Unit 4

One-Step Equations & Inequalities

Checking Solutions to Equations
Solving Equations
Writing Equations
Checking Solutions to Inequalities
Writing Inequalities
Graphing Inequalities on Number Lines
Independent & Dependent Variables
Direct Variation

Name: ______________________________

Math Teacher: ______________________________

Unit 4 Pacing

Week of 1/10:
Equations – Checking Solutions and Solving

Week of 1/17:
Solving Equations, Equation Word Problems and Inequalities **QUIZ**

Week of 1/24:
Inequalities, Direct Variation and Review **QUIZ**

Week of 1/31:
Review, **END OF UNIT TEST, UNIT 4 INTERIM ASSESSMENT**

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Unit 4: One-Step Equations and Inequalities Standards, Checklist and Concept Map

Georgia Standards of Excellence (GSE):

GSE6.EE.5: Understand solving an equation or inequality as a process of answering a question: which values from a specified set, if any, make the equation or inequality true? Use substitution to determine if a given number in a set makes an equation or inequality true.

GSE 6.EE.6: Use variables to represent numbers and write expression when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set

GSE 6.EE.7: Solve real-world and mathematical problems by writing and solving equations of the form $x+p=q$ and $px=q$ for cases in which p,q and x are all nonnegative rational numbers.

GSE 6.EE.8 : Write an inequality of the form $x > c$ or $x < c$ to represent a constraint or condition in real-world problem. Recognize that inequalities of the form $x > c$ or $x < c$ have infinitely many solutions; represent solutions of such inequalities on number line diagrams.

GSE 6.EE.9 : Use variables to represent two quantities in a real-world problem that change in relationship to one another; write an equation to express one quantity, thought of as the dependent variable, in terms of the other quantity, thought of as the independent variable. Analyze the relationship between the dependent and independent variables using graphs and tables, and relate these to the equation. *For example, in a problem involving motion at constant speed, list and graph ordered pairs of distances and times, and use the equation $d = 65t$ to show the relationship between distance and time.*

What Will I Need to Learn??

________ Write expressions (from word problems) with a variable that represents a number

________ To substitute to check the solution of an equation

________ Write equations based on real-world problems

________ Solve equations based on real-world problems

________ To substitute to check the solution of an inequality

________ Write inequalities to represent real-world problems and represent on number line

________ Show relationships between two variables (independent and dependent) using an equation, a table, and a graph

Unit 4 Circle Map: Make a Circle Map below of important vocab and topics from the standards listed to the left.

Unit 4 IXL Tracking Log

Skill	Your Score
Z.1 (Does x Satisfy an Equation?)	
Z.2 (Which x Satisfies an Equation?)	
Z.3 (Write an Equation from Words)	
Z.4 (Identify Expressions and Equations)	
Z.7 (Solve One-Step Add & Sub Equations with Whole #'s)	
Z.8 (Solve One-Step Mult & Div Equations with Whole #'s)	
Z.9 (Solve One-Step Equations with Whole Numbers)	
Z.10 (Solve One-Step Add/Sub Equations with Decimals and Fractions)	
Z.11 (Solve One-Step Mult/Div Equations with Decimals and Fractions)	
Z.12 (Solve One-Step Add/Sub Equations: Word Problems)	
Z.13 (Solve One-Step Mult/Div Equations: Word Problems)	
Z.14 (Write a One-Step Equation: Word Problems)	
Z.15 (Solve One-Step Equations: Word Problems)	
Z.16 (Which Word Problem Matches the One-Step Equation?)	
Z.18 (Solve Equations Involving Like Terms)	
AA.1 (Solutions to Inequalities)	
AA.2 (Graph Inequalities on Number Lines)	
AA.3 (Write Inequalities from Number Lines)	
AA.4 (Write and Graph Inequalities: Word Problems)	
AA.5 (Solve One-Step Inequalities)	
AA.6 (Graph Solutions to One-Step Inequalities)	
BB.1 (Does (x,y) Satisfy an Equation?)	
BB.2 (Identify Independent & Dependent Variables in Tables and Graphs)	
BB.3 (Write an Equation from a Graph Using a Table)	
BB.3 (Find a Value Using Two-Variable Equations)	
BB.4 (Identify Independent and Dependent Variables: Word Problems)	
BB.5 (Find a Value Using Two-Variable Equations: Word Problems)	
BB.8 (Complete a Table for a Two-Variable Relationship)	
BB.11 (Identify the Graph of an Equation)	
BB.13 (Graph a Two-Variable Equation)	
BB.14 (Interpret a Graph: Word Problems)	

Unit 4 - Vocabulary

Term	Definition
Constant of proportionality	The constant *k* in a direct variation equation; it is the ratio of $\frac{y}{x}$, or of $\frac{dependent\ variable}{independent\ variable}$. It is the same as unit rate.
Dependent Variable	The "output" or y value, which "depends" on the input (*x* value/independent variable)
Direct Proportion (Direct Variation)	A relationship between two variables, *x* (independent) and *y* (dependent) that can be written as y-kx, where $k \neq 0$
Equation	A mathematical sentence containing an equal sign, showing two equivalent values
Independent Variable	The "input" or *x* value, which determines the "output" or *y* value/dependent variable
Inequality	A statement showing that two values are NOT equal, using one of the following signs: $>$, $<$, $\geq$, $\leq$ or $\neq$
Inverse Operation	Opposite operations that "undo" each other
Variable	A symbol, usually a letter, that represents a number

Unit 4 – Vocabulary – You Try

Term	Definition
Constant of proportionality	
Dependent Variable	
Direct Proportion (Direct Variation)	
Equation	
Independent Variable	
Inequality	
Inverse Operation	
Variable	

Math 6 – Unit 4: One-Step Equations and Inequalities Review #1

1) What are inverse operations? ______________________________

____

2) Write 3 key words that tell you to do addition and 3 key words that tell you to do subtraction in a word problem.

________________ ________________ ________________

________________ ________________ ________________

3) Jack's Candy Shop sold 8 lollipops today. He now has only 5 lollipops left to sell. How many lollipops did he have originally?

