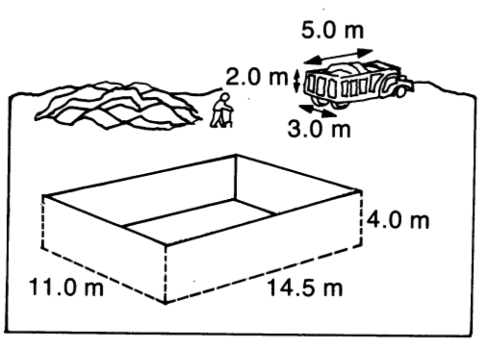
Volume of a cylinder: $V = \pi r^2 h$

Surface Area of a rectangular prism: $SA = 2lw + 2wh + 2hl$

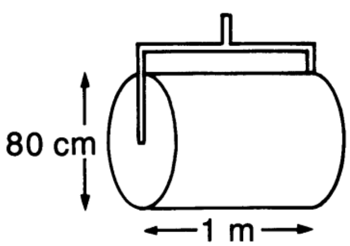
Surface Area of a cylinder: $SA = 2r\pi h + 2\pi r^2$

Exercises: Write out the formula and show the substitutions.

1. The excavation for a house and the trucks to carry away the material, have the dimensions shown. About how many level truck loads are necessary to remove all the dirt?



2. A lawn roller is 1 m wide and 80 cm high. What area is covered in each revolution?



Coordinate Geometry

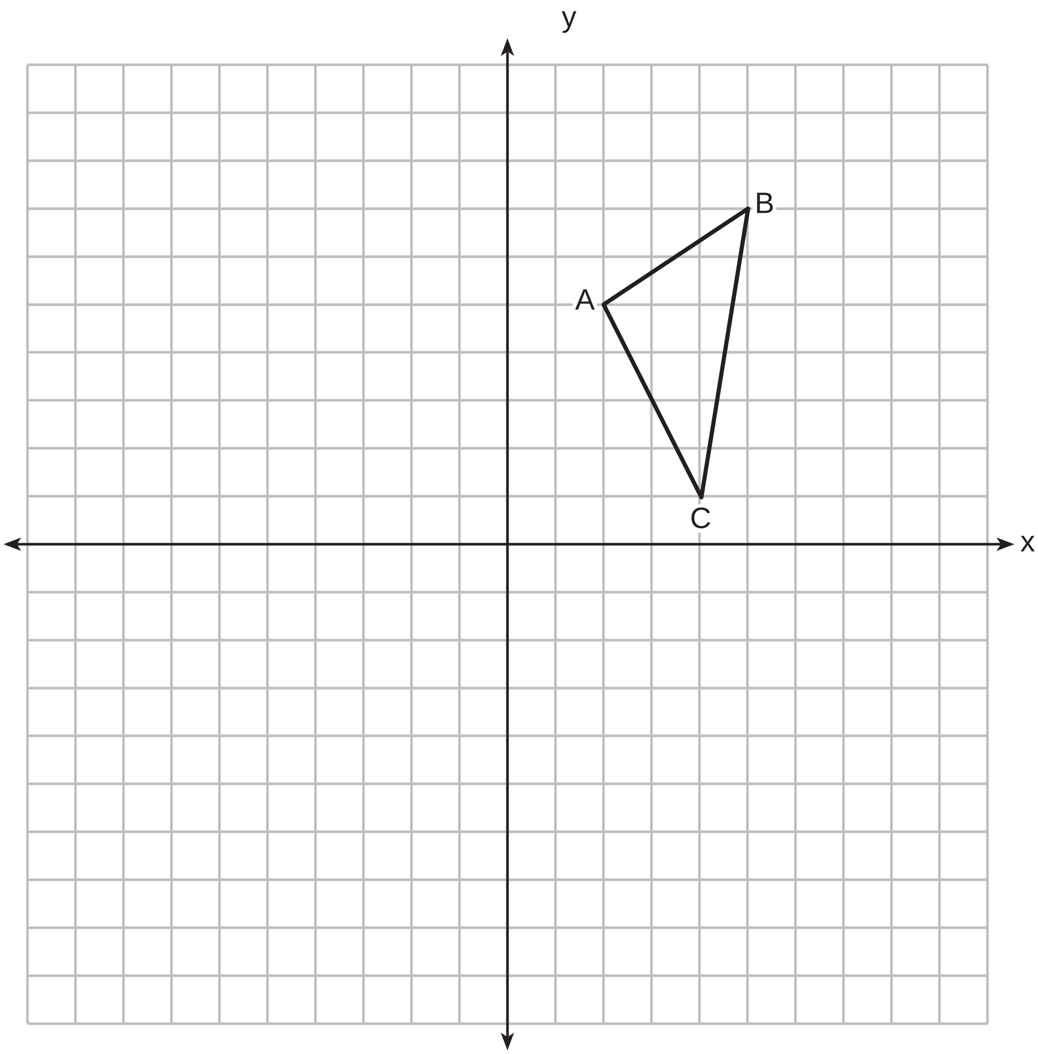
Use a ruler.

