

A-E-I-O-U (Algebraic Enriching Instructional Opportunities for U)

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Files can be downloaded from: <http://wsfcs.k12.nc.us/Page/51682>

Please fill out a **purple** evaluation form before you leave!

Fred:

- ▶ 11 years teaching, primarily Algebra 1
- ▶ Former Engineer and Entrepreneur
- ▶ University of Maine graduate

Greg:

- ▶ Davidson College graduate many years ago (Mascot)
- ▶ Has taught math, Japanese, and ESL in middle schools and high schools in five countries.
- ▶ NBCT and Burroughs Wellcome Fund Career Award in Science and Mathematics Teaching Award recipient.

ADD +

SUBTRACT -

EQUALS =

MULTIPLY
x, •, () ()

DIVIDE
÷, /, —

TRANSLATION TERMS

SORT ACTIVITY

- Terms are on individual slips of paper.
- Sort terms into categories.
- Can be done with a partner or alone.
- Used for future reference in decoding word problems.

less than (<)

greater than (>)

less than or equal to (\leq)

greater than or equal to (\geq)

EXPRESSION BINGO

B	I	N	G	O

Answers for BINGO cards: **RANDOMLY FILL IN THE CARD WITH THE ANSWER LETTERS**

- A. $2y^2$ B. $\frac{y}{3}$ C. $6y$ D. $3 + y$ E. **FREE** F. $-y - 3$ G. $2y - 4$
H. $y^2 + 4$ I. $2y + 5$ J. $\frac{y}{4}$ K. $3y$ L. $y + 2$ M. $-6y$ N. $3y + 2$
O. $y - 3$ P. $y - 5$ Q. $2y + 2$ R. $\frac{y}{-3}$ S. $2y + 3$ T. $2y$ U. y^2
V. $2y + 4$ W. y^3 X. $4y - 3$ Y. $6 - y$

SOLVING INEQUALITIES

1. Begin by exploring the effects of multiplying both sides by a negative number.
 - a. Consider the following true statements. $3 < 7$ $-2 < 1$ $-8 < -4$
 For each statement multiply the number on each side by -1 . Then indicate the relationship between the resulting numbers using $<$ or $>$.
 - b. Based on your observations, complete the statement: *If $a < b$, then $(-1)a$ ___ $(-1)b$.*
 - c. Next, consider relations of the form $c > d$ and multiplication by -1 .
 Test several examples and make a conjecture: *If $c > d$, then $(-1)c$ ___ $(-1)d$.*

2. Pairs of numbers are listed below. For each pair, describe how it can be obtained from the pair above it. Then indicate whether the direction of the inequality stays the same or reverses. The first two examples have been done for you.

		<u>Inequality Operation</u>	<u>Inequality Direction</u>
	$9 > 4$		
	$12 > 7$	add 3 to both sides	stays the same
	$24 > 14$	multiply both sides by 2	stays the same
a.	20 ___ 10	-----	-----
b.	-4 ___ -2	-----	-----
c.	-2 ___ -1	-----	-----
d.	8 ___ 4	-----	-----
e.	6 ___ 2	-----	-----
f.	-18 ___ -6	-----	-----
g.	3 ___ 1	-----	-----
h.	21 ___ 7	-----	-----

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b.	-4 ___ -2	_____	_____
c.	-2 ___ -1	_____	_____
d.	8 ___ 4	_____	_____
e.	6 ___ 2	_____	_____
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c. -2 ___ -1	_____	_____
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g. 3 ___ 1	_____	_____
h. 21 ___ 7	_____	_____

SOURCE: Core Plus Course 1 2nd Edition, 2008 Unit 3, Lesson 2, Investigation 3, page 194–195

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e. 6 ___ 2	_____	_____
f. -18 ___ -6	_____	_____
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d.	$8 > 4$	<u>Multiply both sides by -4</u>	<u>Changes direction</u>
e.	$6 > 2$	<u>Subtract 2 both sides</u>	<u>Stays the same</u>
f.	$-18 < -6$	<u>Multiply both sides by -3</u>	<u>Changes direction</u>
g.	$3 > 1$	<u>Divide both sides by -6</u>	<u>Changes direction</u>
h.	$21 > 7$	<u>Multiply both sides by 7</u>	<u>Stays the same</u>

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page 194–195

Exponential Growth

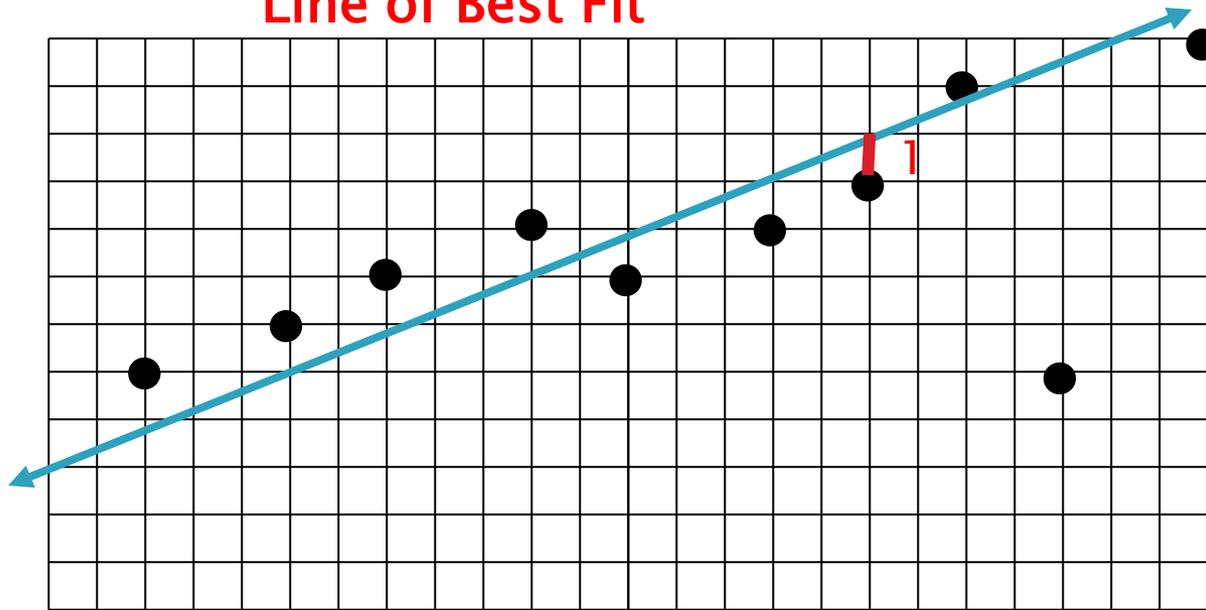
<http://projects.flowingdata.com/walmart/>

