Unit 1 Guided Notes

<u>Functions, Equations, and Graphs</u>

Standards: **A.CED.2, A.CED.3, A.REI.11, A.SSE.1, F.BF.1, F.BF.3, F.IF.7, F.IF.8, F.IF.**

Clio High School – Algebra 2A

Name: ______________________________ Period: ______________

Need help? Support is available!

- Miss Seitz's tutoring: Thursdays after school
- Website with all videos and resources

www.msseitz.weebly.com

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Concept #	What we will be learning…	Text
#1	**Introduction to Functions** ☐ Compare properties of two functions each represented in different ways	2.1
#2	**Linear Functions in Slope-Intercept Form** ☐ Write linear equations in slope-intercept form ☐ Draw a graph of an equation	2.3
#3	**More About Linear Functions** ☐ Manipulate an expression in order to reveal and explain different properties ☐ Change the value of part of an expression and analyze how it changes the whole expression	2.4
#4	**Graphing Linear Equations** ☐ Create appropriate axes with labels and scales with given information ☐ Draw a graph of an equation	2.3 2.4
#5	**Piecewise Functions** ☐ Graph piecewise functions ☐ Write equations of piecewise functions	CB 2.4
#6	**Absolute Value Functions and Step Functions** ☐ Graph absolute value and step functions	2.7
#7	**Transformations of Graphs** ☐ Identify the effect on the graph of replacing f(x) by f(x) + k, k f(x), f(kx), and f(x + k) for specific values of k (both positive and negative) ☐ Find the value of k given the graphs ☐ Recognize even and odd functions from their graphs and algebraic expressions	2.6
#8	**Analyzing Linear Models** ☐ Interpret parts of an expression in real-world context ☐ Write a function that describes a relationship between two quantities	2.5
#9	**Linear Programming** ☐ Represent constraints by equations or inequalities, and by systems of inequalities/equations ☐ Interpret solutions as viable or non-viable options in a modeling context	3.4

#1 | **Introduction to Functions** — **Text: 2.1**

☐ Compare properties of two functions each represented in different ways

Vocabulary: function, domain, range, function notation

Definitions

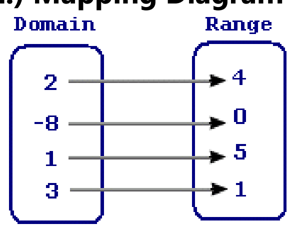
A **F**______________ is a relation in which each element in the domain corresponds to exactly one element in the range. This is also called a **O**______ **T**____ **O**_______ relationship

D_____________ is all possible x-values of a function

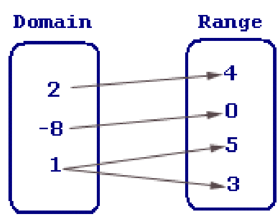
R______________ is all possible y-values of a function

Four Ways to Represent a Function

1.) Mapping Diagram



A mapping diagram ***shows a function*** if each element of the D______________ maps to O_________ one element of the R______________.



A mapping diagram ***does NOT show a function*** if ONE element of the D_______________ maps to M__________ T_________ O_________ Range.

2.) Ordered Pairs

{(2, 4), (-8, 0), (1, 5), (3, 1)}

Ordered pairs ***show a function*** if the D___________ V___________ **DO NOT R**_____________.

{(2, 4), (-8, 0), (1, 5), (1, 3)}

Ordered pairs ***do NOT show a function*** if the D_____________ V_____________ **R**_____________.

Four Ways to Represent a Function

3.) Table of Values

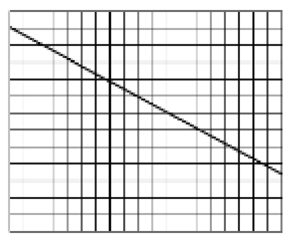
x	2	-8	1	3
y	4	0	5	1

A table of values ***shows a function*** if the X-V__________ **do NOT R**______________.

