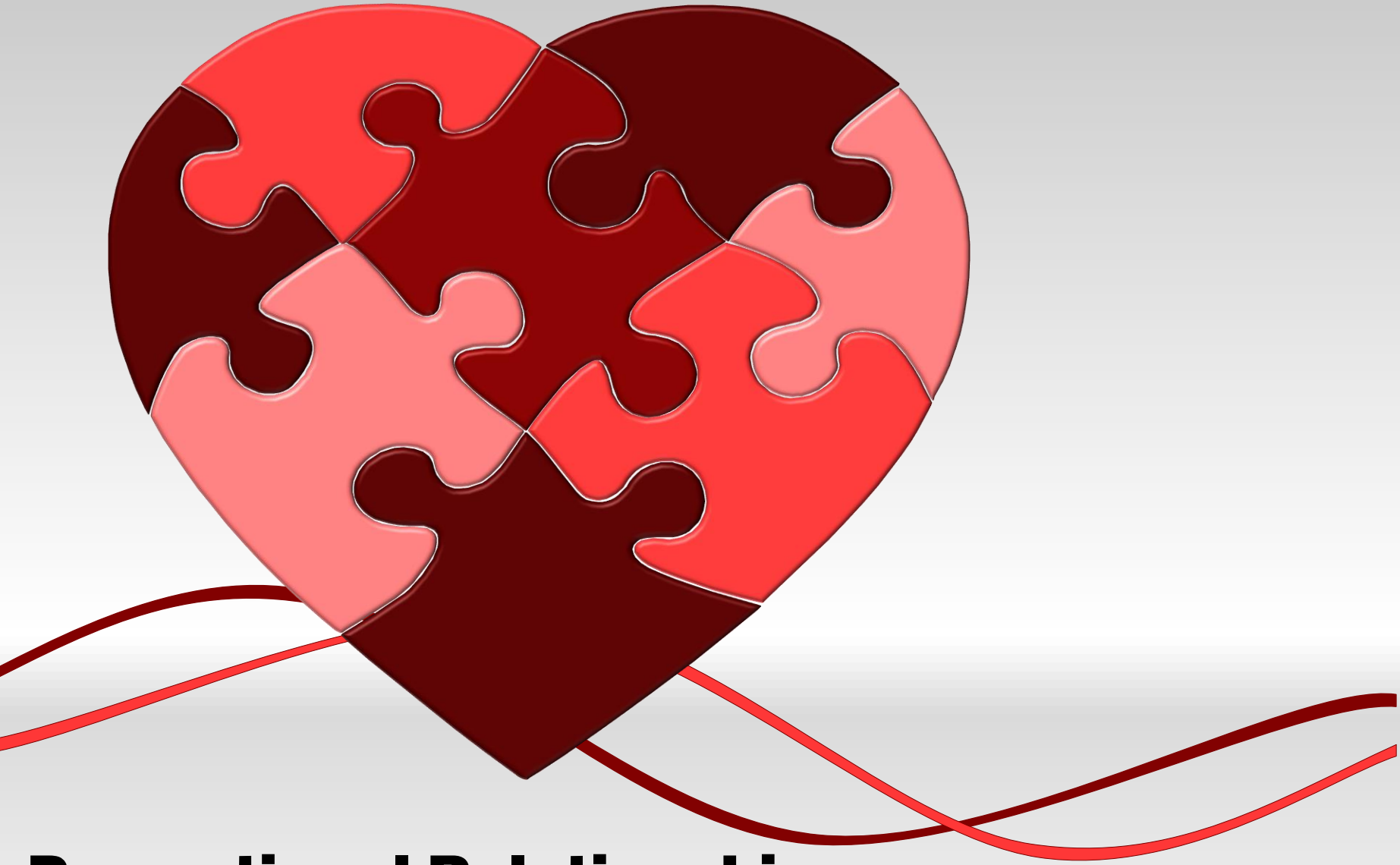

Proportional Relationships:

A Love Story of Linear Algebra

St. Lucie PUBLIC SCHOOLS

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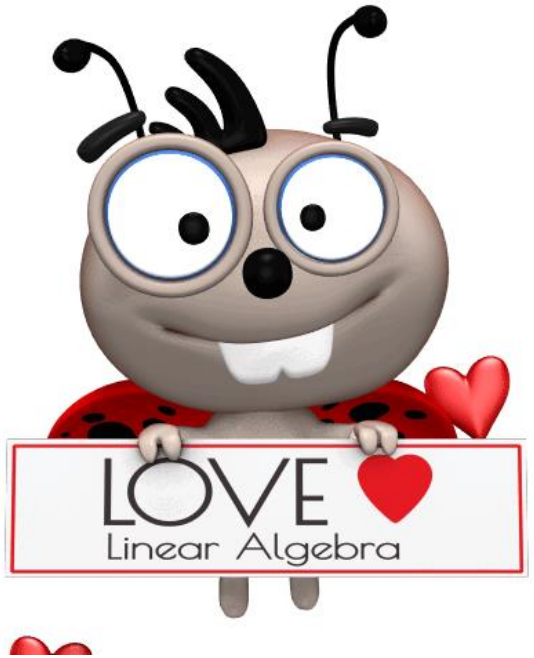