Draw a Picture:	Write your equation and ***SHOW ALL WORK!***
What does your variable represent?	Key Words:

Solution:

4) Alex has some flowers and picks two more for her bouquet. She now has 11 flowers. How many flowers did she start out with?

Draw a Picture:	Write your equation and ***SHOW ALL WORK!***
What does your variable represent?	Key Words:

Solution:

5) Mrs. Ledesma has x dollars. Amanda has 3 times more dollars than Mrs. Ledesma. If Amanda has $90, write an equation and solve for the number of dollars Mrs. Ledesma has.

Equation: ______________ Solution: _______________

Work:

6) Daneya spends half as many hours doing homework as her older brother, Dejon. If Dejon spends 4 hours doing homework, write an equation and solve for the number of hours, x, that Daneya does homework.

Equation: ____________ Solution: _____________

Work:

Solve each equation. Show all steps. Include a "check".

7) $m + 25 = 39$

8) $12x = 138$

9) $z - 29 = 8$

10) $\frac{y}{7} = 21$

11) $x + \frac{1}{4} = 3\frac{1}{2}$

12) $m - 2.8 = 5.2$

13) $3.5x = 70$

14) $\frac{m}{2} = 7.2$

15) Create your own word problem. Write an equation and show all the work to solve.

Equations & Parts of Equations

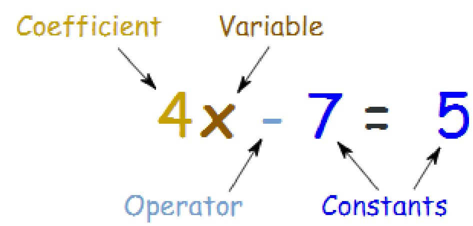
An _________ is a mathematical sentence containing an equal sign that shows two equivalent values.

$$x + 2 = 6$$

The equation says: **what is on the left (x + 2) is equal to what is on the right (6)**

So an equation is like a **statement** "*this* equals *that*".

Here we have an equation that says 4x − 7 equals 5, and all its parts:



A **Variable** is a symbol for a number we don't know yet. It is usually a letter like x or y.

A number on its own is called a **Constant**.

A **Coefficient** is a number used to multiply a variable (**4x** means **4** times **x**, so **4** is a coefficient)

An **Operator** is a symbol that shows an operation, ex: +, -, x, ÷.

Variables on their own (without a number next to them) actually have a coefficient of 1 (**x** is really the same as **1x**)

Solutions to Equations

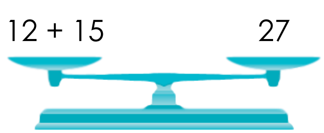
Solutions to equations are values for the variables that make the **two sides equal**.

Think of a correct equation as a balanced scale.

If an equation has a variable you can check to see if a number is a solution to an equation by substituting the number in for the variable. If you get the same number on both sides, you have found a solution to the equation.

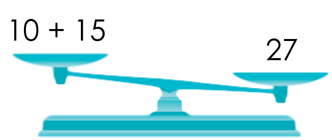
Example: EQUATION: $x + 15 = 27$

Is x=12 a solution?



x=12 is a solution because 12 + 15 = 27

Is x=10 a solution?



x=10 is NOT a solution because 10 + 15 ≠ 27

You Try:

1) Is x = 3 a solution to the equation, $x + 5 = 10$?
2) Is y = 5 a solution to the equation, $\frac{30}{y} = 6$?
3) Is z = 12 a solution to the equation, $8z = 95$?

You Try:

Determine if the following value for the variable is a solution to the equation. Write yes or no.

1) $9 + x = 21,\ for\ x = 11$
2) $n - 12 = 5,\ for\ n = 17$
3) $25r = 75,\ for\ r = 3$
4) $72 \div q = 8,\ for\ q = 9$
5) $28 + c = 43,\ for\ c = 15$
6) $u \div 11 = 10,\ for\ u = 111$
7) $\frac{k}{8} = 4,\ for\ k = 24$
8) $16x = 48,\ for\ x = 3$
9) $73 - f = 29,\ for\ f = 54$
10) $67 - j = 25,\ for\ j = 42$
11) $39 \div v = 13,\ for\ v = 3$
12) $88 + d = 100,\ for\ d = 2$
13) $14p = 20,\ for\ p = 5$
14) $6w = 30,\ for\ w = 5$
15) $7 + x = 70,\ for\ x = 10$
16) $6n = 174,\ for\ n = 29$

Replace each ◈ with a number that makes the equation correct.

17) $5 + 1 = 2 +$ ◈
18) $10 -$ ◈ $= 12 - 7$
19) ◈ $\bullet 3 = 2 \bullet 9$
20) $28 \div 4 = 14 \div$ ◈
21) ◈ $+ 8 = 6 + 3$
22) $12 \bullet 0 =$ ◈ $\bullet 15$
23) Carla had $15. After she bought lunch, she had $8 left. Write an equation using the variable, x, to model this situation. What does your variable represent?
24) Seventy-two people signed up for the soccer league. After the players were evenly divided into teams, there were 6 teams in the league. Write an equation to model this situation using the variable, x.

Solving Equations

There are many different ways to solve equations, but in general, the best way to solve an equation is to use inverse operations.

Inverse operations are opposite operations that "undo" each other. **Addition** is the inverse operation of **SUBTRACTION** and **subtraction** is the inverse operation of **ADDITION**.

Multiplication is the inverse operation of **DIVISION** and **Division** is the inverse operation of **MULTIPLICATION**.

When you solve equations, you should:

1st **identify** the **operation** you need.

2nd **apply** the **inverse operation** to **both** sides of the equation.

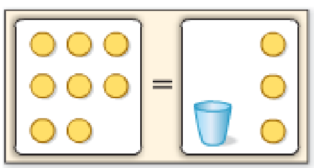
3rd **check** your solution by putting it back into the equation.

Example

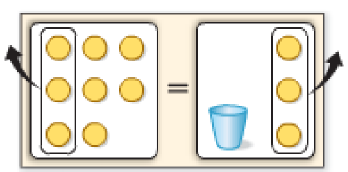
1. Solve $8 = x + 3$. Check your solution.