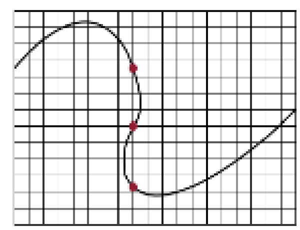
x	2	-8	1	1
y	4	0	5	3

A table of values ***does NOT show a function*** if the X- V__________ **do R**______________.

4.) Graph



A graph ***shows a function*** if it passes the V_____________ L__________ T________.

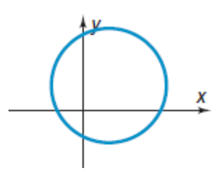


A graph ***does NOT show a function*** if it does NOT pass the V____________ L____________ T__________.

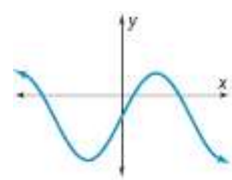
Is Each a Function?

<u>Example 1:</u> Is each of the following a function?

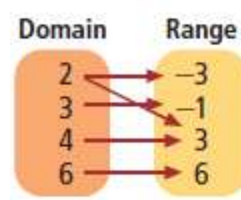
A.



B.



C.



You Try It! Is each a function?

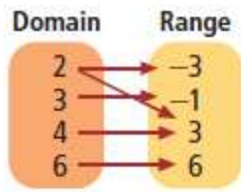
1.) { (1, 3), (2, -5), (3, -13) }

2.)

x	1	4	2	1
y	0	5	7	3

Finding Domain and Range

Example 2: What is the domain and range of the function?



You Try It! What is the domain and range of the function?

3.) { (1, 3), (2, -5), (3, -13) }

4.)

x	1	4	2	1
y	0	5	7	3

Function Notation

f(x) = __________ *It's just another way to write ________!*

<u>Example 3:</u> Given f(x) = -4x + 1, Find the value of f(-2)

To evaluate a given function at a particular value, P__________ in the V____________ for the V______________ and do the C__________________!

You Try It!

5.) Given f(x) = 3x – 5, Find the value of f(6)

#2	**Linear Functions in Slope-Intercept Form** **Text: 2.3** ☐ Write linear equations in slope-intercept form ☐ Draw a graph of an equation Vocabulary: linear function, slope, slope – intercept form, y-intercept

Definitions

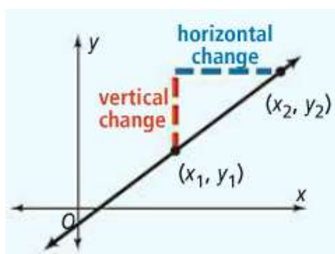
A **L** ____________ **F**___________ is a special type of function whose graph is a straight line

Slope

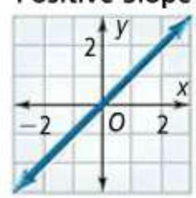
The slope of a non-vertical line through points (x_1 , y_1) and (x_2 , y_2) is the ratio of the vertical change to the corresponding horizontal change.

$$\text{slope} = \frac{\text{vertical change (rise)}}{\text{horizontal change (run)}} = \frac{y_2 - y_1}{x_2 - x_1}, \text{ where } x_2 - x_1 \neq 0$$

S___________ is the ratio of the V____________ change over the H_____________ change.

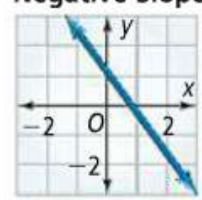


Positive Slope



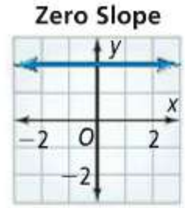
Line rises from left to right

Negative Slope



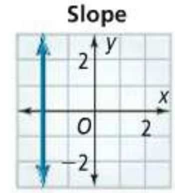
Line falls from left to right

Zero Slope



Horizontal line

Undefined Slope

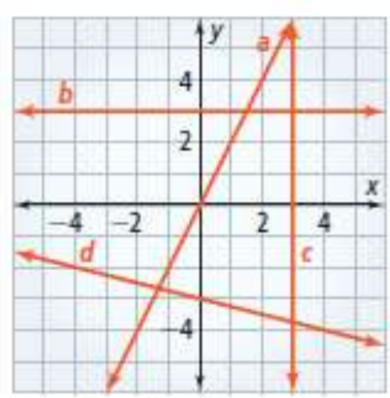


Vertical line

Example 1:

Use the graph at the right. Draw a line from the *slope* in Column A to the line with that slope in Column B.