Guess the ages of the following people:

Name	Guessed Age	Actual Age	Residual Predicted-Actual
1. Shailene Woodley		23	
2. Oprah Winfrey		61	
3. Jaden Smith		16	
4. Jennifer Lopez		45	
5. Morgan Freeman		77	
		Total:	

There is also a regression worksheet

Line of Best Fit



Draw the line of best fit.

Calculate the vertical distance from each point to the line (positive ONLY)

Add all of the distances.

<http://www.shodor.org/interactivate/activities/Regression/>

Matching Card Activity

5^{-2}	$1/25$
----------	--------

-25

-5^{-2}	$-1/25$
-----------	---------

$1/25$

-5^2	-25
--------	-------

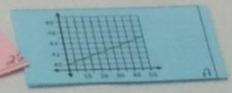
$-1/25$

Caleb's phone company charges a \$40 flat rate and \$0.10 per minute. *y*

slope = 0.10
y-intercept = 40 *R*

NEXT = NOW + 0.10,
starting at 40 *22*

$y = 40 + 0.10x$ *25*



X	0	10	20	40
Y	40	41	42	

Ally's plant was 20 inches tall and grows 1 inch every 2 days. *l*

slope = $\frac{1}{2}$
y-intercept = 20 *S*

NEXT = NOW + $\frac{1}{2}$,
starting at 20 *35*

$y = 20 + \frac{1}{2}x$ *24*



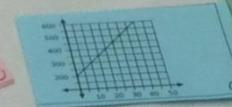
X	0	2	4	6
Y	20	21		23

Roman opened a savings account with \$200 and saves \$10 per month. *S*

slope = 10
y-intercept = 200 *U*

NEXT = NOW + 10,
starting at 200 *33*

Blank *20*



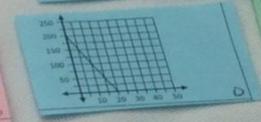
X	0	2	4	6
Y	200		240	260

Allen weighs 200 pounds but loses 10 pounds per month on his diet. *2*

slope = -10
y-intercept = 200 *T*

Blank *31*

$y = 200 - 10x$ *26*



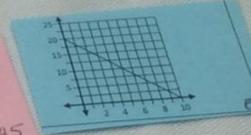
X	0		6	10
Y	200	160	140	100

Sabrina borrowed \$20 from her mom and pays her back \$2 each week. *7*

Blank *Q*

NEXT = NOW - 2,
starting at 20 *34*

$y = 20 - 2x$ *25*



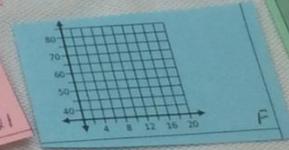
X	0	3	5	8
Y		14	10	4

Isaiah's job pays \$40 per day and \$3 for each sale that he makes. *6*

slope = 3
y-intercept = 40 *V*

NEXT = NOW + 3,
starting at 40 *36*

$y = 40 + 3x$ *21*



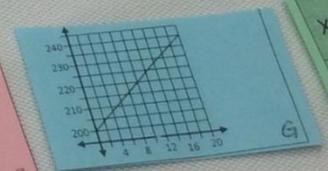
X		8	10	13
Y	55	64	70	79

Blank *3*

slope = 2
y-intercept = 200 *P*

NEXT = NOW + 2,
starting at 200 *30*

$y = 200 + 2x$ *23*



X	3	7		11
Y	206	214	218	222

Find the Mistake

Directions: Find the mistake(s) if any in the working out of the following problems. Work the problem correctly on the right side. Problem 1

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

$$2 + 3x + 4 = 8$$

$$6 + 3x = 8$$

$$3x = 2$$

$$x = 2/3$$

Problem 2

$$5 - (x + 9) > 7$$

$$5 - x - 9 > 7$$

$$4 - x > 7$$

$$-x > 3$$

$$x < -1$$

Problem 3

$$3(x + 2) - 5x < 8$$

$$3x + 6 - 5x < 8$$

$$-2x + 6 < 8$$

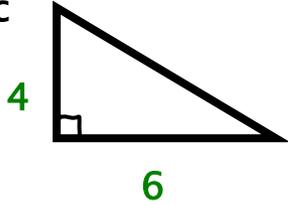
$$-2x < 2$$

$$x < -1$$

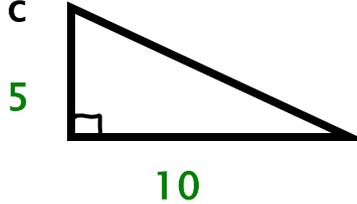
Pythagorean Theorem $c^2 = a^2 + b^2$

Find the missing side. Show your work.

1. Find c



2. Find c



3. a = 9 b = 6 c = ?

Find the length of the hypotenuse for the triangle shown.

4. 5.

Two right-angled triangles are shown on a grid. Triangle 4 has a horizontal leg of length 8 and a vertical leg of length 3. Triangle 5 has a horizontal leg of length 4 and a vertical leg of length 3.

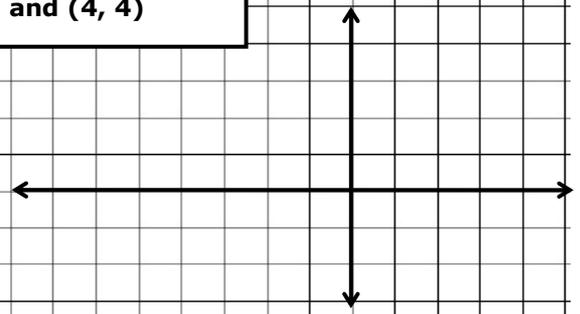
What is the length of the line segment? Assume it is the hypotenuse of a triangle and draw in the missing sides to help you determine the answer.