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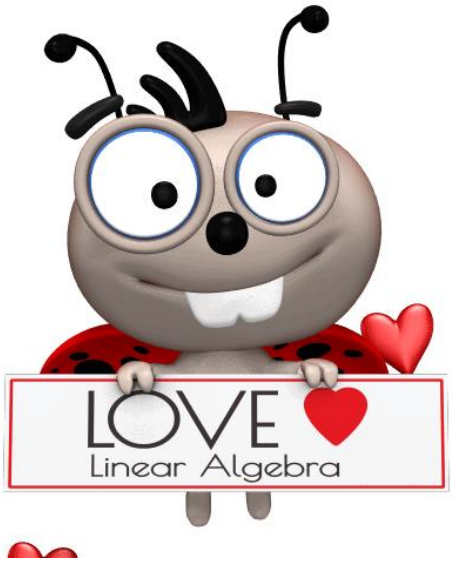
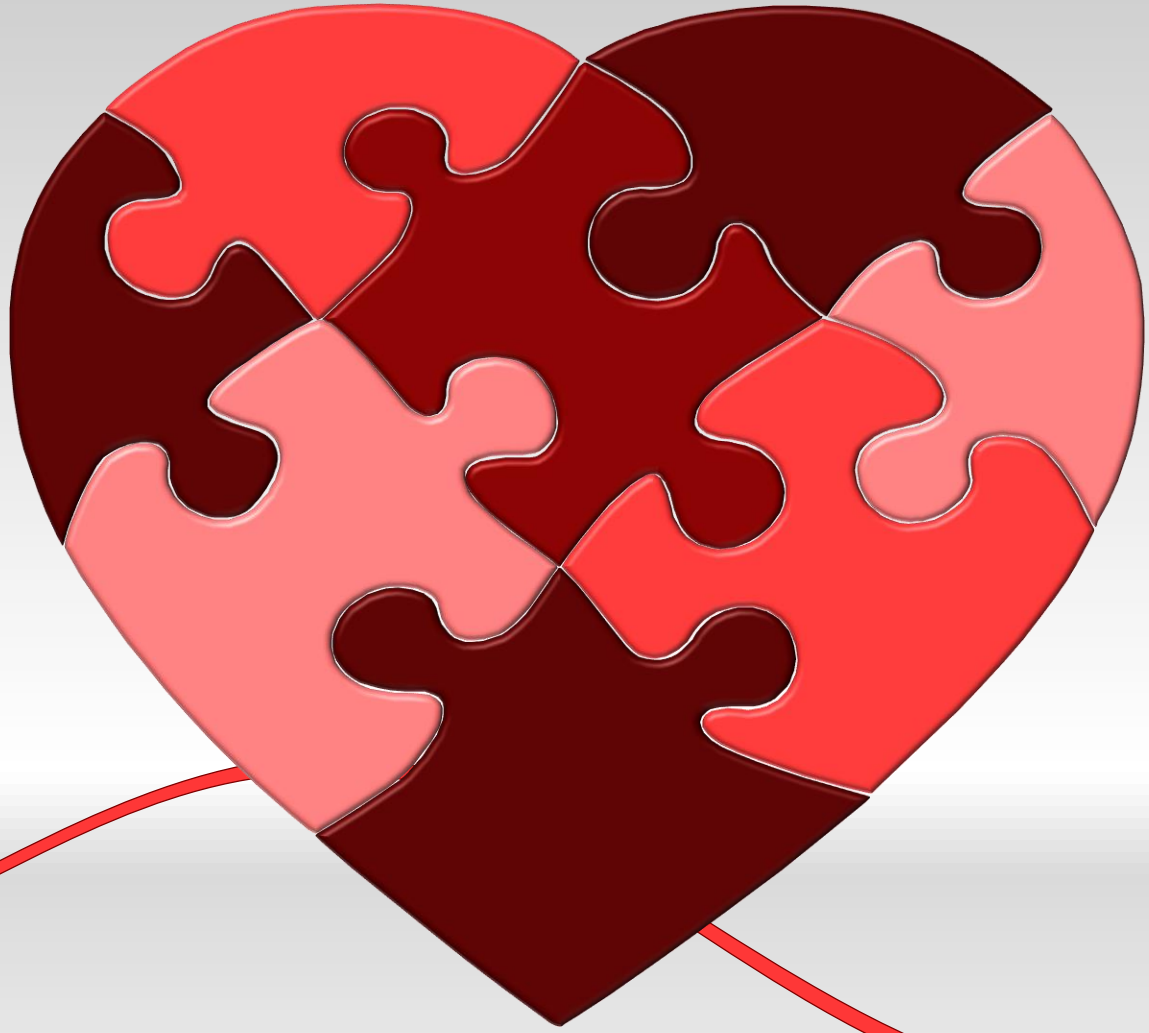
St. Lucie PUBLIC SCHOOLS



Interacting Today

- Padlet: https://padlet.com/pruitte/wax3gi744ims
- OneDrive: https://tinyurl.com/yxuv9qb6

PUBLIC SCHOOLS



Equivalent Fractions

Measurement & Data

Algebraic Thinking

Ratios

Proportional Relationships

Attributes of a Line

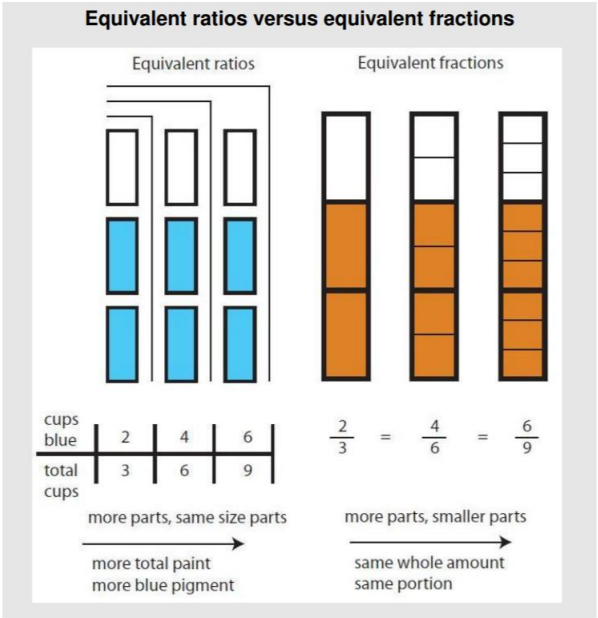
Linear Algebra

Proportional Relationships:

A Love Story of Linear Algebra

Equivalent Fractions

- Starts in 3rd Grade
- Allows for the generation of fractions
- Important to note what happens in equivalent fractions
- FRACTION = A NUMBER



Measurement & Data

- Starts in 4th Grade
- Generate a conversion table for feet and inches listing the number pairs (1, 12), (2, 24), (3, 36),…

Algebraic Thinking

- Starts in 5th Grade
- Form ordered pairs consisting of corresponding terms from the two patterns, and graph the ordered pairs on a coordinate plane.

