Math Progress Strategies

Use Graphic Organizers
- ✓ to Scaffold
- ✓ to CHALLENGE

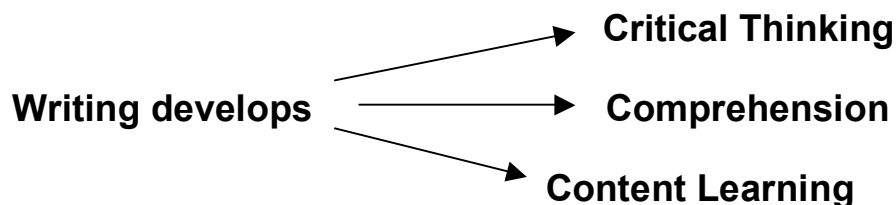Why graphic organizers?

Why writing?

What works?

Graphic Organizers increase learning.

As a tool to support students' thinking and learning processes, the 29 research studies have shown that graphic organizers help students:

• brainstorm ideas.
• develop, organize, and communicate ideas.
• **see connections, patterns, and relationships.**
• assess and share prior knowledge.
• develop vocabulary.
• highlight important ideas.
• classify or categorize concepts, ideas, and information.
• improve social interaction between students, and facilitate group work and collaboration.
• guide review and study.

Graphic organizers have been found to improve students' reading comprehension at all levels, first grade through high school. …NRP (National Reading Panel) cited graphic and semantic organizers (including story maps) as one of seven categories of instruction that is the most effective in improving reading comprehension.

Source: Institute for the Advancement of Research in Education, July 2003

Writing develops → **Critical Thinking**

Writing develops → **Comprehension**

Writing develops → **Content Learning**

There is clear evidence that activities involving writing (**any of the many sorts of writing**) lead to better learning than activities involving reading and studying only. To improve the teaching of writing is also to improve the quality of thinking required of students.... *Source: How Writing Shapes Thinking*

My Plan

To use graphic organizers as models/guides…

For students to create their own graphic organizers…

For students to write to clarify what they learn…

A message about the first day of teaching.

Source: A website dedicated to teachers helping teachers.

The following plea for help has come from a newly appointed teacher who wishes to remain anonymous.

On the first day of my teaching career, I defined a rational number to my class as a number that can be expressed as a ratio of integers. A student asked me: What exactly are ratios? How do ratios differ from fractions? I gave some answers that I was not satisfied with. So, I consulted some other teachers and texts. The result was confusion.