6. 7.

Two line segments are shown on a grid. Segment 6 starts at the origin (0,0) and ends at (4,3). Segment 7 starts at the origin (0,0) and ends at (3,4).

What's the length of the line segment connecting the two points given?

8. (-6, -2) and (4, 4)



What's the distance between the two points given?

9. (4, 10) and (6, 18)

find the "slope numbers" (these are a and b)
square each number and add these together
find the square root

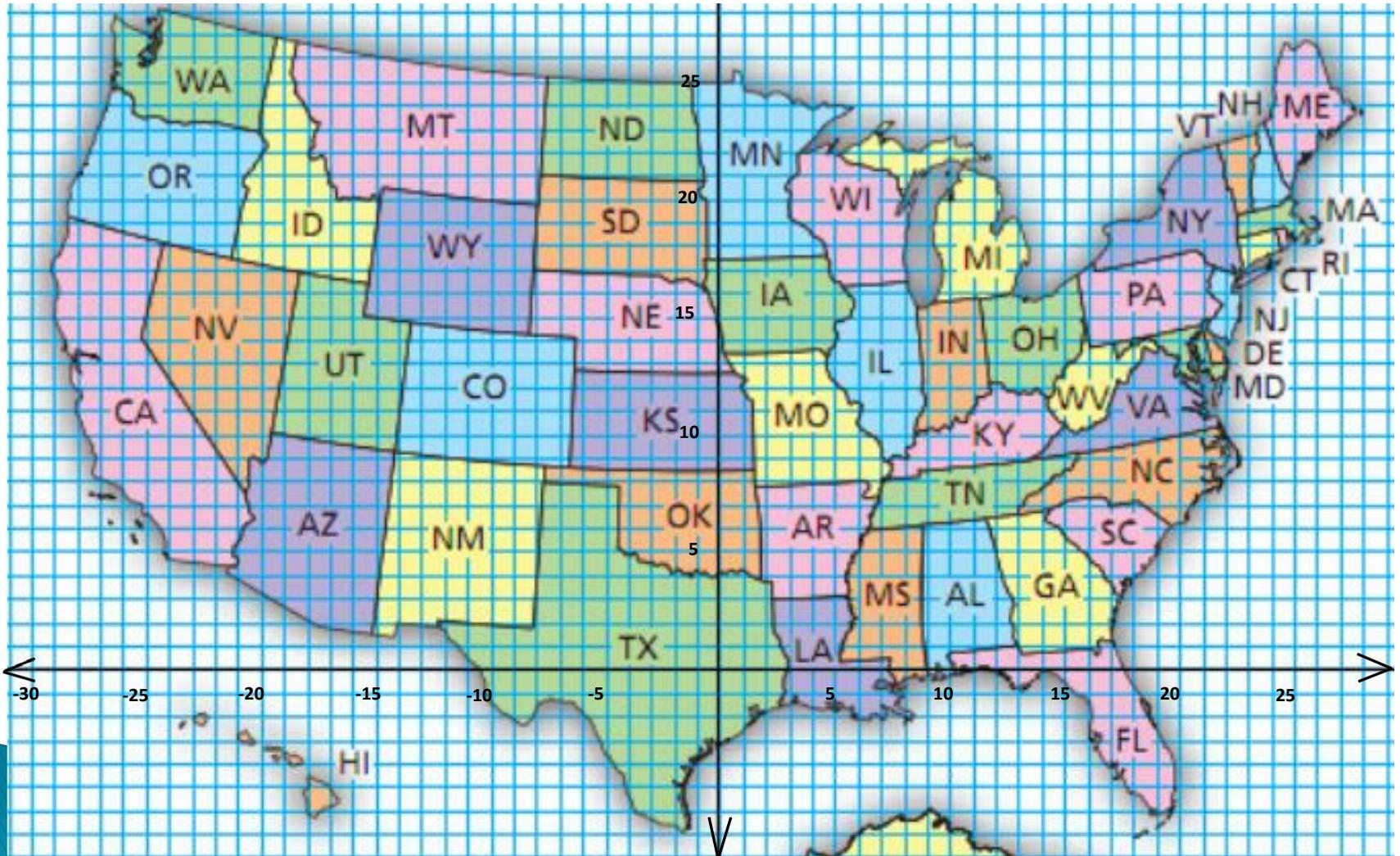
Distance and Midpoint Project

You are planning a 5-day trip across the United States.

Choose a place to start and continue in a “round-trip” throughout the country.

Use the map to determine how far you travel each day (distance formula), with a pit stop along the way (midpoint).

Each block on the map equals 50 miles.