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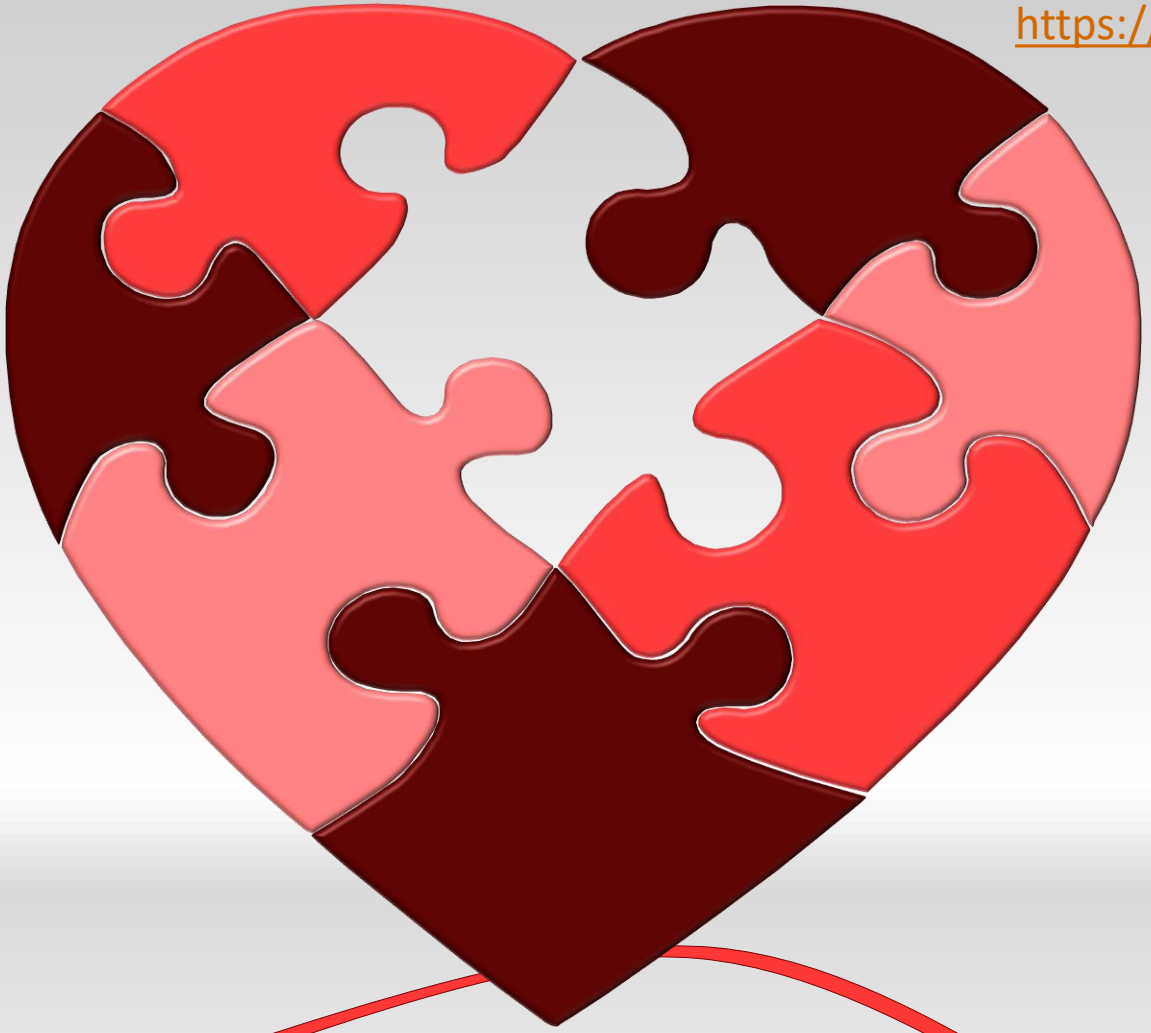


Why are these foundational skills important?

Ratios

- Starts in 6th Grade
- Ratios arise in situations in which two (or more) quantities are related.
- RATIO = A RELATIONSHIP
- Important to build models with students first.
- Frayer Model is one way to do this

Solve for Rates and Ratios in Multiple Ways

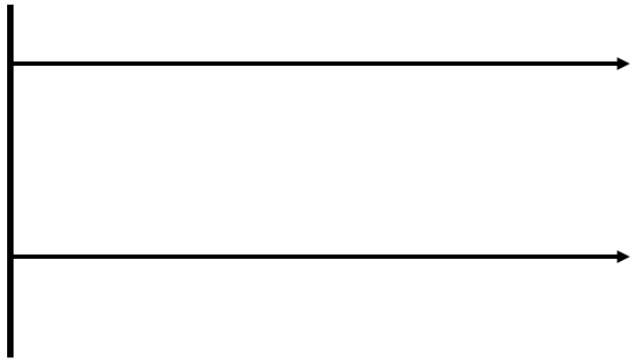
Starting Ratio:

Bar Model/ Tape Diagram/ Other Model:

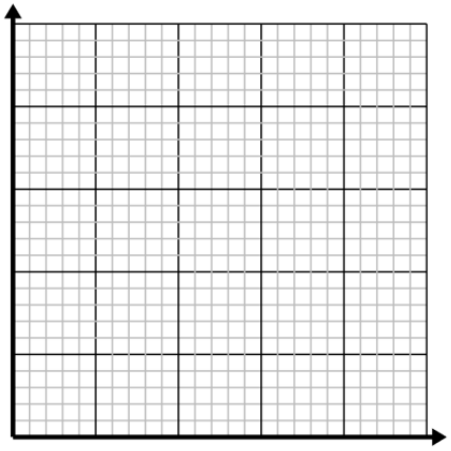
Table:

Place the problem in the text box

Double Number Lines:



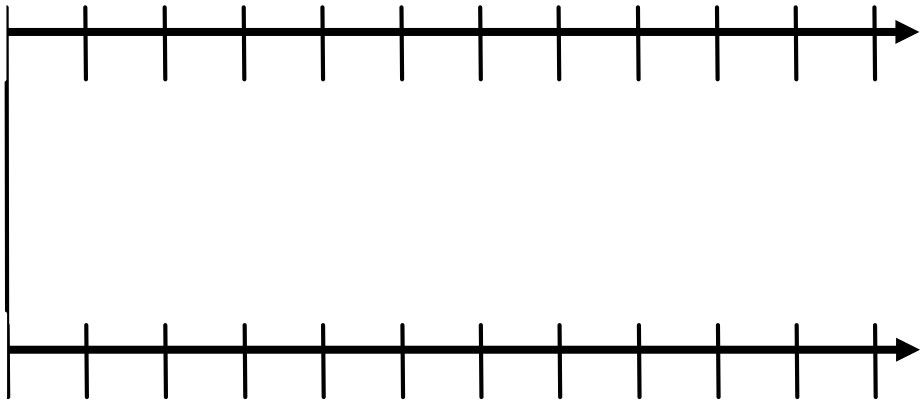
Coordinate Grid:



Explain the process that you used to solve.

DOUBLE NUMBER LINES 6.RP.A.1

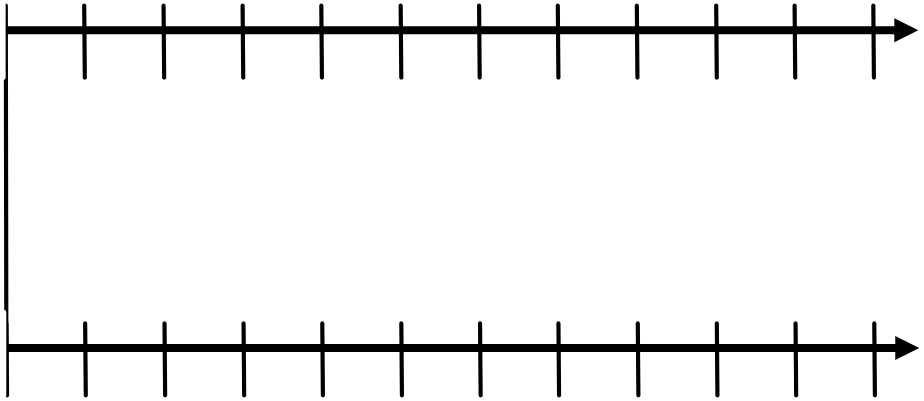
- Use a double number line to represent the following situation.
  - Grandma walks 2 miles in 30 minutes.