The coordinates of $\triangle ABC$, shown on the graph below, are $A(2, 5)$, $B(5, 7)$, and $C(4, 1)$.

Graph and label $\triangle A'B'C'$, the image of $\triangle ABC$ after it is reflected over the ***y*-axis**.

Graph and label $\triangle A''B''C''$, the image of $\triangle A'B'C'$ after it is reflected over the ***x*-axis**.

State a single transformation that will map $\triangle ABC$ onto $\triangle A''B''C''$.



Combining Like Terms

Hints/Guide:

Terms in algebra are numbers, variables or the product of numbers and variables. In algebraic expressions terms are separated by addition (+) or subtraction (5) symbols. Terms can be combined using addition and subtraction if they are **like-terms**.

Like-terms have the same variables to the same power.
Example of like5terms: $5x^2$ and $-6x^2$

Example of terms that are **NOT** like5terms: $9x^2$ and $15x$
Although both terms have the variable ***x****, they are not being raised to the same power*

To combine like-terms using addition and subtraction, add or subtract the numerical factor
Example: Simplify the expression by combining like5terms

$$8x^2+9x-12x+7x^2 = (8+7)x^2+(9-12)x$$
$$= 15x^2+-3x$$
$$= 15x^2-3x$$

Practice: Simplify each expression

1. $5x-9x+2$
2. $3q^2+q-q^2$
3. $c^2+4d^2-7d^2$
4. $5x^2+6x-12x^2-9x+2$
5. $2(3x-4y)+5(x+3y)$
6. $10xy-4(xy+2x^2y)$

Properties of Real Numbers

Following are properties of Real Numbers that are useful in evaluating and solving algebraic expressions.

Additive Identity	For any number a, $a + 0 = a$.
Multiplicative Identity	For any number a, $a \cdot 1 = a$.
Multiplicative Property of 0	For any number a, $a \cdot 0 = 0$.
Multiplicative Inverse Property	For every number $\frac{a}{b}$, $a, b \neq 0$, there is exactly one number $\frac{b}{a}$ such that $\frac{a}{b} \cdot \frac{b}{a} = 1$.
Reflexive Property	For any number a, $a = a$.
Symmetric Property	For any numbers a and b, if $a = b$, then $b = a$.
Transitive Property	For any numbers a, b, and c, if $a = b$ and $b = c$, then $a = c$.
Substitution Property	If $a = b$, then a may be replaced by b in any expression.

Commutative Properties	For any numbers a and b, $a + b = b + a$ and $a \cdot b = b \cdot a$.
Associative Properties	For any numbers a, b, and c, $(a + b) + c = a + (b + c)$ and $(ab)c = a(bc)$.

Practice: Name the property illustrated in each equation.

1. $3 \cdot x = x \cdot 3$ ______________________________

2. $3a + 0 = 3a$ ______________________________

3. $2r + (3r + 4r) = (2r + 3r) + 4r$ ______________________________

4. $5y \cdot \frac{1}{5y} = 1$ ______________________________

3. $9a + (-9a) = 0$ ______________________________

4. $(10b + 12b) + 7b = (12b + 10b) + 7b$ ______________________________

5. $5x + 2 = 5x + 2$ ______________________________

6. If $9 + 4 = 13$ and $13 = 2 + 11$ then $9 + 4 = 2 + 11$ ______________________________

7. If $x = 7$ then $7 = x$ ______________________________

10. $3 \bullet 1 = 3$ ______________________________

The Distributive Property

The Distributive Property states for any number a, b, and c:

1. $a(b+c)=ab+ac$ or $(b+c)a=ba+ca$
2. $a(b-c)=ab-ac$ or $(b-c)a=ba-ca$

Practice: Rewrite each expression using the distributive property.