Column A	Column B
positive	line *a*
negative	line *b*
zero	line *c*
undefined	line *d*



Finding Slope Given Two Points

Example 2: Find the slope of the line between (-3, 7) and (-2, 4).

You Try It! Find the slope of the line with the given points.

1.) Line A from **Example 1** (hint: pick two points on the line)

2.) Between (2, 5) and (1, 8)

Slope-Intercept Form

The ***Slope-Intercept Form*** of an equation of a line is $\boldsymbol{y = mx + b}$, where $\boldsymbol{m}$ is the slope of the line and (0, $\boldsymbol{b}$) is the y-intercept.

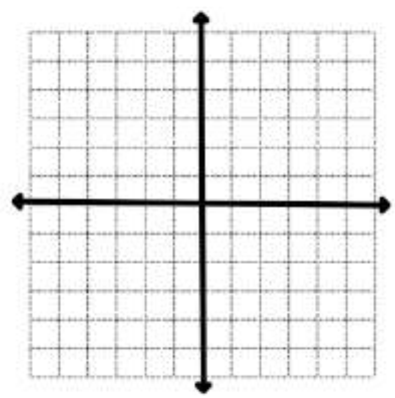
Example 3: Graph y = -2x +1

Steps:

1. Plot the y-intercept

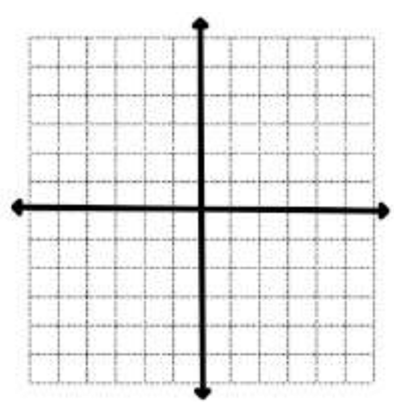
2. Use the slope (rise/run)

3. Draw a line through the two points



You Try It! Graph the equation

3.) Graph y = ½ x – 4



#3	**More about Linear Functions** **Text: 2.4** ☐ Manipulate an expression in order to reveal and explain different properties ☐ Change the value of part of an expression and analyze how it changes the whole expression Vocabulary: point-slope form, standard form, parallel, perpendicular

Point-Slope Form	
The equation of a line in ***Point-Slope Form*** through point (x_1 , y_1) with slope *m* $\boldsymbol{y - y_1 = m(x - x_1)}$	
<u>Derive Point-Slope Form:</u> $m = \frac{y - y_1}{x - x_1}$	**<u>Example 1:</u>** A line passes through (-5, 2) and has slope 3/4. Write an equation for this line.

Standard Form
The equation of a line in ***Standard Form*** is ***Ax* + *By* = *C***, where *A*, *B*, and *C* are real numbers, *A* is not negative, and *A* and *B* are not *both* zero.
<u>Example 2:</u> Write the equation of the line $y = \frac{3}{4}x - 5$ in standard form.

Writing Equations of Lines Summary		
Slope-Intercept Form y = mx + b Use this form when you know the s________ and the y-_______________.	**Point-Slope Form** $y - y_1 = m(x - x_1)$ Use this form when you know the s_________ and a p__________ or when you know two p________.	**Standard Form** Ax + By = C A, B & C are real numbers A is positive A & B cannot both be zero

<u>Example 3:</u> A line goes through (3, 1) and (4, 2). Find the equation of the line in **ALL THREE FORMS!** **<u>Point-Slope Form:</u>**	**<u>Standard Form:</u>**
	<u>Slope-Intercept Form:</u>

Parallel Lines	
Parallel Lines have the same s__________, but different y-_________________.	
<u>Example 4:</u> Write the equation of the line parallel to the line 4x + 2y = 7 through (4, -2) <u>Steps:</u> 1. Put the original equation in Slope-Intercept Form	
2. Write the new equation in Point-Slope Form using *m* from the original equation and the given point	
3. Put in Slope-Intercept Form	

Perpendicular Lines

Perpendicular Lines have o__________________ r__________________ s______________.