Method 1 **Use models.**

Model the equation using counters for the numbers and a cup for the variable.



Remove 3 counters from each side.



There are 5 counters remaining.

Method 2 **Use symbols.**

$8 = x + 3$ Write the equation.

$-3 = \quad -3$ Subtract 3 from each side to "undo" the addition of 3 on the right.

$5 = x$

Check

$8 = x + 3$ Write the equation.

$8 \stackrel{?}{=} 5 + 3$ Replace x with 5.

$8 = 8$ ✓ This sentence is true.

+

Other Examples:

$x - 2 = 3$ Write the equation.

$+2 = +2$ Add 2 to each side.

$x = 5$ Simplify.

Check

$x - 2 = 3$ Write the equation.

$5 - 2 \stackrel{?}{=} 3$ Replace x with 5.

$3 = 3$ ✓ This sentence is true.

−

x

$2x = 10$ Write the equation.

$\frac{2x}{2} = \frac{10}{2}$ Divide each side by the coefficient 2.

$x = 5$

Check $2x = 10$ Write the original equation.

$2(5) \stackrel{?}{=} 10$ Replace x with 5.

$10 = 10$ This sentence is true. ✓

$\frac{a}{3} = 7$ Write the equation.

$\frac{a}{3}(3) = 7(3)$ Multiply each side by 3.

$a = 21$ Simplify.

Check $\frac{a}{3} = 7$ Write the original equation.

$\frac{21}{3} \stackrel{?}{=} 7$ Replace a with 21.

$7 = 7$ This is a true sentence. ✓

÷

Subtraction Property of Equality

Words If you subtract the same number from each side of an equation, the two sides remain equal.

Examples

Numbers

$$\begin{aligned} 5 &= 5 \\ -3 &= -3 \\ \hline 2 &= 2 \end{aligned}$$

Algebra

$$\begin{aligned} x + 2 &= 3 \\ -2 &= -2 \\ \hline x &= 1 \end{aligned}$$

When you solve an equation by subtracting the same number from each side of the equation, you are using the **Subtraction Property of Equality**.

You Try:

1) $c + 2 = 5$ 2) $6 = x + 5$ 3) $3.5 + y = 12.75$

Addition Property of Equality

Words If you add the same number to each side of an equation, the two sides remain equal.

Examples

Numbers

$$\begin{aligned} 5 &= 5 \\ +3 &= +3 \\ \hline 8 &= 8 \end{aligned}$$

Algebra

$$\begin{aligned} x - 2 &= 3 \\ +2 &= +2 \\ \hline x &= 5 \end{aligned}$$

When you solve an equation by adding the same number to each side of the equation, you are using the **Addition Property of Equality**.

You Try:

1) $x - 7 = 4$ 2) $y - 6 = 8$ 3) $9 = a - 5$

Division Property of Equality

Words If you divide each side of an equation by the same nonzero number, the two sides remain equal.

Examples

Numbers

$$18 = 18$$
$$\frac{18}{6} = \frac{18}{6}$$
$$3 = 3$$

Algebra

$$3x = 12$$
$$\frac{3x}{3} = \frac{12}{3}$$
$$x = 4$$

When you solve an equation by dividing both sides of the equation by the same number, you are using the **Division Property of Equality**.

You Try:

1) $3x = 15$ 2) $8 = 4x$ 3) $2x = 14$

Multiplication Property of Equality

Words If you multiply each side of an equation by the same nonzero number, the two sides remain equal.

Examples

Numbers

$$3 = 3$$
$$3(6) = 3(6)$$
$$18 = 18$$

Algebra

$$\frac{x}{4} = 7$$
$$\frac{x}{4}(4) = 7(4)$$
$$x = 28$$

When you solve an equation by multiplying each side of the equation by the same number, you are using the **Multiplication Property of Equality**.

You Try:

1) $\frac{x}{8} = 9$ 2) $\frac{y}{4} = 8$ 3) $\frac{m}{5} = 9$

Scaffolded Equation Solving

Use the organizer below to practice solving one-step-equations.

1	Problem	$4x=48$	Problem	
	Inverse Operation *(On **BOTH** Sides)*		Substitution	
	Solution		Check	

2	Problem	$x - 8 = 11$	Problem	
	Inverse Operation *(On **BOTH** Sides)*		Substitution	
	Solution		Check	

3	Problem	$x + 13 = 42$	Problem	
	Inverse Operation *(On **BOTH** Sides)*		Substitution	
	Solution		Check	

4	Problem	$\frac{x}{8} = 15$	Problem	
	Inverse Operation *(On **BOTH** Sides)*		Substitution	
	Solution		Check	

5	Problem	$18x = 45$	Problem	
	Inverse Operation *(On **BOTH** Sides)*		Substitution	
	Solution		Check	

6	Problem	$x + 52 = 100$	Problem	
	Inverse Operation *(On **BOTH** Sides)*		Substitution	
	Solution		Check	

More Equation Solving (+/-)

Solve each equation. Show <u>ALL</u> your work.

1) $x + 4 = 5$	2) $x - 1 = 3$
3) $y - 3 = 4$	4) $y + 5 = 5$
5) $s + 8 = 9$	6) $s - 7 = 0$
7) $n - 6 = 3$	8) $n + 9 = 11$

More Equation Solving (x/÷)

Solve each equation. Show ALL your work.

1) $5x = 25$	2) $\frac{y}{4} = 7$
3) $\frac{n}{2} = 19$	4) $6g = 54$
5) $8b = 64$	6) $\frac{h}{6} = 11$
7) $\frac{f}{4} = 9$	8) $7s = 49$

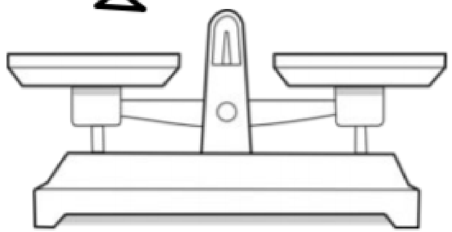
More Equation Solving (Mixed)

Solve each equation. Show ALL your work.