1. $7(h-3)$

2. $-3(2x+5)$

3. $(5x-9)4$

4. $\frac{1}{2}(14-6y)$

5. $3(7x^2-3x+2)$

6. $\frac{1}{4}(16x-12y+4z)$

7. $(9-2x+3xy)(-4)$

8. $0.3(40a+10b-5)$

Ratios and Proportions

Solve Proportions If a proportion involves a variable, you can use cross products to solve the proportion. In the proportion $\frac{x}{5} = \frac{10}{13}$, x and 13 are called **extremes.** They are the first and last terms of the proportion. 5 and 10 are called **means**. They are the middle terms of the proportion. In a proportion, the product of the extremes is equal to the product of the means.

Means-Extremes Property of Proportions	For any numbers a, b, c, and d, if $\frac{a}{b} = \frac{c}{d}$, then $ad = bc$.

Example 1:

$$\frac{x}{5} = \frac{10}{13}$$

$$x \cdot 13 = 5 \cdot 10$$

$$13x = 50$$

$$x = \frac{50}{13}$$

Example 2:

$$\frac{x+1}{4} = \frac{3}{4}$$

$$4(x+1) = 3 \cdot 4$$

$$4x + 4 = 12$$

$$-4 \quad -4$$

$$4x = 8$$

$$\frac{4x}{4} = \frac{8}{4}$$

$$x = 2$$

Practice: Solve each proportion.

1. $\frac{x}{21} = \frac{3}{63}$

2. $\frac{9}{y+1} = \frac{18}{54}$

3. $\frac{-3}{x} = \frac{2}{8}$

4. $\frac{0.1}{2} = \frac{0.5}{x}$

5. $\frac{a-8}{12} = \frac{15}{3}$

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

Rate of Change and Slope

Find Slope

Slope of a Line	$m = \frac{\text{rise}}{\text{run}}$ or $m = \frac{y_2 - y_1}{x_2 - x_1}$, where (x_1, y_1) and (x_2, y_2) are the coordinates of any two points on a nonvertical line

Example 1 **Find the slope of the line that passes through $(-3, 5)$ and $(4, -2)$.**

Let $(-3, 5) = (x_1, y_1)$ and $(4, -2) = (x_2, y_2)$.

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

$= \frac{-2 - 5}{4 - (-3)}$ $y_2 = -2, y_1 = 5, x_2 = 4, x_1 = -3$

$= \frac{-7}{7}$ Simplify.

$= -1$

Example 2 **Find the value of r so that the line through $(10, r)$ and $(3, 4)$ has a slope of $-\frac{2}{7}$.**

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

$-\frac{2}{7} = \frac{4 - r}{3 - 10}$ $m = -\frac{2}{7}, y_2 = 4, y_1 = r, x_2 = 3, x_1 = 10$

$-\frac{2}{7} = \frac{4 - r}{-7}$ Simplify.

$-2(-7) = 7(4 - r)$ Cross multiply.

$14 = 28 - 7r$ Distributive Property

$-14 = -7r$ Subtract 28 from each side.

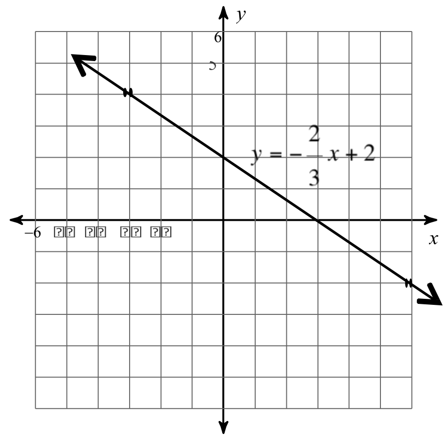
$2 = r$ Divide each side by -7.

Practice:

Find the slope of the line that passes through each pair of points.

1. (4 , 9) and (1 , -6)
2. (2 , 5) and (6 , 2)
3. (4 , 3.5) and (-4 , 3.5)
4. (1 , -2) and (-2 , -5)
5. (12 , -18) and (11 , 12)
6. (-20 , -4) and (-12 , -10)

Graphing Linear Equations



Hints/Guide:

Graphing a linear equation in slope-intercept form: y = mx + b,
where m = slope and b = y-intercept.