Example 5: Write the equation of the line perpendicular to the line $y = \frac{2}{3}x - 1$ through (0, 6)

Steps:	Old Slope:	New Slope:
1. Find the new slope		
2. Write the new equation in Point-Slope Form using your new *m* and the given point		
3. Put in Slope-Intercept Form		

You Try It! Write the equation of each in Slope-Intercept Form.

1.) Parallel to y = 1/3x – 6 through (-1, 6)

2.) Perpendicular to y = 2x + 5 through (1, 4)

#4 Graphing Linear Equations

Text: 2.3 - 2.4

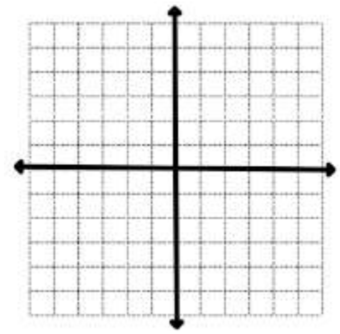
☐ Create appropriate axes with labels and scales with given information
☐ Draw a graph of an equation
Vocabulary: intercepts

Graphing a Line Using a Table

Example 1: Graph $y = -2x + 5$ using a table

Steps:
1. Draw the table
2. Choose 5 x-values
3. Plug x-values into the equation to get y-values
4. Plot and connect points on a graph

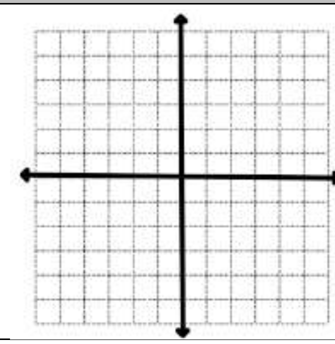
x	**-2x + 5**	**y**



Graphing a Line Using Slope-Intercept Form

Example 2: Graph $y = \frac{1}{2}x + 3$

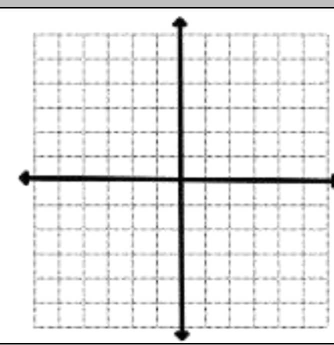
Steps:
1. Identify the slope and y-intercept
2. Plot the y-intercept on the graph
3. Use the slope (rise/run) to find the next point
4. Connect the points



Graphing a Line Using Point-Slope Form

Example 3: Graph $y - 4 = 3(x + 2)$

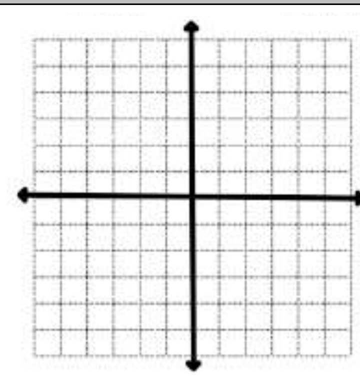
Steps:
1. Identify the slope and point (x_1, y_1)
2. Plot (x_1, y_1)
3. Use the slope (rise/run) to find the next point
4. Connect the points



Graphing a Line Using Standard Form (Using Intercepts)

Example 4: Graph $3x + 2y = 12$

1. Set $x = 0$ to find the y-intercept
2. Set $y = 0$ to find the x-intercept
3. Plot the intercepts
4. Connect the points



#5	**Piecewise Functions** **Text: CB 2.4** ☐ Graph piecewise functions ☐ Write equations of piecewise functions Vocabulary: piecewise function

Definitions

A **P**__________________ **F**_______________ is a function which is defined by sub-functions that each applies to a specific part of the domain. So the graph is broken into "pieces". Hence the name!