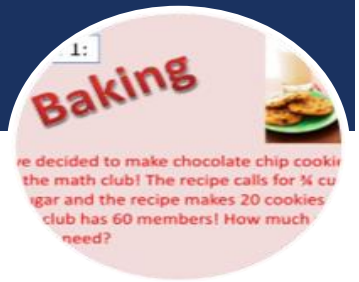
DOUBLE NUMBER LINES 6.RP.A.2

- Use a double number line to represent the following situation.
  - Ms. Fraiser the librarian can read $1\frac{1}{2}$ books in 3 days. Create a number line to model this information.
  - How many books can Ms. Fraiser read in one day?

What other questions can be asked using this information?



PROBLEM SOLVING WITH RATIOS 6.RP.A.3



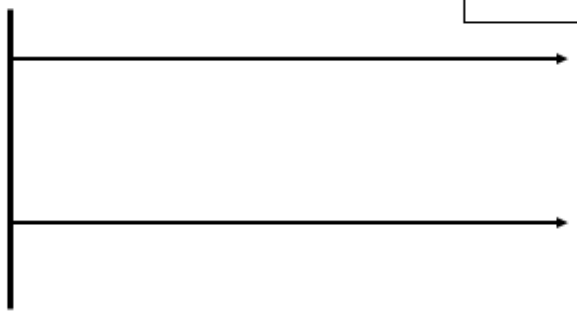
Starting Ratio:

Table:

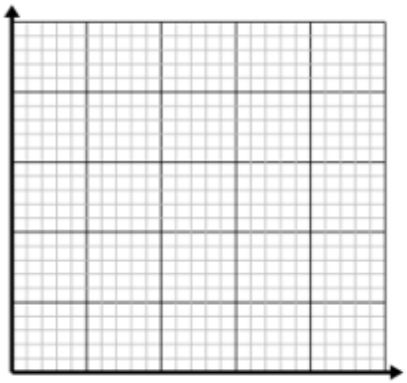
Bar Model/ Tape Diagram/Other Model:

Two batches of cookies require 7 cups of flour. Solve to find how much flour will be needed for up to 8 batches of cookie.

Double Number Lines:

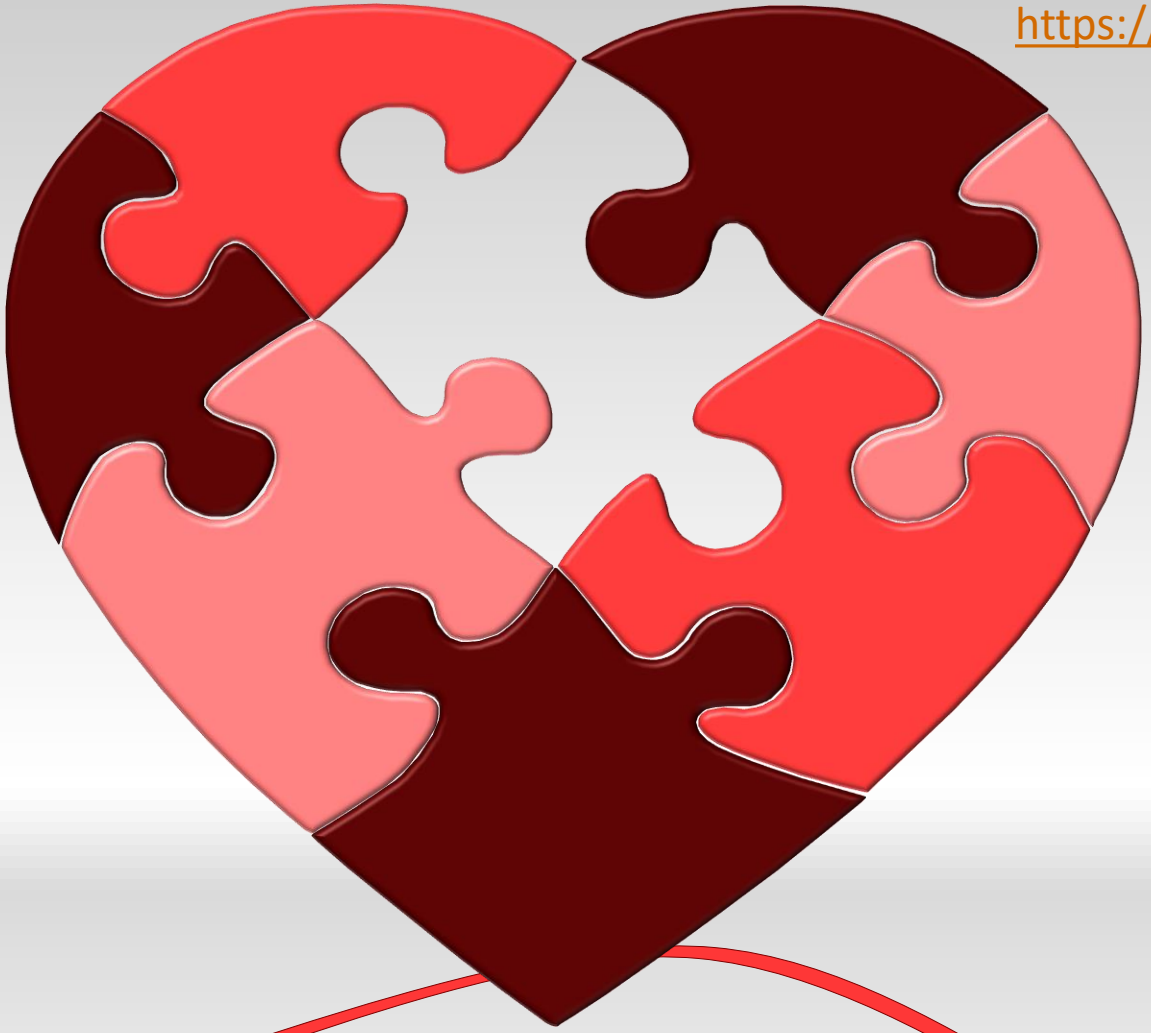


Coordinate Grid:



Explain the process that you used to solve.

https://padlet.com/pruitte/wax3gi744ims



Why is it important to make connections of different representations?

Proportional Relationships

MAFS.7.RP.1.2

Recognize and represent proportional relationships between quantities.

a. Decide whether two quantities are in a proportional relationship, e.g., by testing for equivalent ratios in a table or graphing on a coordinate plane and observing whether the graph is a straight line through the origin.

b. Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships.

c. Represent proportional relationships by equations. *For example, if total cost t is proportional to the number n of items purchased at a constant price p, the relationship between the total cost and the number of items can be expressed* as $t = pn$.

d. Explain what a point (x, y) on the graph of a proportional relationship means in terms of the situation, with special attention to the points $(0, 0)$ and $(1, r)$ where r is the unit rate.