I find that opinions and texts vary about the definitions of these terms. Please tell me how ratios, rational numbers and fractions should be defined to make their distinguishing properties meaningful to the high school students.
To convince you why it is confusing, I am giving below a sample of definitions of ratios and fractions from different texts.
   'A comparison of two quantities by division is a ratio.'
   'A fraction is a comparison of two numbers. Another word for the comparison of two numbers is ratio.'
   'A ratio is the comparison of two quantities that have the same units.'
   'A ratio of two quantities is their quotient. For example, the ratio of 3 oranges to 5 oranges is 3/5.'
   'A ratio is a comparison of two quantities, usually expressed as a fraction. In fact, a fraction is frequently called a 'rational number,' because one meaning of the word rational is 'having to do with ratios'.'
   'An indicated quotient of two numbers is often called a ratio.'
   'For any two positive numbers, a and b, the ratio of a to b is a/b. This is sometimes written as a : b.'
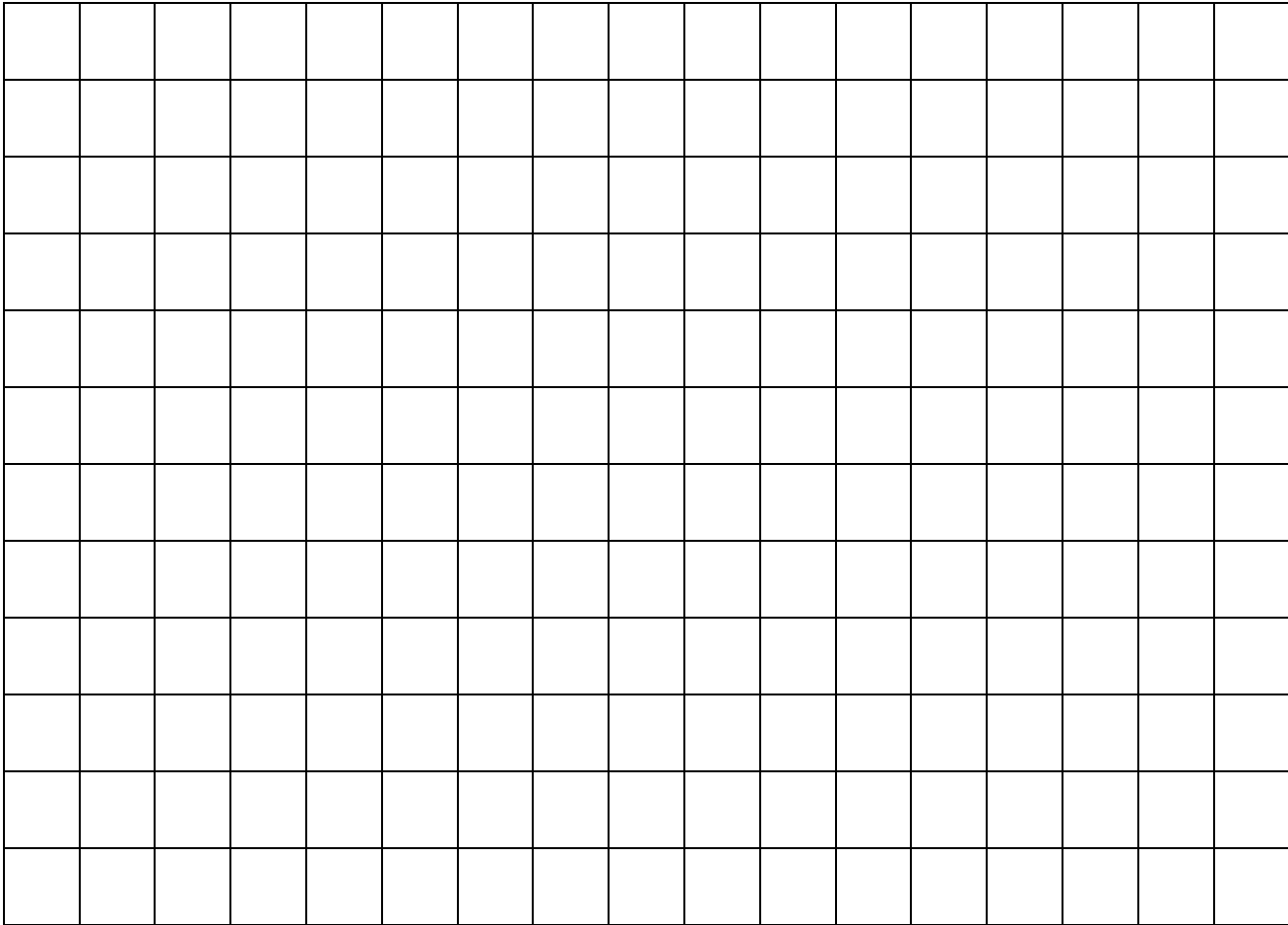   'Any fraction may be considered as a ratio of its numerator to its denominator.'"

The website included some recommendations. One teacher suggested a word chart. How could such a graphic organizer help this teacher's students get and stay clear?

Term	Explanation	Example

Quantitative Reasoning: Analyze Patterns
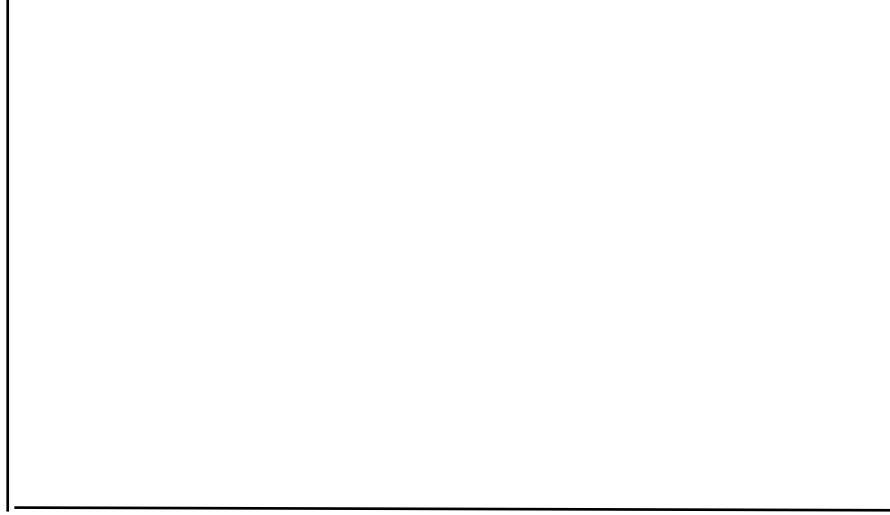
Title: _____

(grid)

💡 Explain what the graph shows. _____

BAR GRAPH

Title of the Graph

Analysis of the Graph

LINE GRAPH

Use quantitative information about something that changes over time.