Graphing a Piecewise Function

***** REMINDER *****

When you have **<** or **>**, you will have an **O**_______ **C**_________ at the point

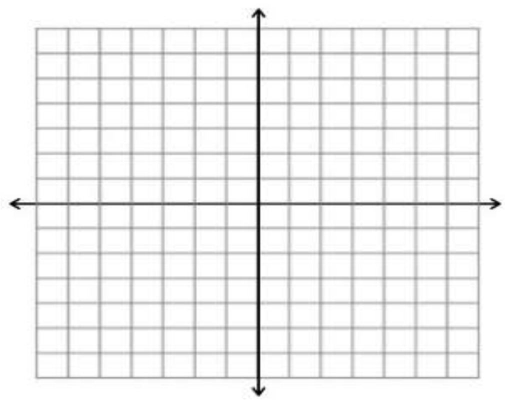
When you have **≤** or **≥**, you will have a **C**_________ **C**_________ at the point

Example 1: Graph

$$f(x) = \begin{cases} 2x + 1 \text{ if } x < 0 \\ 2x - 1 \text{ if } x \geq 0 \end{cases}$$

Steps:

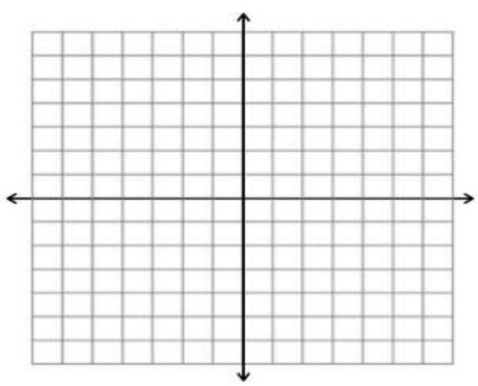
1. Draw boundary lines at the "breaks"
2. Graph the function for the first interval (2x + 1 if x < 0)
   - ✓ Open or closed circle?
3. Graph the function for the second interval (2x – 1 if x ≥ 0)
   - ✓ Open or closed circle?



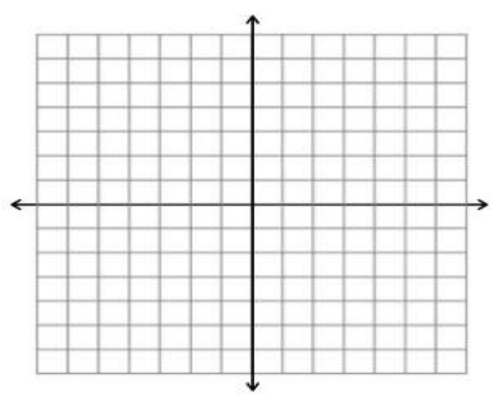
**** For help with graphing equations, see notes for Unit 1 Concept 4****

You Try It! Graph the following functions

1.) $f(x) = \begin{cases} 3x + 1 \text{ if } x < -1 \\ x - 3 \text{ if } x \geq -1 \end{cases}$



2.) $f(x) = \begin{cases} x + 1 \text{ if } x < 1 \\ -2x + 4 \text{ if } x \geq 1 \end{cases}$

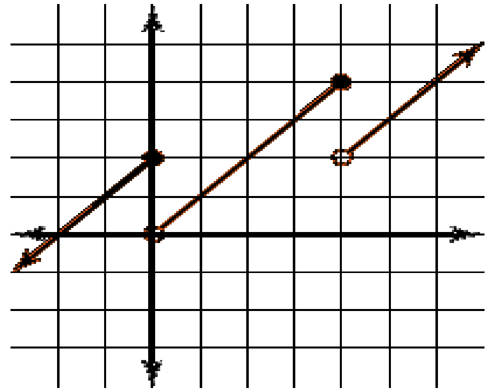


Writing a Piecewise Function

Example 2: Write the equation for the piecewise function below

Steps:

1. Find your intervals
   - ✓ 1^{st} interval:
   - ✓ 2^{nd} interval:
   - ✓ 3^{rd} interval:

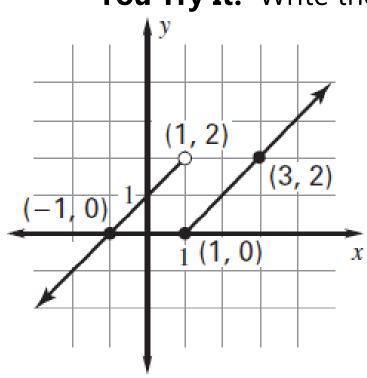


2. Pick two points on each interval. Use them to find the slope of the line.
3. Use one of the points and the slope to write the equation of the line in Point-Slope Form
4. Change to Slope-Intercept Form

Work for 1^{st} Interval:	Work for 2^{nd} Interval	Work for 3^{rd} Interval:

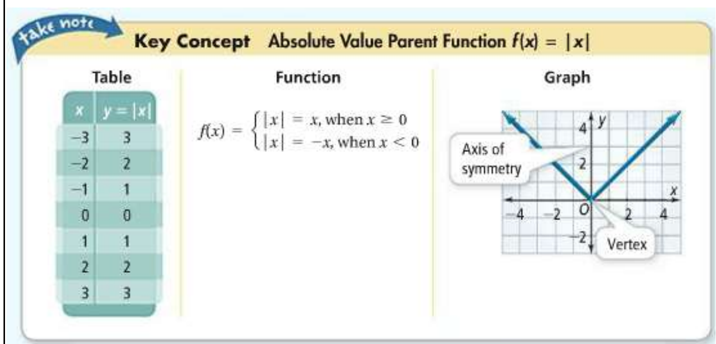
Equation:

You Try It! Write the equation of the piecewise function below



#6	**Absolute Value Functions and Step Functions** ☐ Graph absolute value and step functions Vocabulary: absolute value, even function, odd function, step function, ceiling function, floor function	**Text: 2.7**

Definitions

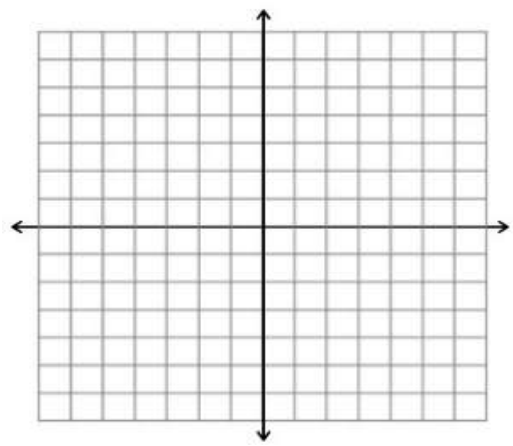


Think of the absolute value as the d___________ f________ z__________

That's why it is always p________________!

Example 1: Use a table of values to help graph the function f(x) = -2| x |

x	-2|x|	y
-3		
-2		
-1		
0		
1		
2		
3		



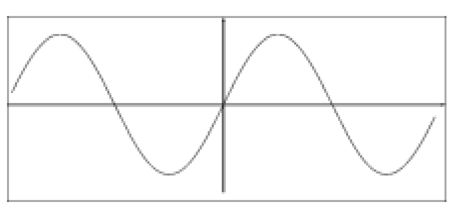
Domain: ____________________ **Range:** ____________________

Even and Odd Functions

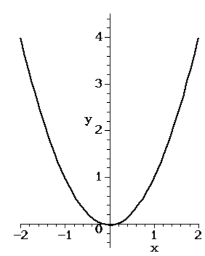
An **E**_________ **F**_______________ is symmetric about the y – axis.