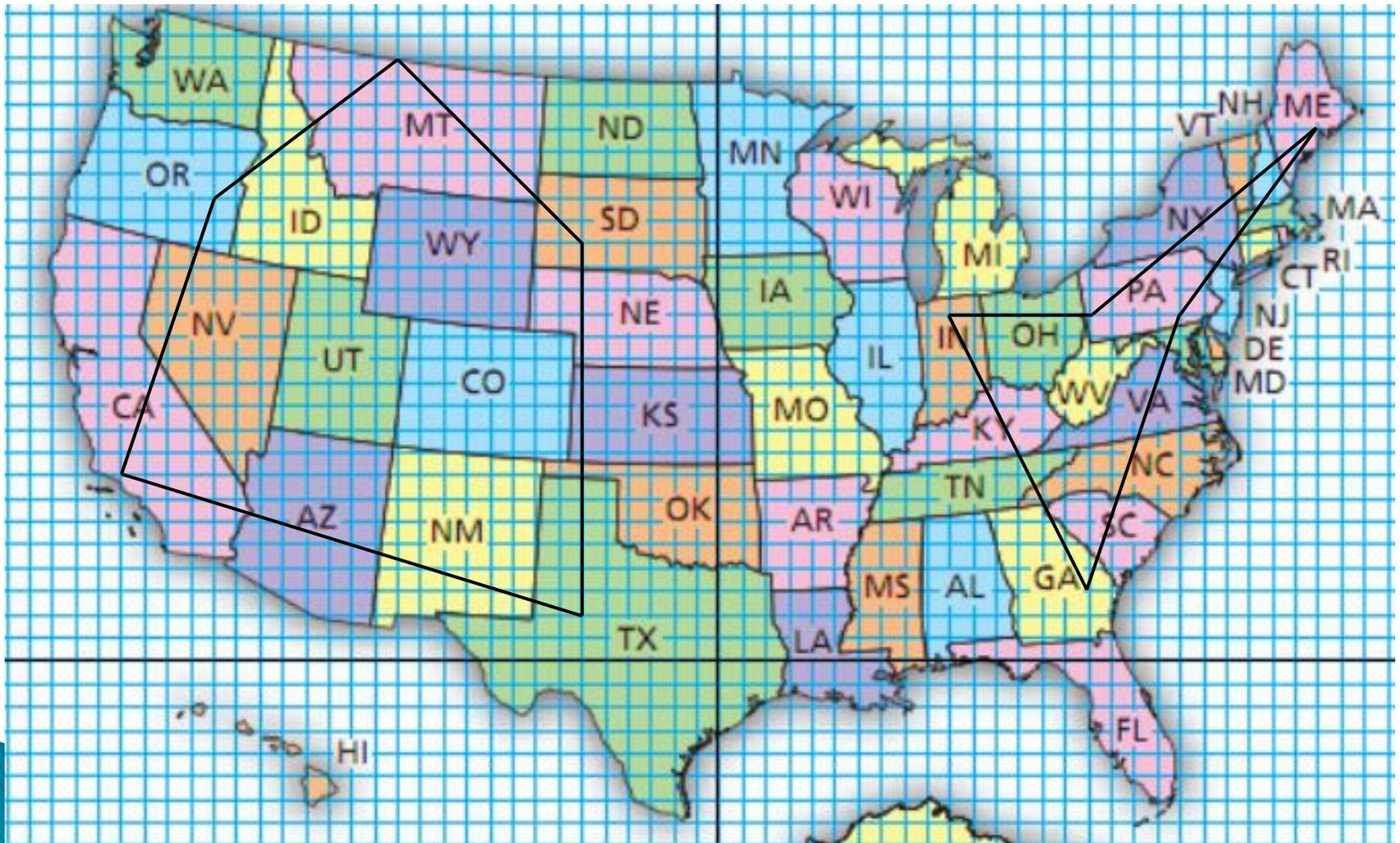
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Systems of Equations Around the World, also called a Scavenger Hunt or a Circuit.

Page 3

Enlarge and place these cards around the room. Students start at different places, solve the problem at the bottom and then look for the answer on top of another card. They then look for their answer etc.. until they have gone around the room.

A (15,-7)

$$\begin{aligned}4x + 6y &= -12 \\ 3x - 5y &= 29\end{aligned}$$

B (50,30)

$$\begin{aligned}5x - 3y &= 4 \\ 2x + 3y &= 52\end{aligned}$$

C (3,-4)

$$\begin{aligned}y &= 10x + 60 \\ y &= 8x + 52\end{aligned}$$

D (2,6)

$$\begin{aligned}x + y &= 80 \\ 3x + 2y &= 210\end{aligned}$$

E (-4,20)

$$\begin{aligned}3y &= 12x - 66 \\ 8x - 3y &= 26\end{aligned}$$

F (12,20)

$$\begin{aligned}x + y &= 8 \\ x - y &= 22\end{aligned}$$

G (10,18)

$$\begin{aligned}4x + 7y &= 50 \\ y &= 5x - 4\end{aligned}$$

H (8,12)

$$\begin{aligned}.25x + .05y &= 4 \\ x + y &= 32\end{aligned}$$

Exponential Growth Slap Jack

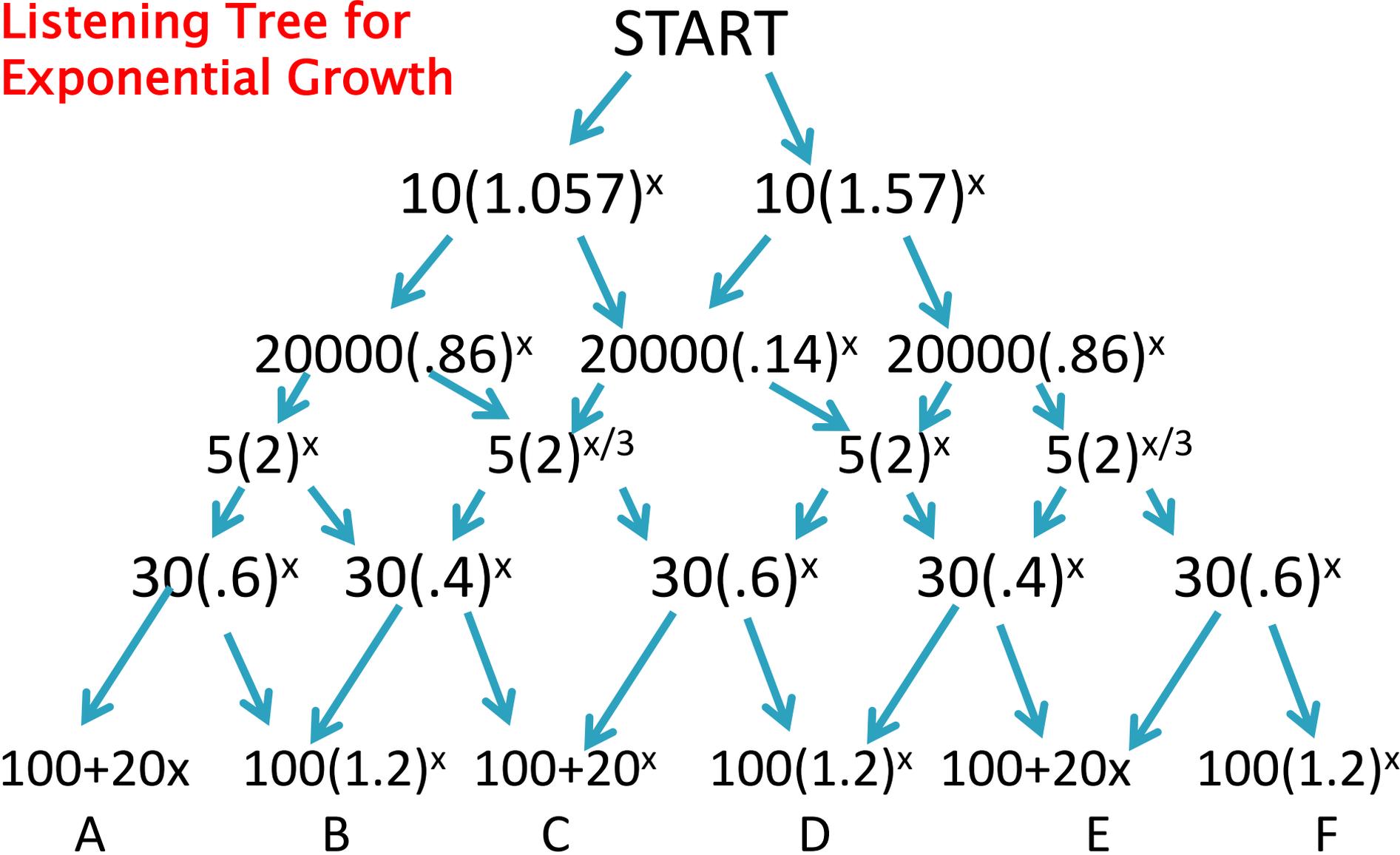
First person to touch **correct** box: +2 points