Solve for Rates and Ratios in Multiple Ways

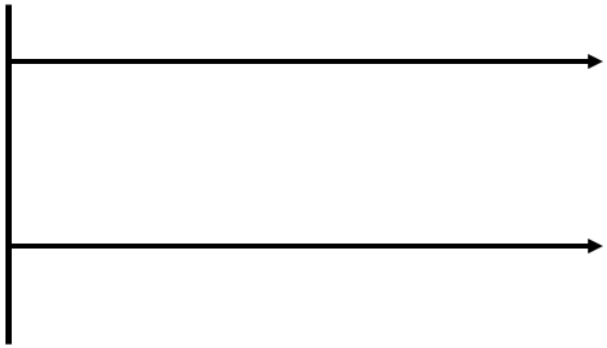
Starting Ratio:

Equation to Represent Proportionality:

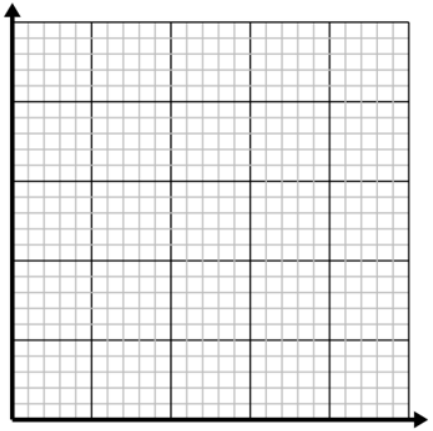
Table:

Place the problem in the text box

Double Number Lines:



Coordinate Grid:



Explain the process that you used to solve.

Buying Bananas, Assessment Version

Task

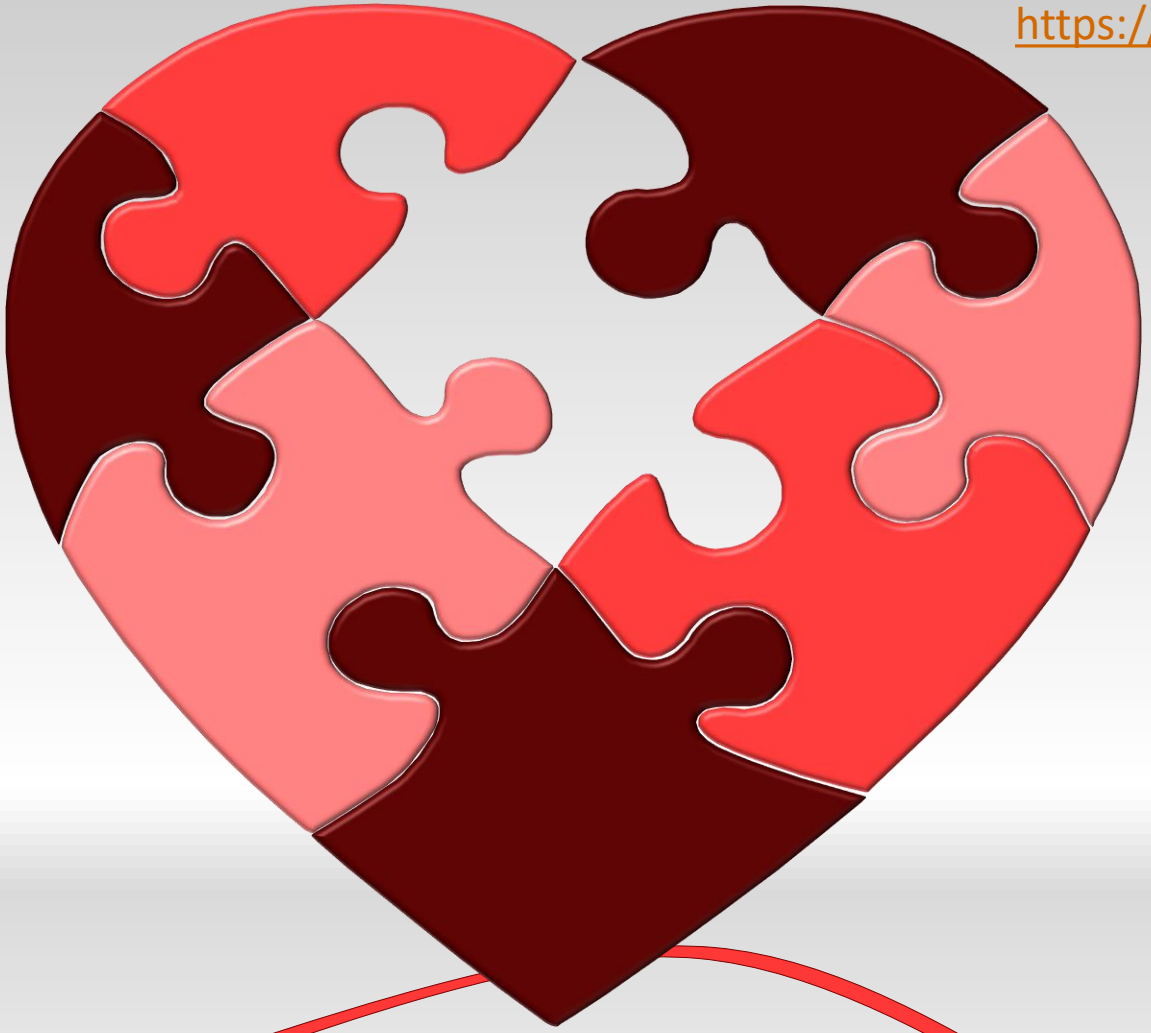
Carlos bought $6\frac{1}{2}$ pounds of bananas for $5.20.

a. What is the price per pound of the bananas that Carlos bought? [_____]

b. What quantity of bananas would one dollar buy? [_____] pounds

c. Which of the points in the coordinate plane shown below correspond to a quantity of bananas that cost the same price per pound as the bananas Carlos bought? (Select all that apply.)

https://padlet.com/pruitte/wax3gi744ims

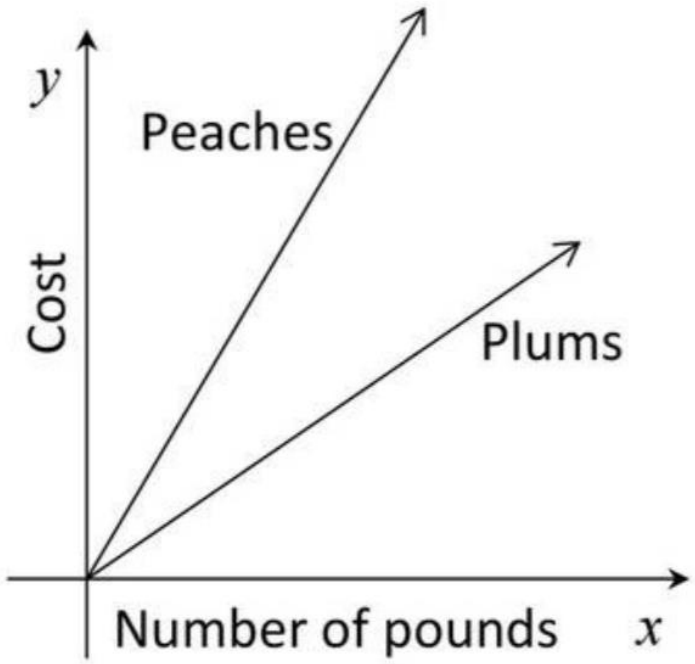


How does this help with slope?