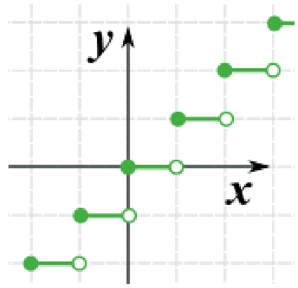
An **O**______ **F**_______________ is symmetric about the origin *(it looks the same if it's flipped over the x-axis and then the y-axis)*

Example 2: Even or odd?



Example 3: Even or odd?



<table>
<tr><th colspan="2">Step Functions</th></tr>
<tr><td colspan="2">A step function is a function whose graph looks like a bunch of steps.
The most common step functions are the F_________ F______________ and the C___________ F_____________.</td></tr>
<tr><td>The Floor Function takes whatever number you put in for x and rounds it D__________ to the nearest integer.
The Floor Function is written f(x) = $\lfloor x \rfloor$
</td><td><u>Example 4:</u> What is the floor of each number?

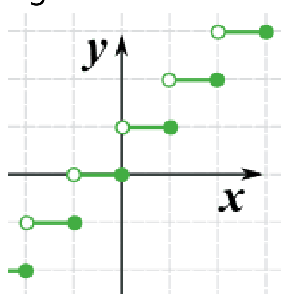
-1.1

0

1.01

2.9

3</td></tr>
<tr><td>The Ceiling Function takes whatever number you put in for x and rounds it U____ to the nearest integer.

The Ceiling Function is written f(x) = $\lceil x \rceil$
</td><td><u>Example 5:</u> What is the ceiling of each number?

-1.1

0

1.01

2.9

3</td></tr>
</table>

You Try It! Evaluate each

1.) $\lfloor -2.0001 \rfloor$

2.) $\lceil 2.0001 \rceil$

#7	**Transformations of Graphs** **Text: 2.6** ☐ Identify the effect on the graph of replacing f(x) by f(x) + k, k f(x), f(kx), and f(x + k) for specific values of k (both positive and negative) ☐ Find the value of k given the graphs ☐ Recognize even and odd functions from their graphs and algebraic expressions Vocabulary: vertical translation, horizontal translation, vertical stretch/compression, reflection

Transformations of f(x)	
Vertical Translations (shifts) Translation up *k* units y = f(x) + k Translation down *k* units y = f(x) – k	**Example:** f(x) = |x| **+** 4 shifts 4 units ________ f(x) = x **–** 6 shifts 6 units _________
Horizontal Translations (shifts) Translation right *h* units y = f(x – h) Translation left *h* units y = f(x + h)	**Example:** f(x) = (x **+** 3) shifts 3 units to the _________ f(x) = |x **–** 5| shifts 5 units to the __________
Vertical Stretches and Compressions/Shrinks Vertical Stretch, a > 1 y = a · f(x) Vertical Compression (shrink), 0 < a < 1 y = a · f(x)	**Example:** f(x) = **3**x _____________ the graph by a factor of 3 f(x) = **¼** x ____________or________________ the graph by a factor of ¼ .
Reflections (flips) In the x-axis y = – f(x) In the y-axis y = f(– x)	**Example:** f(x) = **-**|x + 5| Flip about the ___**-axis** occurs if the **E**______ **F**________ is made negative. f(x) = **-**|x| + 5 Flip about the ___**-axis** occurs if **O**_________ ____ is made negative.

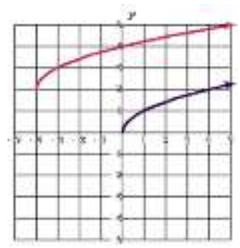
Describing Transformations	
Example 1: Describe how the parent function f(x) = |x| must be changed to graph the function y = 2|x – 1| + 3	
What has changed? ✓ 2 is being ________________ ✓ - 1 is being ______________ ✓ 3 is being ________________	So what happens to the graph? ✓ _________________________ ✓ _________________________ ✓ _________________________

Identifying the Transformation Given the Graph

Example 2: Write the equation of the new function

Steps:

1. Identify what has changed
2. Write the equation



Parent Function: $y = \sqrt{x}$
(pink is new function)

What has changed?