1) $6x = 96$	2) $\frac{y}{18} = 5$
3) $y - 84 = 212$	4) $y + 19 = 30$
5) $4b = 48.8$	6) $\frac{h}{3.2} = 10$
7) $n - 5.7 = 12$	8) $n + 8 = 13.4$

one step equations

Goal of solving equations:



Steps:

1. Do the opposite operation of what's on the same side as the variable to both sides
2. Check your solution

Remember
Add & subtract are inverse operations. Multiply & divide are inverse operations.

Try it!

$-2x = 22$	$x - 9 = -3$

Always remember to check your answer by substituting it in for x. Both sides of the equation should be equal!

In an equation chain, you use the solution of one equation to help you find the solution of the next equation in the chain. The last equation in the chain is used to check that you have solved the entire chain correctly.

Complete each equation chain:

1)		
	$5 + a = 12$	so a = _____
	$ab = 14$	so b = _____
	$16 \div b = c$	so c = _____
	$14 - d = c$	so d = _____
	$e \div d = 3$	so e = _____
	$a + e = 25$	***check***

2)		
	$9f = 36$	so f = _____
	$g = 13 - f$	so g = _____
	$63 \div g = h$	so h = _____
	$h + i = 18$	so i = _____
	$j - i = 9$	so j = _____
	$j \div f = 5$	***Check***

3)		
	$m \div 4 = 8$	so m = _____
	$m - n = 12$	so n = _____
	$np = 100$	so p = _____
	$q = 40 + p$	so q = _____
	$p + q - 10 = r$	so r = _____
	$r - m = 8$	***check***

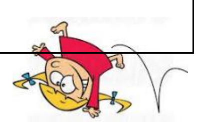
4)		
	$18 = v - 12$	so v = _____
	$v \div w = 3$	so w = _____
	$80 = wx$	so x = _____
	$w + x = 2y$	so y = _____
	$xy - z = 40$	so z = _____
	$z - v = 2$	***Check***

Challenge: Create your own equation chain using these numbers for the variables: $a = 10$, $b = 6$, $c = 18$ and $d = 3$

Equations Error Analysis

Sally is a silly little girl who makes mistakes! In Column #1, analyze her work and <u>*circle her mistake*</u>. In Column #2, explain what she did wrong. In Column #3, show how Silly Sally should work out the problem correctly. Show ALL work!

Silly Sally's Work (Circle her mistake):	**What did Silly Sally do wrong?**	**Show Silly Sally how it's done! (Show ALL steps!)**
$x + 5 = 28$ $\underline{\ \ +5 \quad +5\ }$ $x \quad = 33$		
$\frac{12a}{12} = \frac{108}{12}$ $a = 8$		
$w - 42 = 18$ $\underline{\ \ +18 \quad +18\ }$ $w \quad = 36$		
$\frac{y}{15} = 3$ $\underline{\div 15 \quad \div 15}$ $y = 5$		
$x + 23.45 = 32$ $\underline{\ \ -23.45 \quad -23.45\ }$ $x = \quad 9.45$		
$4\frac{1}{2}b = 36$ $\bullet 4\frac{1}{2} \quad \bullet 4\frac{1}{2}$ $b = 162$		



Solving One-Step Equations Problems

You can solve a word problem using one-step equations.

1) Figure out **what you know** and **what you want to know**. What you want to know will be represented by a **variable**.
2) Set up an **equation** to solve for the unknown (variable).
3) Use **inverse operations** to solve.
4) Don't forget to **label** your solution and write it as statement.

<u>**Example:**</u>

Edgar jogs for 20 minutes. He stretched then jogs some more. Altogether, he jogs for 35 minutes. How far does he jog after he stretches?

What do you know? ________________________________

What do you want to know? __________________________

What does your variable represent? ____________________

What operation is used in the equation? _________________

What inverse operation will you use to solve? _____________

Write the one-step equation to solve. ___________________

Solution: _____________

Solution as a statement: _____________________________

You Try:

1) Jan used 22 gallons of water in the shower. This amount is 7 gallons less than the amount she used for washing clothes. How much water does Jan use to wash clothes?

What do you know? ______________________

What do you want to know? ______________________

What does your variable represent? ______________________

What operation is used in the equation? ______________________

What inverse operation will you use to solve? ______________________

Write the one-step equation to solve. ______________________

Solution: ____________

Solution as a statement: ______________________

2) While training for a sports event, Oliver hiked 5.3 miles each day. If he hiked for a total of 42.4 miles, how many days did Oliver hike?

What do you know? ______________________

What do you want to know? ______________________

What does your variable represent? ______________________

What operation is used in the equation? ______________________

What inverse operation will you use to solve? ______________________

Write the one-step equation to solve. ______________________

Solution: ____________

Solution as a statement: ______________________

3) At a restaurant, Erin and her three friends decided to split the bill evenly. If each person paid $11 what was the total cost of their bill?

What do you know? ______________________

What do you want to know? ______________________

What does your variable represent? ______________________

What operation is used in the equation? ______________________

What inverse operation will you use to solve? ______________________

Write the one-step equation to solve. ______________________

Solution: ____________

Solution as a statement: ______________________

4) Ronique had 3 cookies and then she bought some more and then she had a total of 19 cookies. How many cookies did she buy?

What do you know? ______________________

What do you want to know? ______________________

What does your variable represent? ______________________

What operation is used in the equation? ______________________

What inverse operation will you use to solve? ______________________

Write the one-step equation to solve. ______________________

Solution: ____________

Solution as a statement: ______________________

Additional One-Step Equation Practice

1) Robyn had some video games, and then bought 4 more games. If she now has a total of 10 games, how many did she start out with?

What does your variable represent in the word problem? ___________

What operation will you use to solve the word problem? ___________

One Step Equation: ________________________________

Solution: ________________

2) Three friends found some money on the playground. They split the money evenly, and each person got $14. How much money did they find on the playground?

What does your variable represent in the word problem? ___________

What operation will you use to solve the word problem? ___________

One Step Equation: ________________________________

Solution: ________________

3) Josh sent 574 text messages over the last 7 days. On average, how many text messages did he send each day?