Linear Algebra

MAFS.8.EE.2.5 Graph proportional relationships, interpreting the unit rate as the slope of the graph. Compare two different proportional relationships represented in different ways. *For example, compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed.*
MAFS.8.EE.2.6 Use similar triangles to explain why the slope *m* is the same between any two distinct points on a non-vertical line in the coordinate plane; derive the equation $y = mx$ for a line through the origin and the equation $y = mx + b$ for a line intercepting the vertical axis at *b*.

The graphs below show the cost y of buying x pounds of fruit. One graph shows the cost of buying x pounds of peaches, and the other shows the cost of buying x pounds of plums.



a. Which kind of fruit costs more per pound? Explain.

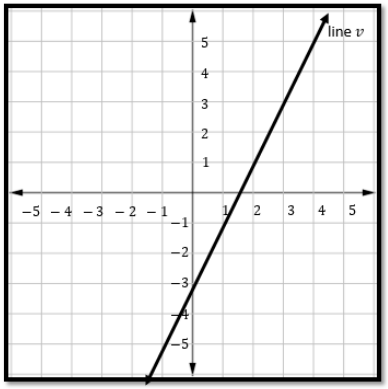
b. Bananas cost less per pound than peaches or plums. Draw a line alongside the other graphs that might represent the cost y of buying x pounds of bananas.

Name: _____ **Period:** _____

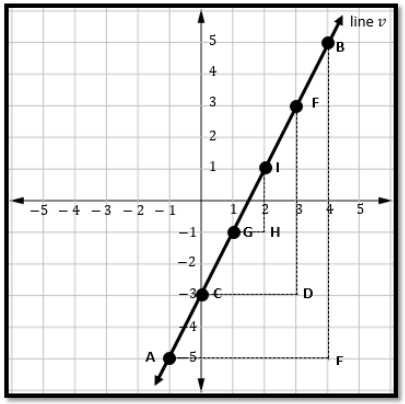
Item 1

Use the following information to complete the task.

Mrs. Thomas assigned the following graph of line v to a group of students on a big poster.



Joy, Gaby, and Dave are working on the poster together to compute the slope of line v. Joy finds the slope between the points (0, -3) and (3,3). Gaby finds the slope between the points (-1, -5) and (4,5). Dave finds the slope between the points (1, -1) and (2,1). They have each drawn a triangle to help with their calculations (shown below).



Part A:

Which student has drawn which triangle? Match the name of the student with the triangle they drew.

Joy	$\triangle GHI$
Gaby	$\triangle CDF$
Dave	$\triangle AEB$

Part B:

Determine the slope that each student calculated.

Joy: _____ Gaby: _____ Dave: _____

Part C:

Which of the following statements are true? Select all that apply.

A. The slope of $\overline{CF}$ is equal to the slope of $\overline{GI}$.
B. The slope of $\overline{CF}$ is equal to the slope of $\overline{AB}$.
C. The slope of $\overline{CF}$ is equal to the slope of $\overline{CD}$.
D. The slope of $\overline{CF}$ is equal to the slope of line v.
E. The slope of line v is equal to $\frac{CD}{DF}$.
F. The slope of line v is equal to $\frac{EB}{AB}$.
G. The slope of line v is equal to $\frac{GI}{HI}$.

Part D:

Which of the following statements best describes the way that the triangles drawn by the students illustrate the concept of slope calculation?

A. For each pair of right triangles, we can find the proportion that compares each horizontal leg. This quotient is the slope of the line.
B. For each pair of right triangles, we can find the proportion that compares each vertical leg. This quotient is the slope of the line.
C. For each right triangle, we can divide the length of the vertical leg by the length of the horizontal leg. This quotient is the slope of the line.
D. For each right triangle, we can divide the length of the horizontal leg by the length of the vertical leg. This quotient is the slope of the line.

Part E:

Complete the equation of line v in the spaces provided below.

$y =$ ☐ $x +$ ☐

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Bar Model/ Tape Diagram/ Other Model:

Table:

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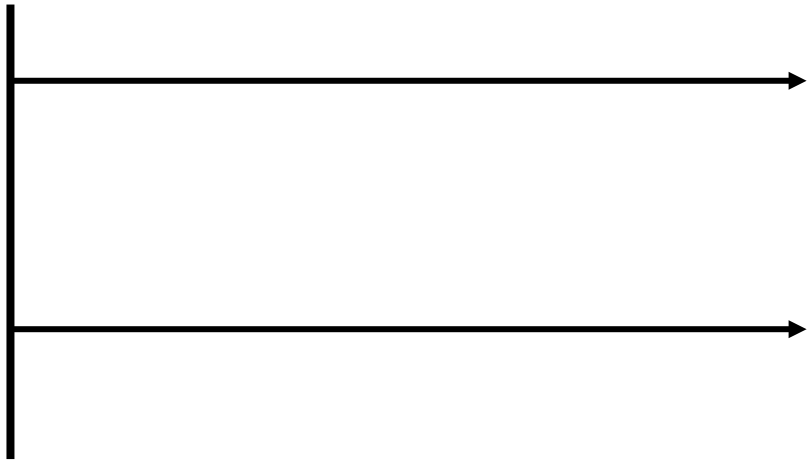

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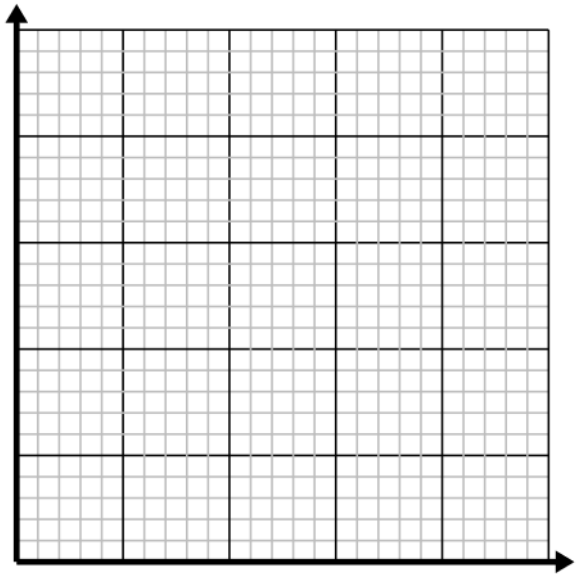