Anyone else touching **correct** box: +1 point

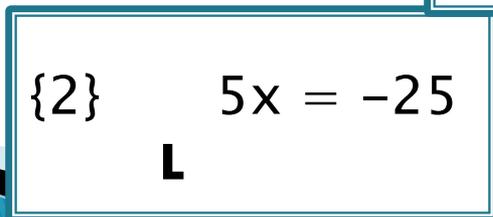
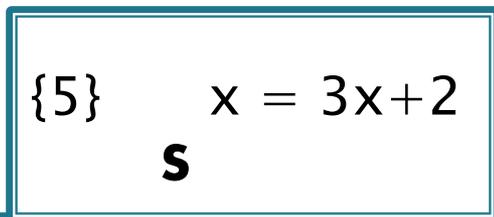
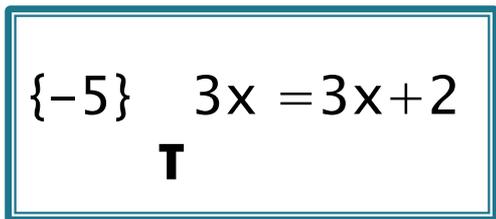
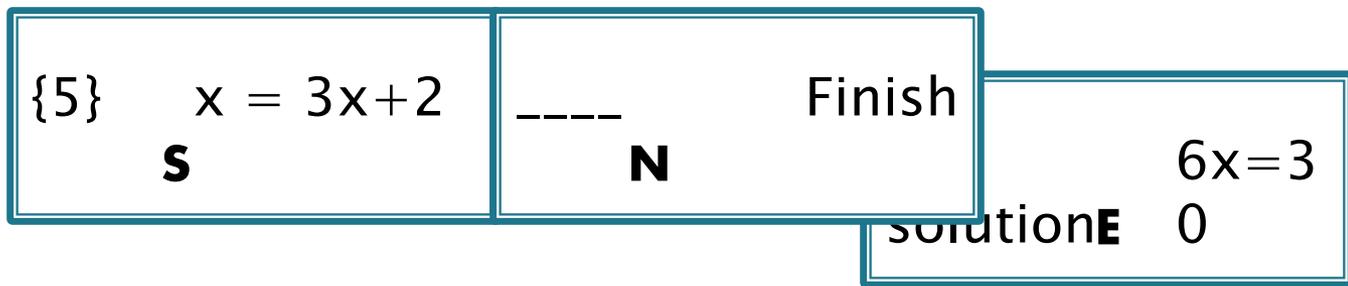
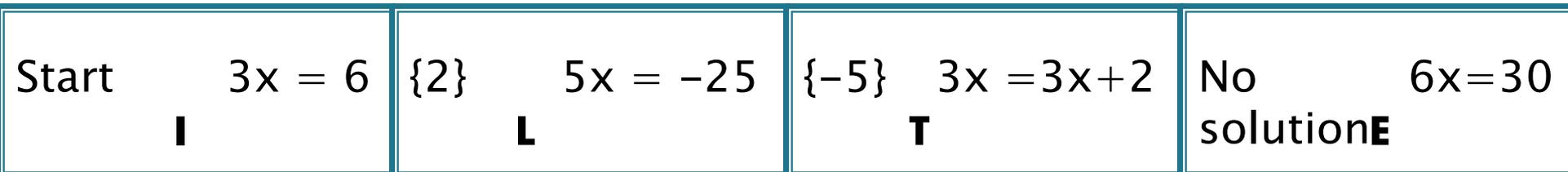
Incorrect box: -1 point

$Y = (1.056)^x$	Neither	2	5% increase	7	$Y = 6(1.4)^x$
A	B	C	D	E	F
56	50% increase	Growth	$6(1.04)^x$	Decay	30% decrease
G	H	I	J	K	L
132	37% increase	$6(.96)^x$	3% decrease	3.7% increase	$Y = (1.56)^x$
M	N	O	P	Q	R

Listening Tree for Exponential Growth



Dominoes <Not the pizza>



$$3x^{\frac{5}{2}}y^{\frac{1}{2}} \quad \mathbf{A} \quad (8x^7y^2)^{\frac{1}{3}}$$

$$3x^4y^{\frac{5}{3}} \quad \mathbf{E} \quad \sqrt{64x^2y^3}$$

$$2x^{\frac{5}{2}}y^{\frac{1}{2}} \quad \mathbf{C} \quad \sqrt[3]{27x^{12}y^5}$$

$$4x^{\frac{2}{3}}y \quad \mathbf{F} \quad (9x^5y)^{\frac{1}{2}}$$

$$\text{-----} \quad \mathbf{D} \quad \sqrt[3]{64x^2y^3}$$

$$2x^{\frac{7}{3}}y^{\frac{2}{3}} \quad \mathbf{B} \quad \sqrt{4x^5y}$$

EXPONENT DOMINOES
 The problem is on the right side, with simplified "answers" on the left side.
 Put them in order. Fill in the blank.