What does your variable represent in the word problem? ___________

What operation will you use to solve the word problem? ___________

One Step Equation: ________________________________

Solution: ________________

4) In a recent presidential election, Ohio had 18 electoral votes. This is 20 votes less than Texas had, how many electoral votes did Texas have?

What does your variable represent in the word problem? ___________

What operation will you use to solve the word problem? ___________

One Step Equation: ________________________________

Solution: ________________

Solve each equation below:

5) $2.3 = x + 0.34$

6) $p + \frac{1}{7} = \frac{6}{7}$

7) $\frac{3}{4}d = 12$

8) $19 = \frac{x}{7}$

9) $h - 26 = 29$

10) $1.6w = 72$

11) $12.22 = y - 7.5$

12) $38.2 = 4x$

Inequalities

An **inequality** is a mathematical sentence that compares two quantities. We use the symbols and wording below to write inequalities.

Symbol	Meaning/Word Phrases	Example
$<$	is less than is fewer than is below	$3 < 5$
$>$	is greater than is more than is above	$8 > 4$
$\leq$	is less than or equal to at most no more than	$7 \leq 10$ $10 \leq 10$
$\geq$	is greater than or equal to at least no less than	$12 \geq 9$ $12 \geq 12$

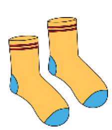
Determining if a number is a solution to an inequality requires you to substitute the value into the inequality and check to see if the value makes the inequality true.

Example:

The "Dollar Savers" store sells everything less than $5. Would you be able to buy the following items at the "Dollar Savers" store? Use the inequality $x < 5$ to substitute. Circle Yes or No.

$2

Yes No



$5

Yes No

$4.50

Yes No

$5.25

Yes No

You Try:

1) To ride a roller coaster, you must be at least 48" tall. Write an inequality and substitute to determine who can ride the roller coaster. Circle Yes or No.

Silly Steve

40"

Yes No

Cool Carl

36"

Yes No

Laughing Lou

48"

Yes No

Toothy Tim

52"

Yes No

Circle all of the values that will satisfy each of the given inequalities.

2) $y > 8$	6	8	9	15
3) $m \leq 525$	525	510	500	650
4) $c < 22$	12	25	30	22
5) $f \geq 80$	81	0	75	80
6) $g \geq 27$	27	26	25	20
7) $n < 16$	15	10	0	16
8) $a > 48$	36	48	24	64
9) $z \leq 100$	55	3	110	100

Writing Inequalities

Inequalities can be written to represent many situations.

Examples:

There are at least 25 students in the auditorium.

$n \geq 25$ "at least" means greater than or equal to

n represents the number of students in the auditorium

No more than 150 people can occupy the room.

$r \leq 150$ "no more than" means less than or equal to

r represents the possible room capacity

You Try:

Write an inequality for each given situation.

1) You cannot eat more than 2 pieces of your Halloween candy per day.

2) There are less than 15 people in the room.

3) There are at most 12 books on a shelf.

4) There are fewer than 200 people at the game.

5) You must get at least 30 minutes of exercise each day.

6) You must be at least 15 years old to get your driver's permit.

7) A pony is less than 14.2 hands tall.

8) You must be over 12 years old to ride the go karts.

9) The pig weighs at most 220 pounds.

10) Every candy bar costs at least $2.20.

11) You must complete at least 80% of your homework to attend the Homework Stars Celebration.

12) There are no more than seven people on the boat.

13) More than 40 people attended the movie last night.

14) You must be under 54" to ride the kiddie rides at Six Flags.

15) Getting at least 8 hours of sleep at night keeps you healthy.

Graphing Inequalities

Inequalities can be graphed on a number line to illustrate all of the possible solutions.

1st draw a number line and include the number in your inequality.

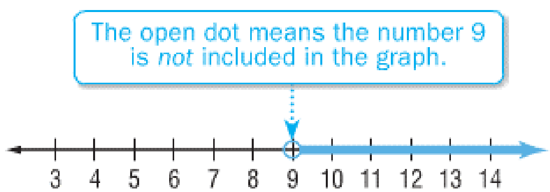
2nd draw an open or closed dot on the number (depending on which inequality symbol is in the inequality. Use an open dot (○) if the inequality has the greater than (>) or less than (<) symbol. Use a solid dot (•) if the inequality has the greater than or equal to (≥) or less than or equal to (≤) symbol.

3rd draw a line and an arrow that shows all of the possible solutions.

Examples:

***n* > 9**

Place an open dot at 9. Then draw a line and an arrow to the right.

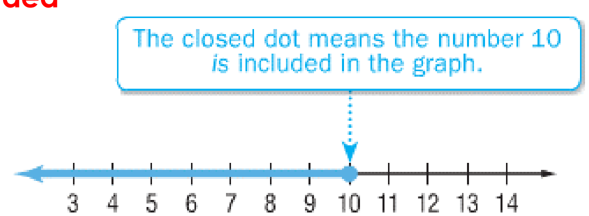


The values that lie on the line make the sentence true. All numbers greater than 9 make the sentence true.

equal to means included

***n* ≤ 10**

Place a closed dot at 10. Then draw a line and an arrow to the left.



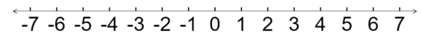
All numbers 10 and less make the sentence true.

TIP: If you keep the variable on the LEFT, the arrow at the end of your number line looks just like your inequality symbol.

You Try:

Graph the following inequalities on a number line. Then write a word phrase to describe each inequality.

1) n ≤ -5



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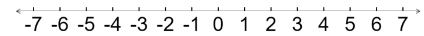
2) n ≤ 5



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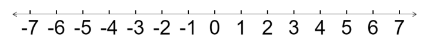
3) n < 1



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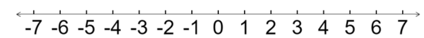
4) r > 2



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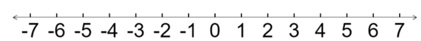
5) n > 5



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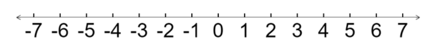
6) n ≤ -2



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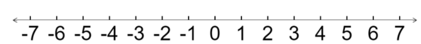
7) n ≥ -7



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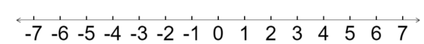
8) n < 0



____

Write the inequality AND graph for each problem below in 7 - 10

7) Fetty Wap has **at least 3 fans** in Mrs. Ledesma's 3rd period math class.