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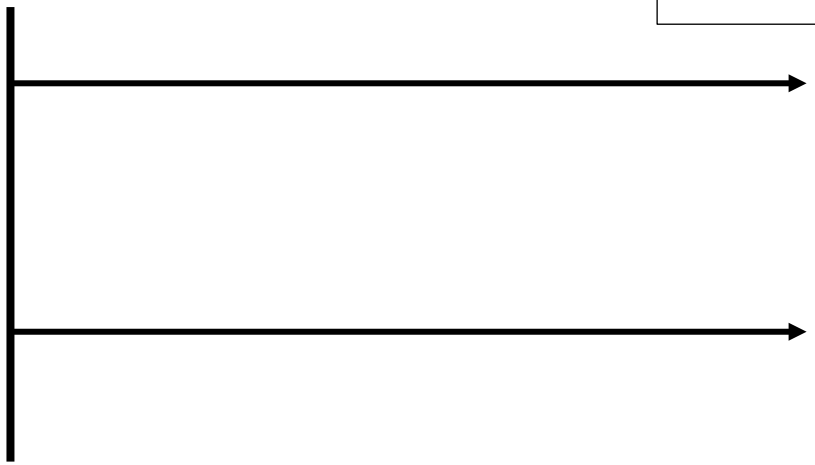

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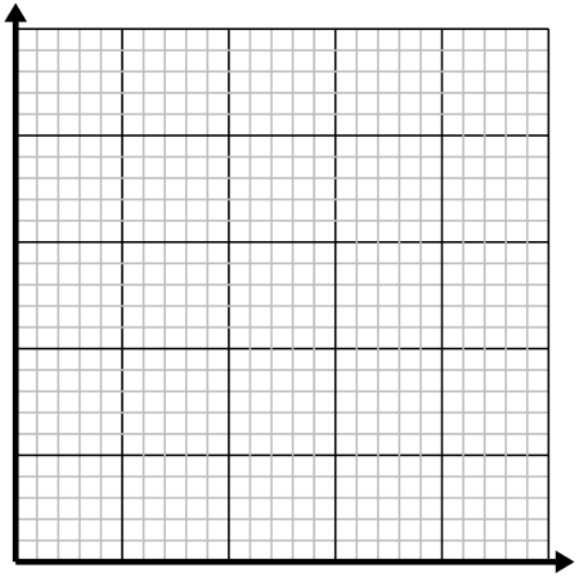

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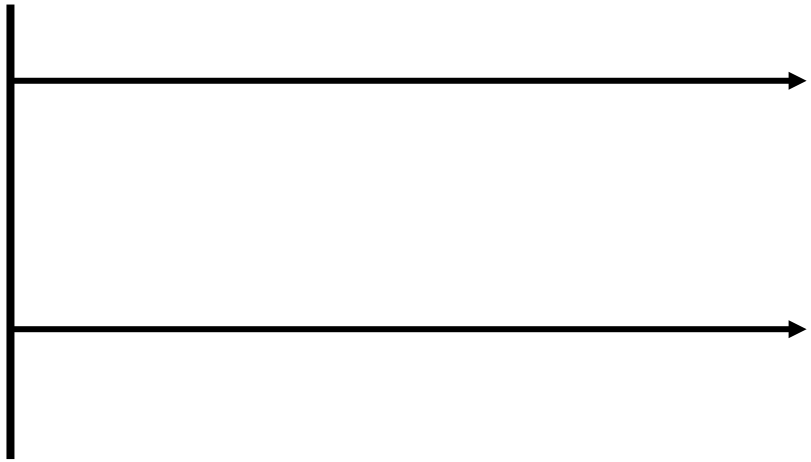

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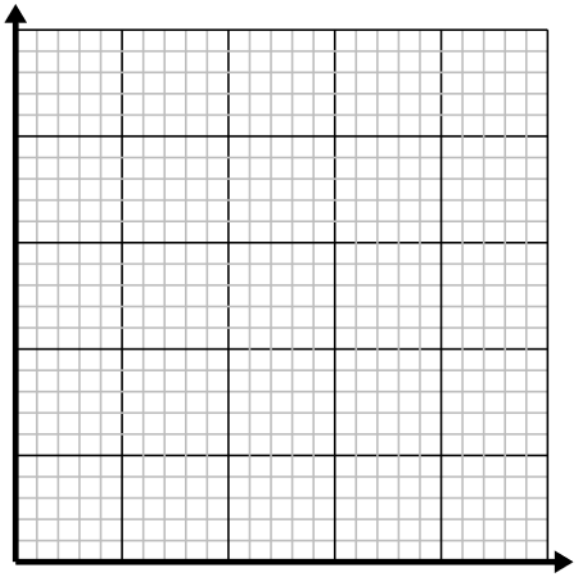

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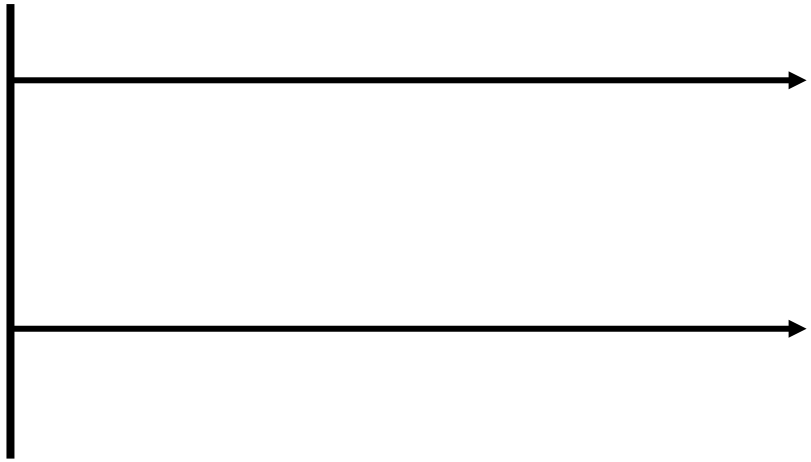

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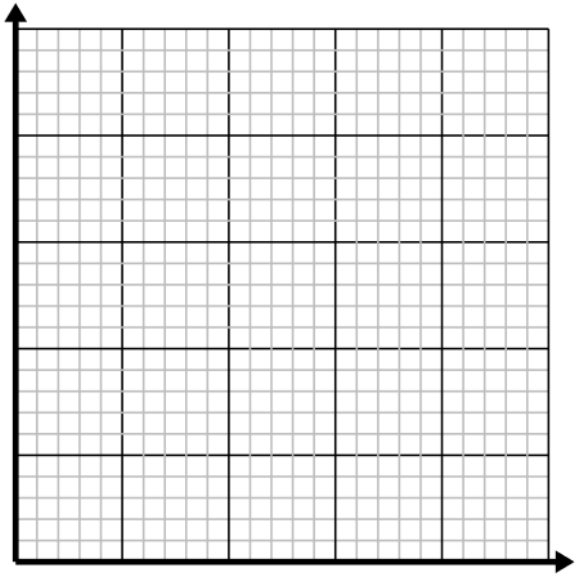