$$2x^{\frac{5}{2}}y^{\frac{1}{2}} \quad \mathbf{C} \quad \sqrt[3]{27x^{12}y^5}$$

$$3x^4y^{\frac{5}{3}} \quad \mathbf{E} \quad \sqrt{64x^2y^3}$$

$$8xy^{\frac{3}{2}} \quad \mathbf{D} \quad \sqrt[3]{64x^2y^3}$$

$$4x^{\frac{2}{3}}y \quad \mathbf{F} \quad (9x^5y)^{\frac{1}{2}}$$

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$$2x^{\frac{7}{3}}y^{\frac{2}{3}} \quad \mathbf{B} \quad \sqrt{4x^5y}$$

Fisher Says

If I say “Fisher Says” then model what I say

If I don't say “Fisher Says” then “Freeze!!!”

$$y = x$$

$$y = 3$$

$$x = 3$$

$$y = x + 1$$

$$y = 2x - 1$$

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

$$y = x^2 + 1$$

$$2y + x = -4$$

$$2y + x = -4$$

Another kinesthetic activity is to give each group of four students some string and then graph equations on a tile floor with their bodies using an easy origin label.

Partner Relay

Left person: Solve for x : $x + 2 = 7$

Right Person: Solve for y : $2x - y = 8$

(x is what you get from your partner)

Left person: Solve for x : $3x + 4 = -11$

Right Person: Solve for y : $2x - y = 25$

(x is what you get from your partner)

Right person: Solve for x : $-3x + 4 = -20$

Left Person: Solve for y : $2x - 3y = 25$

(x is what you get from your partner)

Partner Matching Activity

Partner A does the left side and Partner B does the right side. After both partners have completed the first four problems, compare your answers. Each partner should have the same 4 answers (but in a different order.)

$$A \quad (5n^3)(4n^2) \quad \underline{20n^5}$$

$$B \quad \frac{30n^{10}}{2n} \quad \underline{15n^9}$$

$$C \quad \frac{4n^4}{0.25n^{-2}} \quad \underline{16n^6}$$

$$D \quad (3n^4)^2 \quad \underline{9n^8}$$

$$E. \quad \frac{10r^3t^5}{40r^7t^3} \quad \underline{\hspace{2cm}}$$

$$F. \quad \left(\frac{2r}{3t^3}\right)^2 \quad \underline{\hspace{2cm}}$$

$$G. \quad \frac{6r^0 \cdot 9t^9}{t} \quad \underline{\hspace{2cm}}$$

$$H. \quad (4r^3)^2(3rt^2) \quad \underline{\hspace{2cm}}$$

$$1. \quad \frac{18n^6}{2n^{-2}} \quad \underline{9n^8}$$

$$2. \quad \frac{40n^8}{2n^3} \quad \underline{20n^5}$$

$$3. \quad (4n^3)^2 \quad \underline{16n^6}$$

$$4. \quad (5n^8)(3n) \quad \underline{15n^9}$$

$$5. \quad (3t^3)^2 \cdot 6t^2 \quad \underline{\hspace{2cm}}$$

$$6. \quad \left(\frac{t}{2r^2}\right)^2 \quad \underline{\hspace{2cm}}$$

$$7. \quad \frac{8r^4t}{18r^2t^7} \quad \underline{\hspace{2cm}}$$

$$8. \quad \frac{16r^0 3r^7 t^3}{t} \quad \underline{\hspace{2cm}}$$

Slope	Pair #1	Pair #2	Pair #3
5	(1, 6) and (2, 11)	(-2, -3) and (0, 7)	(4, 8) and (7, 23)
$\frac{2}{3}$	(-1, -8) and (5, -4)	(5, 6) and (8, 8)	(-4, 1) and (-13, -5)
$-\frac{1}{7}$	(0, 3) and (14, 1)	(3, -2) and (-11, 0)	(2, 4) and (9, 3)
0	(8, 12) and (4, 12)	(5, -2) and (-3, -2)	(-1, 5) and (10, 5)
Undefined	(3, 8) and (3, 0)	(-2, 6) and (-2, -2)	(0, 7) and (0, 2)
$\frac{9}{5}$	(3, 6) and (13, 24)	(-3, -8) and (2, 1)	(-7, 8) and (-2, 17)
-6	(2, -8) and (-1, 10)	(-3, -15) and (-5, -3)	(4, 9) and (6, -3)
$-\frac{7}{6}$	(5, 12) and (11, 5)	(-3, 8) and (3, 1)	(-7, -7) and (5, -21)

Vocabulary Recall

3% Increase (1.03) ^x	30% Increase (1.3) ^x	3% Decrease (.97) ^x	30% decrease (.7) ^x
5.3% Increase (1.053) ^x	5.3% Decrease (.947) ^x	15% Tip (1.15) ^x	15% Discount (.85) ^x
7% Tax (1.07) ^x	7% Discount (.93) ^x		

EXPANDING Binomials

A

$$x + 5$$

B

$$x - 5$$

C

$$x + 4$$

D

$$x - 2$$

E

$$2x - 3$$

F

$$3x + 8$$

G

$$2x + 1$$

H

$$4x - 6$$

Cut up the 32 cards and distribute to the students – so they can practice the Distribution Property!

Students pair up with each other and work together to multiply the 2 binomials. Each student records the problem and shows their work. Students find another classmate and repeat the process.