Inequality: ______________________________

Graph: -7 -6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6 7

8) Mr. Shaw should send Mrs. Shaw **more than 6 roses per day**.

Inequality: ______________________________

Graph: -7 -6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6 7

9) Shawn snuck into a G Rated movie because he thought you had to be **at most 7 years old**.

Inequality: ______________________________

Graph: -7 -6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6 7

10) When trick or treating, Daniella's dream came true. A lady told her she could take **no less than 5 pieces of candy**.

Inequality: ______________________________

Graph: -7 -6 -5 -4 -3 -2 -1 0 1 2 3 4 5 6 7

More Practice with Inequalities

Write an inequality for each situation, and graph on a number line.

1) Students must score at least 800 to pass the CRCT.

2) You must be shorter than 48" to ride the kiddie train.

3) You should brush your teeth at least twice a day.

4) A good credit score is higher than 699.

5) Classes can have no more than 34 students.

6) AJ needs to save more than $500.

7) A book costs less than $20

More Inequalities Practice

1) Which number is a solution to the inequality below? **x > 4**

a) 1 b) 2

c) 4 d) 5

2) Which number is NOT a solution to the inequality below? **x ≤ 8**

a) 6 b) 7

c) 8 d) 9

3) Which statement describes "a number more than 22"?

a) x < 22 b) x > 22

c) x ≤ 22 d) x ≥ 22

4) Which statement describes "a number less than or equal to 43"?

a) x < 43 b) x > 43

c) x ≤ 43 d) x ≥ 43

5) Which statement describes " a number no more than 17"?

a) x < 17 b) x > 17

c) x ≤ 17 d) x ≥ 17

6) Which statement describes "at least 32"?

a) x < 32 b) x > 32

c) x ≤ 32 d) x ≥ 32

7) Which number is a solution to x + 4 > 12

a) 3 b) 5

c) 7 d) 9

8) Which number is **NOT** a solution to **x – 3 < 10**

a) 7 b) 8

c) 10 d) 14

9) Which number is a solution to **3x > 12**

a) 4 b) 5

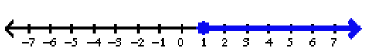
c) 2 d) 3

10) Which number is **NOT** a solution to **2x ≤ 10**

a) 3 b) 4

c) 5 d) 6

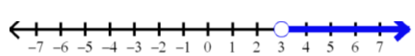
11) Which inequality matches the graph below?



a) n > 1 b) n ≤ 1

c) n ≥ 1 d) n ≥ -1

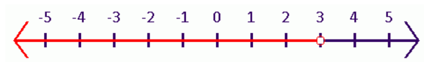
12) Which inequality matches the graph below?



a) v > -3 b) v > 3

c) v ≤ -3 d) v < 3

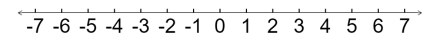
13) Which inequality matches the graph below?



a) x > 3 b) x < 3

c) x ≤ 3 d). x ≥ 3

14) Which inequality matches the graph below?

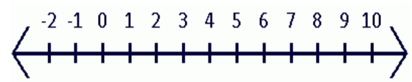


a) n < 0 b) n ≤ 0

c) n ≥ 0 d) n > 0

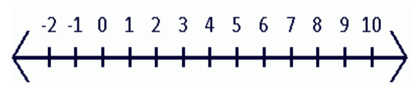
15) Solve x + 11 > 19

16) Graph the solution to the inequality from question #15.



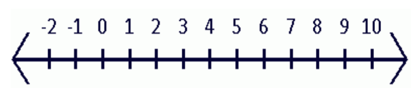
17) Solve x – 3 ≤ 5

18) Graph the solution to the inequality from question #17.



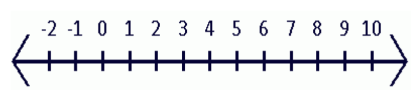
19) Solve 3x < 12

20) Graph the solution to the inequality from question #19.



21) Solve $\frac{x}{4} \geq 2$

22) Graph the solution to the inequality from question #21.



23. Write an inequality for this statement "x is less than or equal to 7".

24. Write an inequality for this statement

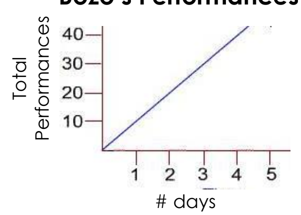
"x is greater than -9"

Direct Variation & Functions

A direct variation equation is used to relate two quantities using a constant of variation.

<table>
<tr><th>What?</th><th>Meaning</th><th>Example</th></tr>
<tr><td>The situation</td><td>You have a problem or situation that describes a constant relationship. There is a constant, k, that will stay the same.</td><td>Bozo performs in 10 circus acts per day.

(10 is the constant, k, because it stays the same.</td></tr>
<tr><td>The rule</td><td>Direct variation can be written as an equation, y=kx, where k represents the constant.</td><td>y=10x

x represents the number of days Bozo performs. y represents the # of total circus acts performed.</td></tr>
<tr><td>Table of Ordered Pairs</td><td>For every input, x, there is one output, y. Each (x,y) pair gives you an ordered pair that you can graph on a coordinate plane.
FYI: The x value is the independent variable and the y value is the dependent variable. (The y value is "dependent" on whatever the x value is.)</td><td>Plug in input values for x and get y values.
In 0 days, Bozo performs 0 acts.
In 1 day, Bozo performs 10 acts.
In 2 days, Bozo performs 20 acts and so on…
You can write this information in a table:<table><tr><th>x</th><th>y</th></tr><tr><td>0</td><td>0</td></tr><tr><td>1</td><td>10</td></tr><tr><td>2</td><td>20</td></tr><tr><td>3</td><td>30</td></tr></table>Each set is an ordered pair to be graphed. Pairs can be written as (0,0), (1,10) etc.</td></tr>
<tr><td>Graph</td><td>The ordered pairs can be graphed because x and y vary proportionally, they will always:
1) Start at (0,0)
2) Form a straight line</td><td>Bozo's Performances
</td></tr>
</table>

You Try:

A table is useful for changing cups to ounces.