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

slope (m) = $-\frac{2}{3}$

y-intercept (b) - where the line crosses the **y-axis** = 2

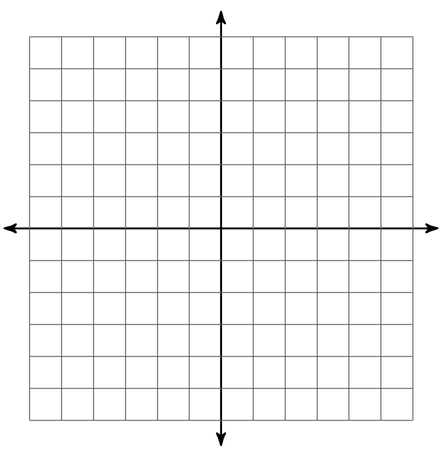
Remember
slope = $\frac{rise}{run}$

Directions: Write in the slope and the y-intercept for each line and then graph it. Use a straightedge to connect the points. You should try to have at least 3 points.

1. $y = x + 2$

Slope (m) = _________________

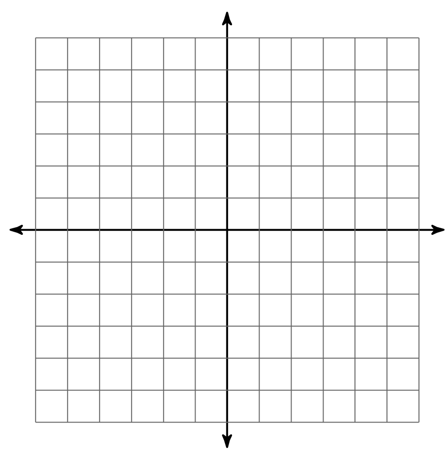
y-intercept (b) = ______________



2. $y = 2x - 3$

slope (m) = ____________

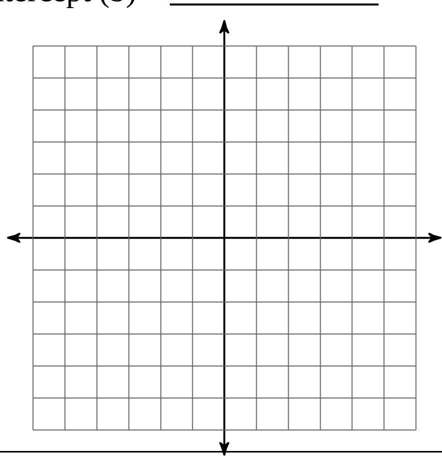
y-intercept (b) = __________________



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

Slope (m) = _________________

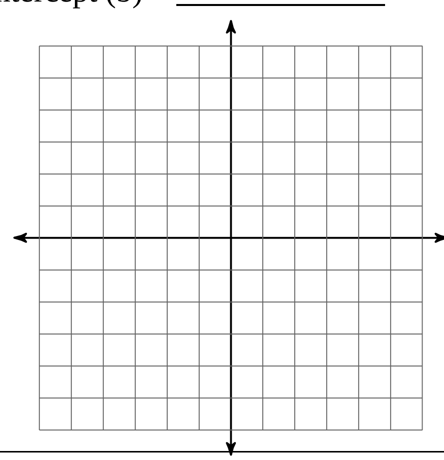
y-intercept (b) = ______________



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

Slope (m) = _________________

y-intercept (b) = ______________



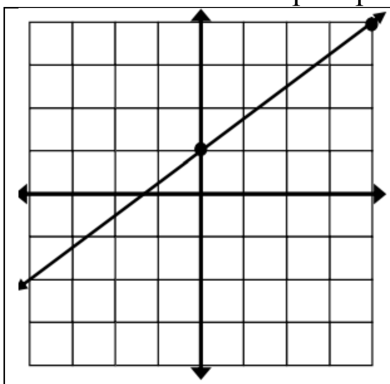
Slope of Linear Functions

Hints/Guide:

To write the equation of a given line, you must first find the slope and the y-intercept. Then put those values into the equation: $y = mx + b$

The slope will be the coefficient of *x* is the *m* value and the y-intercept (where the line crosses the y-axis) is the *b* value.