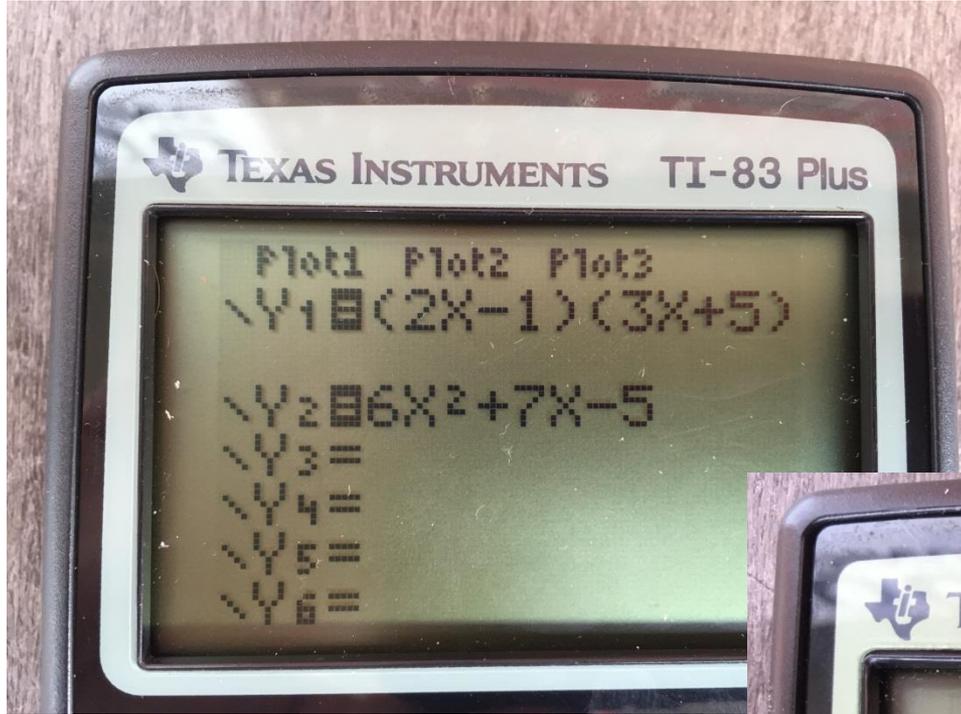
Some different ways for students to pair up:

Same sign in the middle; Different sign in the middle; 1 odd and 1 even;

“a” coefficient = 1 and “a” coefficient \neq 1

Both constants are the same (either odd or even)

Self Check for EXPANdING Binomials/Factoring Quadratic Functions



TEXAS INSTRUMENTS TI-83 Plus

X	Y1	Y2
0	-5	-5
1	33	33
2	70	70
3	119	119
4	180	180
5	253	253

X=0

QUADRATIC FUNCTIONS

EQUATION

**Axis of
Symmetry**

y-intercept:

Graph

Vertex

a= b= c=

x-intercept(s)

EXCELLENT FOR:

Vocabulary
“How to” steps
Calculator steps

“Find the missing value”
Factored form to Expanded form
Word Problem Clues
Project Based format

Number Line

Place the following from least (left side) to largest (right side).
(Teachers can cut these out or just give it as a worksheet)

A: Y intercept of $y = 3x^2 + 2x - 7$

B: x coordinate of vertex of $y = 2x^2 - 8x - 2$

C: y coordinate of vertex of $y = 2x^2 - 8x - 3$

D: The larger x-intercept of: $x^2 - 9x + 8 = 0$

E: The smaller x-intercept of: $x^2 - 9x + 8 = 0$

F: The smaller x-intercept of: $x^2 + 9x - 10 = 0$

G: The larger root of: $-x^2 + 10x - 24 = 0$

H: $f(4)$ of $y = 2x^2 - 3x - 8$

I: The rate of change of $y = x^2 - 7x + 10$ on the interval of $[1, 5]$

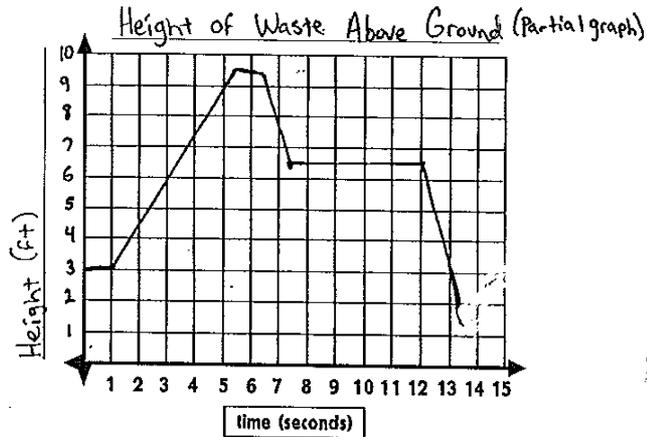
J: The sum of the roots of: $y = -x^2 + 5x + 6$

Key: A: **-7** B: **2** C: **-11** D: **8** E: **1** F: **-10** G: **6** H: **12** I: **-1** J: **5**

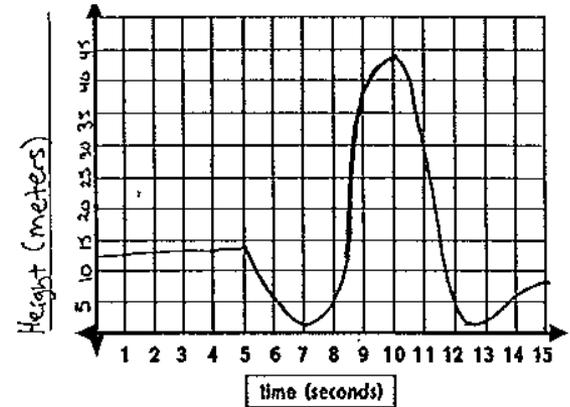
So: **C, F, A, I, E, B, J, G, D, H**

Graphing stories

www.graphingstories.com Look at the "Height of Waste Above Ground" with the slide.



www.graphingstories.com . Look at the "Height" one with the swing.