Cups	Ounces
1	8
2	16
3	24
4	32
5	40

1) How many ounces are in 1 cup? ____________________

2) How many ounces are in 3 cups? ____________________

3) If "6 cups" were added to the table, how many ounces would be listed? ____________________

An equation shows the relationship between cups and ounces.

ounces = 8 • cups

y = 8x

You can also write this information in an input/output table.

Input →	**x**	1	2	3	4	5
Output →	**y**	8	16	24	32	40

For every value of **x**, there is one value of ***y***. This relationship is called a ***function***.

4) Which variable stands for the output value? ____________

5) Which variable stands for the input value? ____________

6) What is the output value for **x** = 2? ____________

Practice with Functions and Tables

Just the Basics ~

Direct variation is the relation between 2 quantities that are proportional (they have the same unit rate).

k represents the "constant of proportionality," or unit rate. As x and y values change, this stays the same.

When one variable increases, the other variable **increases**.

If your y values are smaller than your x values, this means that k must be a **fraction** or a **decimal**.

Using the given rules, find the missing **x** and **y** values.

1) ***y* = 9x**

x	0	2	3	5	8
y					

2) ***y* = 12x**

x	1		6		12
y		48		120	

3) ***y* = 1.25x**

x	0	2	4	6	8
y					

4) $y = \frac{2}{5}x$

x	0	4	9		20
y				4	

Using the given values, determine the equations in terms of *y=kx*

5) Rule: ____________________

x	0	1	2	3	4
y	0	5	10	15	20

How do you know this rule works?

____

____

6) Rule: ____________________

x	1		6		12
y		48		120	

How do you know this rule works?

____

____

Direct Variation Problem Solving

1) Vanessa is purchasing tickets to a Bebe Rexha concert. Tickets cost $35 apiece.

What is the constant of variation, ***k***? ____________________

x, the input/ind. variable represents: ____________________

y, the output/dep. variable represents: ____________________

What direct variation equation represents this situation?

____

Complete the chart below using your equation.

x	0	2	3	4	6
y					

2) TJ is saving up for a new Fortnite skin. He earns $7.50 for each chore he does.

What is the constant of variation, ***k***? ____________________

x, the input/ind. variable represents: ____________________

y, the output/dep. variable represents: ____________________

What direct variation equation represents this situation?

____

Complete the chart below using your equation.

x	0	2	10	15	50
y					

3) There are 37 boys in the drama club. They want to buy new props, so they are all going to pitch in some money. They all want to pitch in the same amount.

What is the constant of variation, ***k***? ____________________

x, the input/ind. variable represents: ____________________

y, the output/dep. variable represents: __________________

What direct variation equation represents this situation?

____

Complete the chart below using your equation.

x	0	2	3	5	10
y					

4) The students in math class earn 3 Jolly Ranchers for every homework assignments that they complete.

What is the constant of variation, ***k***? ____________________

x, the input/ind. variable represents: ____________________

y, the output/dep. variable represents: __________________

What direct variation equation represents this situation?

____

Complete the chart below using your equation.

x	0	1	2	3	4
y					

5) The direct variation ALWAYS uses the formula $y = kx$

Therefore, when x = 0, *y* always equals ________________.

Graphing Direct Variation

In direct variation, your (x,y) data creates ordered pairs that can be graphed.

A direct variation graph will **ALWAYS** begin at the point (**0,0**).

A direct variation graph will **ALWAYS** be a **straight line**.

Example:

Anthony is selling lemonade for $2 per cup. Write an equc

$$y = 2x$$

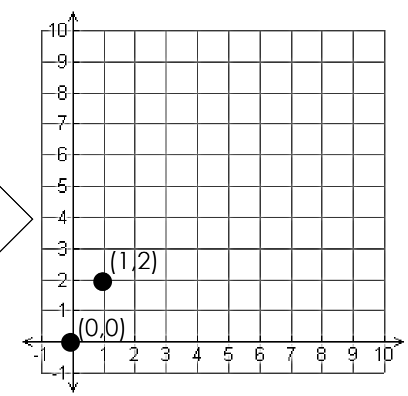
y represents the total $ made; this is the *output*, or dependent variable

2 is the constant (k)

x represents how many cups are sold; this is the *input*, or the *independent* variable

x (cups sold)	y ($)
0	0
1	2
2	
4	

Graph the ordered pairs.

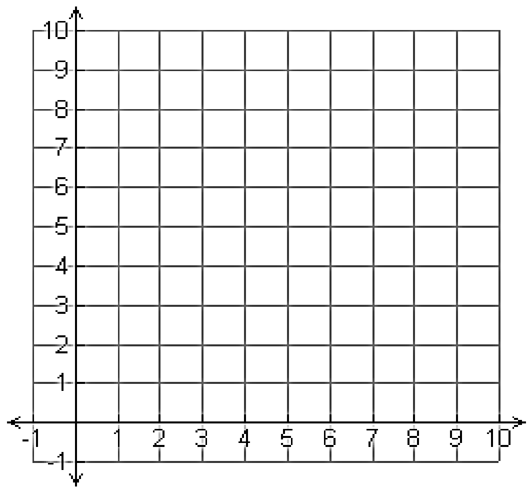


You Try:

Use the direct variation equation to complete the table and then graph the ordered pairs.