Be careful with the slope: up and to the right are "+" and down and to the left are "-"



In this graph, you start by finding the slope using two points on the graph and the formula $\frac{rise}{run}$

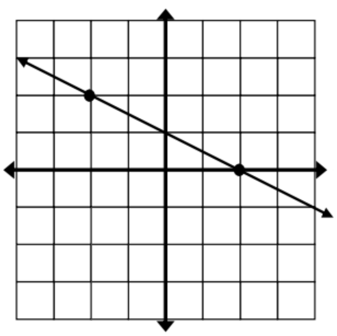
In this graph, start at (0,1) and move up 3 and to the right 4 to get to the point (4, 4). The rise is 3 and the run is 4 so the slope is: $\frac{3}{4}$

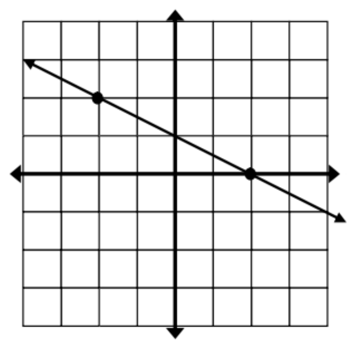
Then, you find where the line crosses the *y*-axis.

In this graph, the line crosses the *y*-axis at (0, 1) so the *y*-intercept (b) is 1

The equation for this line is $y = \frac{3}{4}x + 1$

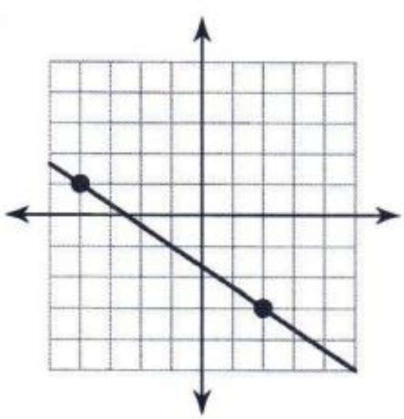
Write the equation for each of the given graphs

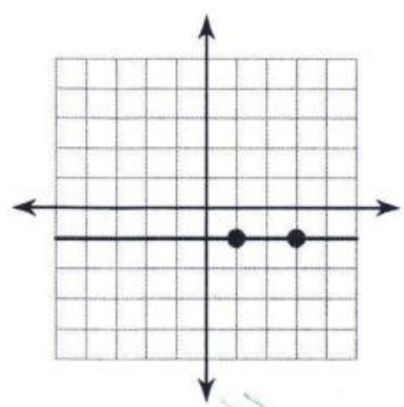




1. ________________________________

2. ________________________________





3. ________________________________

4. ________________________________

Writing Linear Functions

There are 2 main forms of linear equations (equations that represent a line).

- slope-intercept form: $\boldsymbol{y = mx + b}$

  you can easily identify the slope (m) and the y-intercept (b)
- Standard form: **A*x* + B*y* = C**

  you cannot get slope and y-intercept until you convert to slope intercept form

Example: Given the equation $3x - 2y = -16$ find the slope and the y-intercept

You must first convert to slope intercept form

$3x - 2y = -16$	*this is the given equation*
$-2y = -3x - 16$	*subtract 3x from both sides to get the y by itself*
$y = \frac{-3}{-2}x + \frac{-16}{-2}$	*divide each term by -2*
$y = \frac{3}{2}x + 8$	*simplify*

Using this form, the slope is $\frac{3}{2}$ *and the y-intercept is (0 , 8)*

Write the slope-intercept form of the equation of each line.

1. $13x - 11y = -12$

2. $9x - 7y = -7$

3. $11x - 4y = 32$

4. $4x - y = 1$

5. $x - 3y = 6$

6. $11x - 8y = -48$

Simplifying Polynomial Expressions

Simplify the following polynomial expressions. If you need a refresher for Combining Like Terms, look back at page 13. Look to page 4 for the rules for the Laws of Exponents.

1. $(5p^2 - 3) + (2p^2 - 3p^3)$

2. $(4r^3 + 3r^4) - (r^4 - 5r^3)$

3. $(9r^3 + 5r^2 + 11r) + (-2r^3 + 9r - 8r^2)$

4. $(12a^5 - 6a - 10a^3) - (10a - 2a^5 - 14a^4)$

5. $-5g(3 - 2g^2)$

6. $3(x + 4) - 2(x + 3) + 5(2x - 1)$

7. $(-3x^2y^4)(-5x^6y)$

8. $2b^3(4b^2 + 3by - 7y^2)$

9. $3(x + 4) - 2[(x + 3) + 5(2x + 1)]$

10. $20x^3 + 7x^2 - 3x^3 + 23x^2 - 27x^3 + 10x^2$