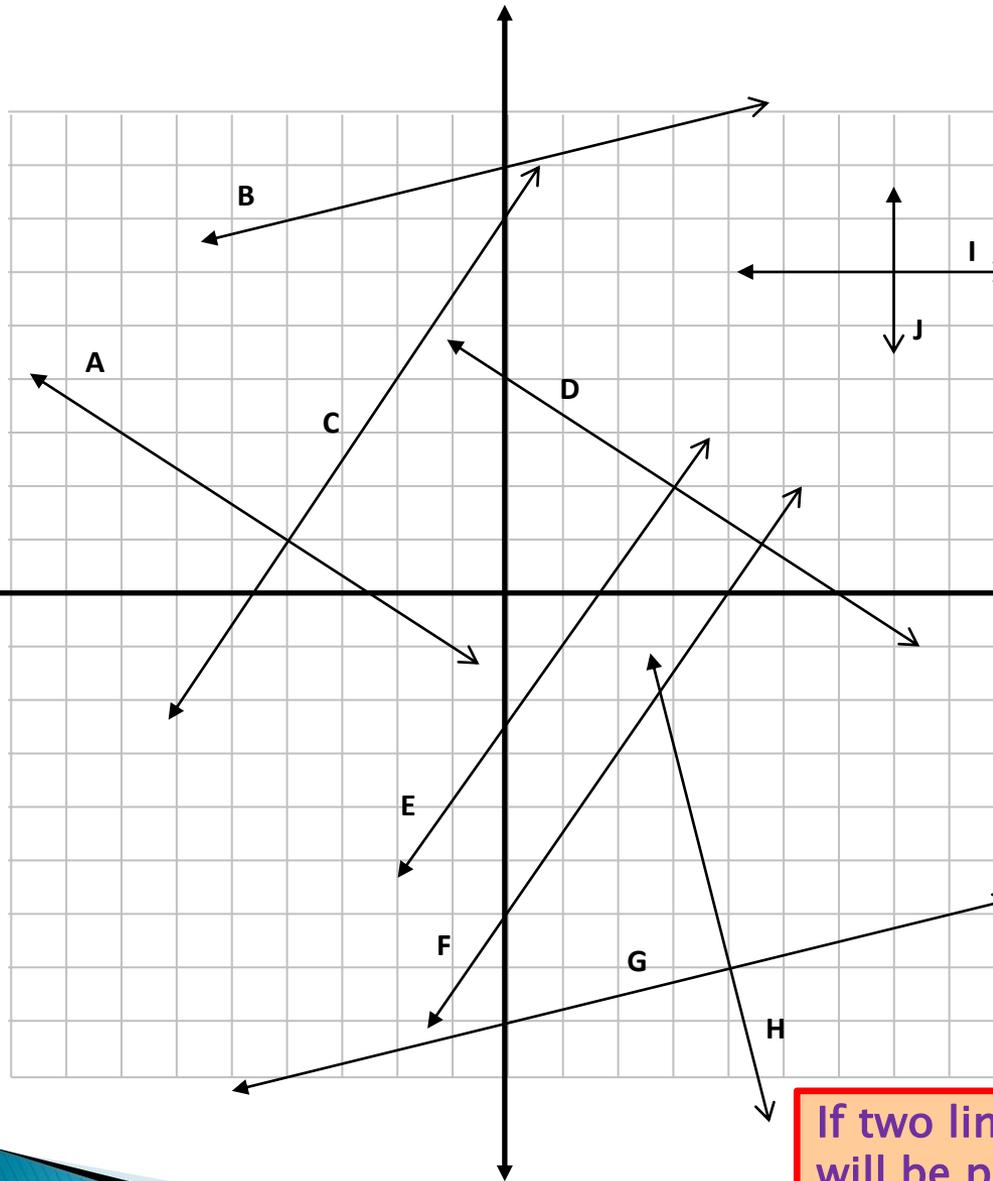


- 1) What is the domain and range? _____
- 2) Is this a function? Explain. _____
- 3) Is it a 1-1 function? Explain. _____
- 4) Find and interpret $f(0.5)$. _____
- 5) Find and interpret $f(4.5)$. _____
- 6) Find and interpret $f(8.5)$. _____

1. What is the domain and range? _____
2. Is it a function? Is it 1-1? Explain. _____
3. Find and interpret $f(2)$ _____
4. Find and interpret $f(8)$ _____
5. Find and interpret $f(x) = 20$? _____
6. Find and interpret $f(x) = 46$? _____
7. How does your answer to #6 relate to your range? _____
8. Suppose that the swing started 10 feet higher. What would $f(3)$ become? _____
9. Explain how the answer to #8 is equivalent to $f(3) + 10$. _____

Parallel and Perpendicular Lines Investigation

Find the slopes of all 10 lines.



Which line appears to be parallel to Line A? What do you notice about the slopes of these two lines?

What line appears to be parallel to Line B? What do you notice the slopes of these two lines?

What lines appear to be parallel to E and what do you notice about the slopes of these three lines?

Two Lines are parallel if they have the _____ slope.

Do Lines A and C appear to be parallel or perpendicular? What do you notice about these two slopes?

Do Lines G and H appear to be parallel or perpendicular? What do you notice about these two slopes?

If two lines are perpendicular then one slope will be positive and the other will be _____. They will be _____ of each other.

Slope Aerobics

Positive Negative Zero Undefined

Positive Negative Zero Undefined

Rise over Run

Rise over Run

$Y - y$ over $x - x$

$Y - y$ over $x - x$

Parallel same, perpendicular negative flip

Parallel same, perpendicular negative flip

$Y = \text{Slope } x + B$

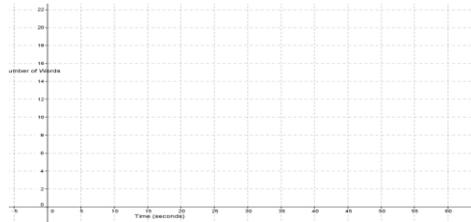
$Y = \text{slope } x + B$

X-line undefined, y line 0

X-line undefined, y line 0

Rate of Change

Time (s)	Total bubbles
0	
10	
20	
30	
40	
50	
60	



- 4) Find and interpret the y -intercept from the table: _____
- 5) How could you find the y -intercept from the plot?_
- 6 a) To find rate of change from 0-60 seconds, find out how many words did you increase by from 0-60: _____ words
- b) Then find out how much the time increased by from 0-60:
Change in time: _____ seconds
- c) Then divide your answer from a) by b)
Rate of change = _____ words/sec.

A-E-I-O-U

Algebraic Enriching Instructional Opportunities for U

Presentation #105

- Thank you for coming!
- Please fill out the purple evaluation form
 - Please email us at:

fgthompson@wsfcs.k12.nc.us

gfisher@wsfcs.k12.nc.us