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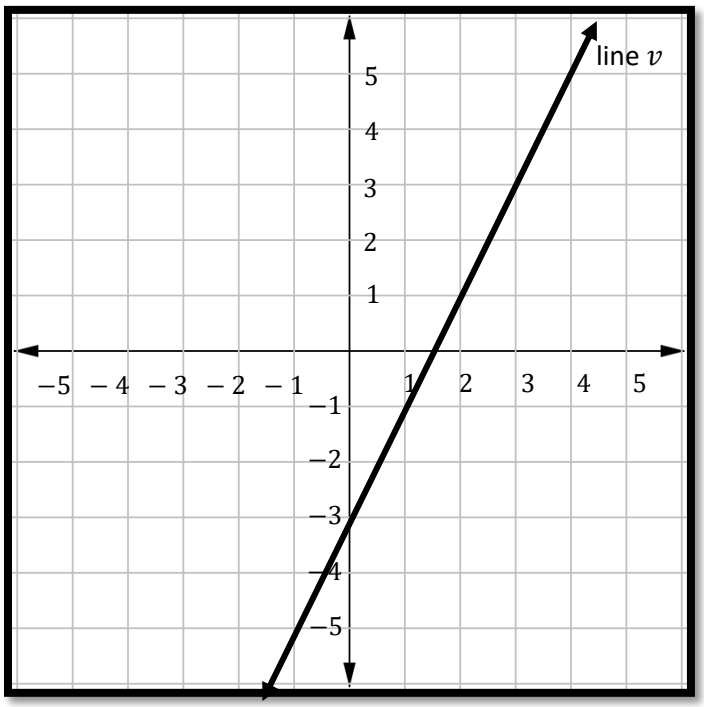

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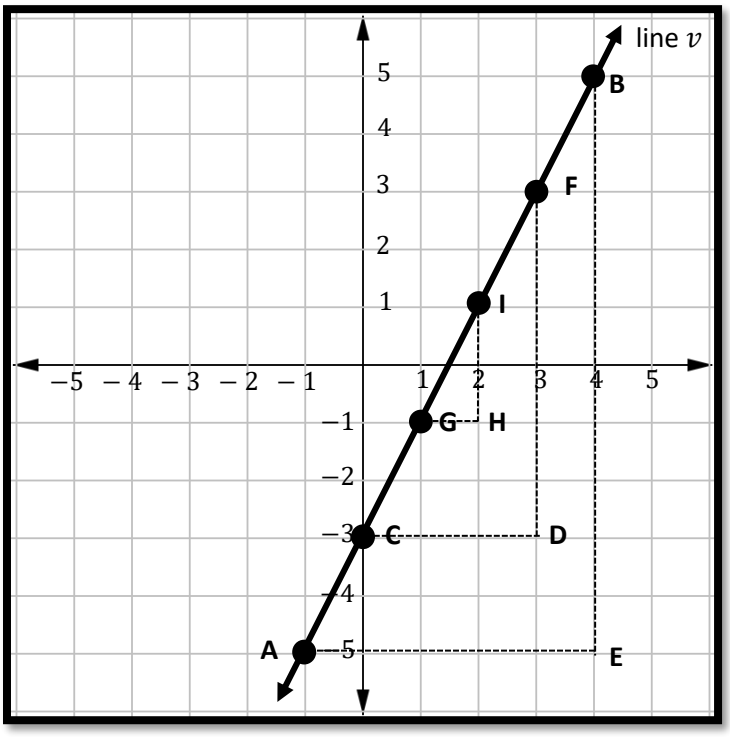

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Part E:

Complete the equation of line v in the spaces provided below.

$y =$ ☐ $x +$ ☐

Item 2

PART A:

Complete the table to show four points on the same line.

x	y
1	____
-2	-5
3	5
____	-2

PART B:

A line is drawn through the four points. Write the equation of the line in slope-intercept form.

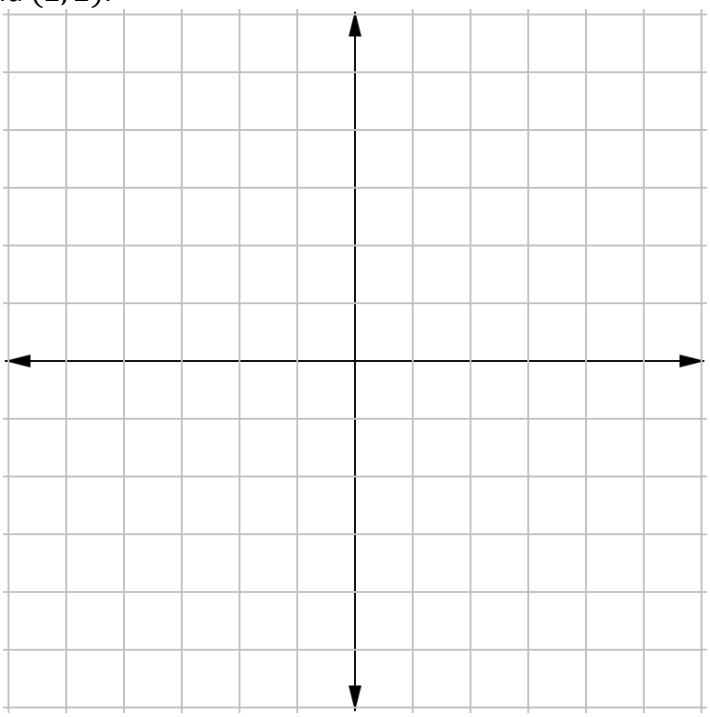
PART C:

What is another point that falls on this line?

(____, ____)

Item 3

Plot the following points on the given graph in order to answer the questions below:
$(-4, -1), (-2, 0), (0, 1)$ and $(2, 2)$.



Part A:
Draw a line that connects the four points, then draw two similar right triangles and label them.

Part B:
Find the slope of the hypotenuse of the two similar triangles you created in Part A.

Triangle 1: _____ Triangle 2: _____

Part C:
Compare the slopes of the two triangles. What do you notice?

Part D:
Write the equation of the line in the form $y = mx + b$.

Extension:

Select all points listed below that fall on this same line.

A. $(1, 0)$
B. $(3, -1)$
C. $(4, 3)$
D. $(-6, -2)$
E. $(-9, -17)$
F. $(10, 6)$

Using any of the coordinates above, explain how the points are on the same line.