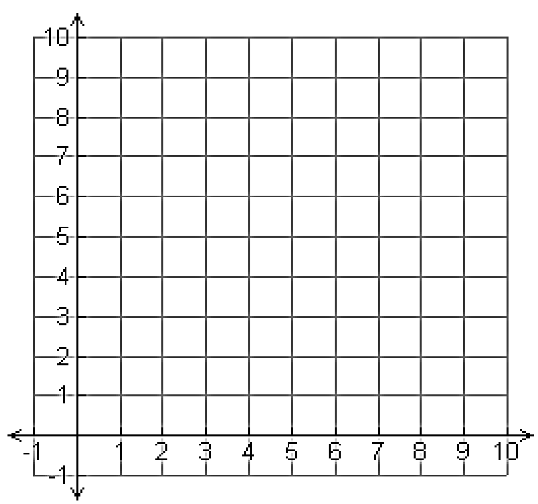
1)

$y = 3x$	**x**	0	1	2	3
	y				



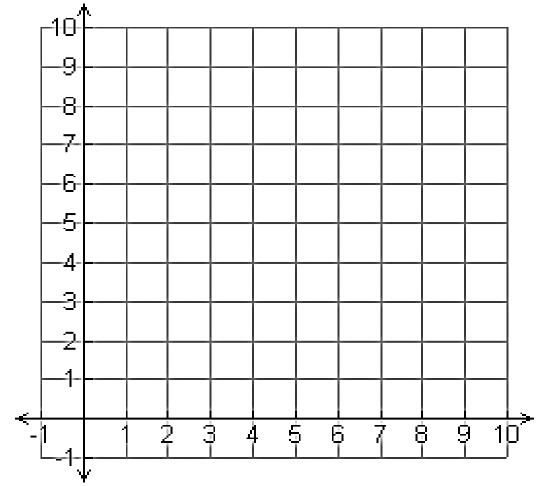
2)

$y = \frac{1}{2}x$	**x**		2	6	8	
	y	0				5



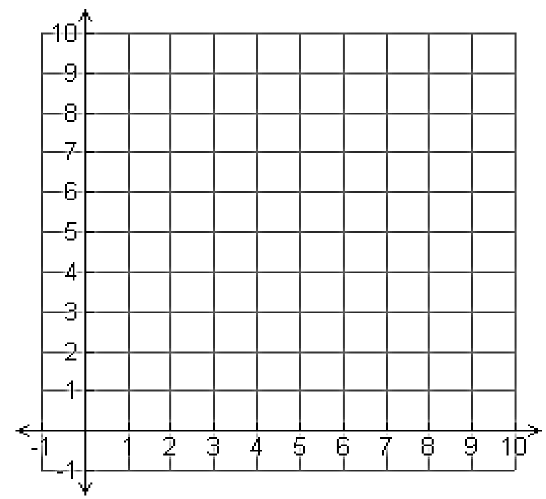
3)

$y = 0.8x$	**x**	0	1	4		
	y				4.8	8



4)

$y = 2x$	**x**	0	2	3	4	
	y					10



Direct Variation in the REAL World

An iPod Nano can hold up to 16 gigabytes (GB) of data.

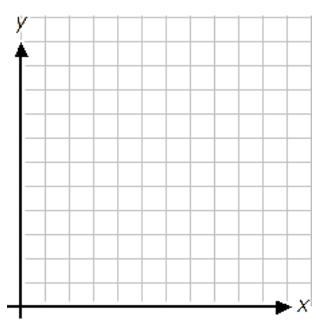
1) How many gigabytes can be stored on 0 Nanos? ____________
   How many on 1 Nano? ________
   How many on 5 Nano? ________
   How many on 12 Nano? ________
2) If you have enough iPod Nanos to hold 80 GB, how many iPod Nanos do you have? ____________________
3) Complete the chart:

x (# of iPods)	0	2			25
y (total GB)			64	160	

4) What is the direct variation equation (in terms of y=kx): ____
5) Based on this problem, answer the following:
   a) In words, what does the input (x) represent? ____________
   b) In words, what does the output (y) represent? ____________
   c) In words, what does the constant (k) represent? __________
6) As the number of iPods increases, the total number of GB ______
7) Look at the values in the table above. Write each set of (x,y) values as an ordered pair

________ ________ ________ ________ ________

8) Graph the ordered pairs:



Math 6 – Unit 4: One-Step Equations and Inequalities Review #2

Knowledge and Understanding

1) When solving equations, why is it important to substitute your solution into the equation at the end. ______________

____

2) What is the difference between an open circle and a closed circle in an inequality? ______________________

____

____

Proficiency of Skills

Solve each equation. Remember to show all work!

3) $t - 1 = 11\frac{1}{2}$ 4) $\frac{n}{5} = 10$ 5) $r + 7 = 49$

Solve and graph the solution to each inequality. Show all work!

6) $k \leq 7$ 7) $a > 120$ 8) $x \neq 3$

Application

9) A quarterback threw a ball x total yards over 10 games. If he averaged 90 yards per game, write an equation that represents this situation and solve for x, the total number of yards thrown.

Equation: ______________________

Solution: _______________________

10) Janiah had x dollars in her bank account. After spending \$182 on Christmas gifts, she has \$200 left in her account. Write an equation and solve for x, the amount she originally had in her account.

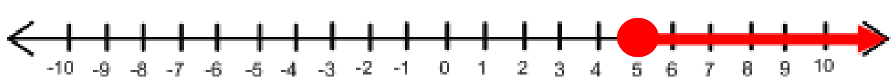
Equation: ______________________

Solution: _______________________

11) The weight limit on a cargo plane is 55 tons. Write an inequality to represent the weight limit, *w*, and graph it.

Inequality: _____________________

12) What inequality is graphed on the number line? _________



13) Maggie needs at least 15 lbs. of chocolate to make her chocolate fountain work. Write an inequality and graph it.

Inequality: _____________________

14) Which problem situation matches the equation 12x = 240?

a) Jamie sold 240 newspaper subscriptions each month for 12 months. What is x, the total number of newspaper subscriptions that Jamie sold in 1 year?
b) Brenna cycled a total of 240 miles this month. She cycled 12 miles less this month than last month. What is x, the number of miles Brenna cycled last month?
c) Mary charges \$12 per hour for labor to paint houses. What is x, the number of hours Mary worked if she charged \$240 for labor?
d) Sara bought 12 ride tickets and x game tickets. How many game tickets did she buy if she bought 240 tickets in all?

15) Andy makes \$2.50 per chore he does on the weekends. Write a direct variation equation: _____________________

Make an (*x*,*y*) table of values and graph it.

16) Draw an example of a graph of direct variation. Then draw an example of a graph that is NOT a direct variation.