✓ ________________

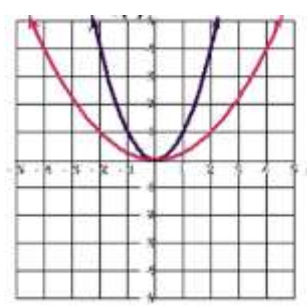
✓ ________________

Example 3: Write the equation of the new function

When it's Stretched/Shrunk:

To find the value of the multiplier, we need to create and solve an equation using the parent function Pick a point on the new graph and plug in the x and y coordinates to our new equation. We will use this to solve for our unknown, ***u****.*

$y = \mathbf{u}x^2$



Parent Function: $y = x^2$
(pink is new function)

#8	**Analyzing Linear Models** **Text: 2.5** ☐ Interpret parts of an expression in real-world context ☐ Write a function that describes the relationship between two quantities Vocabulary: coefficient

Definitions
A C_______________ is the number in front of the variable.

Example 1: Name the coefficients of the following:

y = 3x + 2	**4x – 2y = 10**	**y = 4x – 2**
Coefficient of X: _____	Coefficient of X: _____	Coefficient of X: _____
Coefficient of Y: _____	Coefficient of Y: _____	Coefficient of Y: _____

Writing Functions to Describe Relationships	
Example 2: Write an equation for the situation. Phillip bought a roll of raffle tickets for $10. He will be selling 50-50 raffle tickets for $1 each. How much money, **m,** will he make if he sells **t** tickets?	
Given:	**Find:**

Example 3: The number of boxes, **b**, in a warehouse is given by the equation **b = 100d + 800** where **d** represents the number of days gone by. What do the coefficients in the equation represent?	
✓ What does the 100 mean?	✓ What does the 800 mean?

You Try It! Write an equation for each situation

1.) Shelly wants to buy Legos. She is told the cost, **c**, will be **c = 7.35p + 5** where **p** represents the weight of her Lego purchase in pounds.

a. What does the number 7.35 represent?

b. What might the number 5 represent?

2.) Yahn is climbing a rope. His height, h, above the ground is given by the equation h = 10t + 2 where t represents time measured in minutes and h is measured in feet.

a. What does the number 10 represent?

b. What does the number 2 represent?

#9	**Linear Programming** **Text: 3.4** ☐ Represent constraints by equation or inequalities, and by systems of equations/inequalities ☐ Interpret solutions as viable or nonviable options in a modeling context Vocabulary: constraint, viable solution, nonviable solution

Definitions	
A **C**______________ is a factor which restricts a system	
Example 1: List all constraints. For your rock collection display, you want to have **at most 25** samples. You want to have **at least three times** as many **sedimentary** samples as **metamorphic** samples.	**Example 2:** List all constraints. An exam has two sections; a multiple choice section and an essay section. You can score a maximum of 100 points. You must get at least 65 points on the essay to pass the course.

You Try It! Identify all constraints

1.) Suppose you are buying two kinds of notebooks. A spiral notebook costs \$2 and a 3-ring binder costs \$5. You must have at least 6 notebooks. The cost of notebooks can be no more than \$20.

Checking for Viability	
A **V**__________ **S** _______ is a solution which does not violate any constraints of a system	A **N**__________ **S** ________is a solution which violates a constraint of a system
Example 3: Given a list of constraints, tell whether a given solution is viable or not. If not, identify the constraint(s) which is/are not met Constraints: $-4x + 7y \geq 21$; $3x + 7y \leq 28$ Solution: (2, 3)	

You Try It! Given a list of constraints, tell whether a given solution is viable or not. If not, identify the constraint(s) which is/are not met

2.) Constraints: $-4x + 7y \geq 21$;

$3x + 7y \leq 28$

Solution: (0, 4)

3.) Is the solution (3,1) viable with the following

Constraints: $x \leq 3$, $y \leq 5$, $x + y \geq 1$