1. Locate and collect information about a situation that changes over time.

2. Use that information to make a line graph.
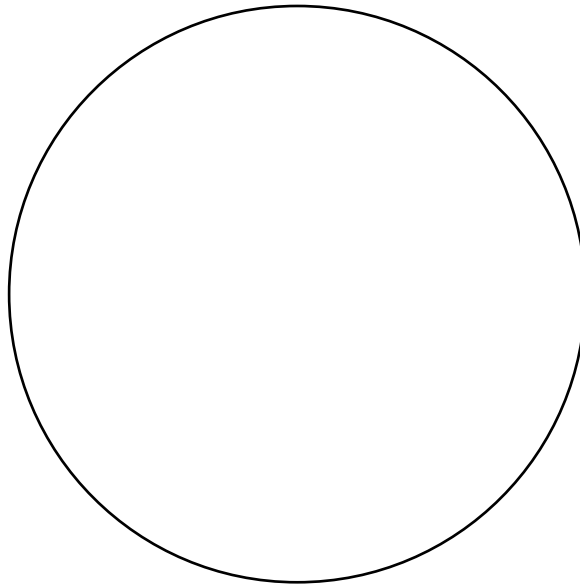
Title of the Graph

Analysis of the Graph

GRAPH PROPORTIONS

1. *Locate and collect information about a topic or situation.*

Topic/Situation: _____

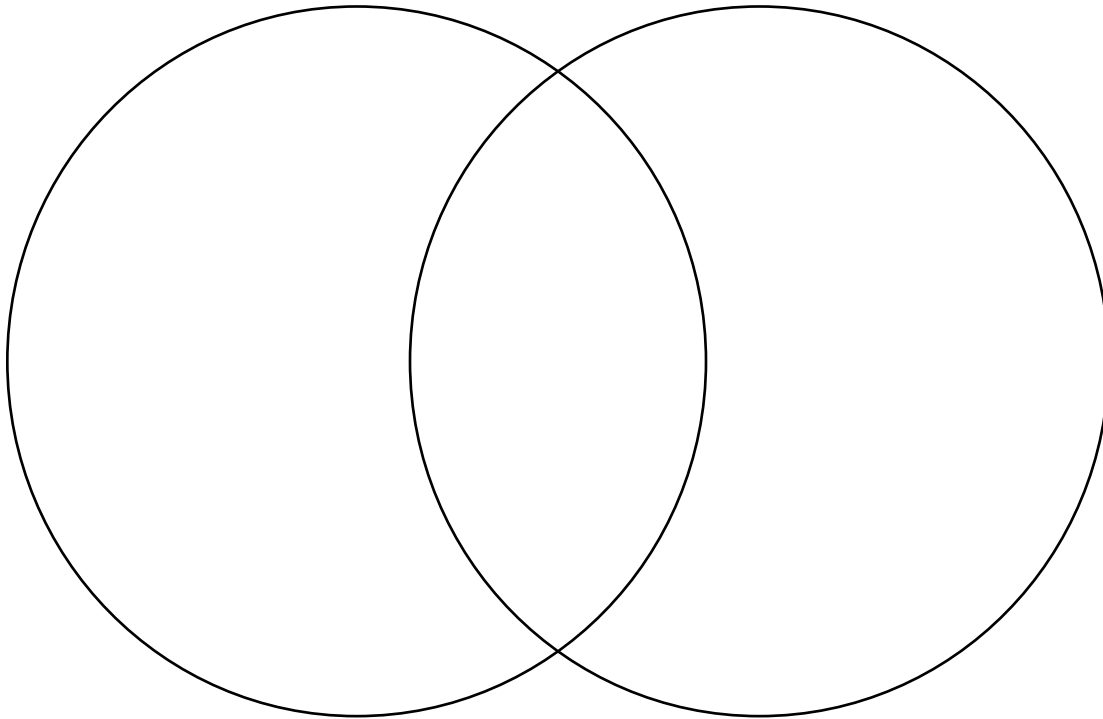*2. Use that information to make a circle graph.*

Title of the Graph

Key:

Analysis of the Graph

Show Differences and Similarities

Title: _____

💡*Explain what your Venn diagram shows.* _____

Show How You Solved the Math Problem

Step 1. What is the problem—what are you going to determine?

Step 2. How will you do it? What strategy will you use to solve the problem?

Step 3. What information will you use to solve it?

Step 4. What do you estimate the answer will be? _____

Solve it here. *Show your work.*

What is your answer? _____

How and why did it differ from your estimate? _____

_____

Major Question:

How do you …

Answer with:

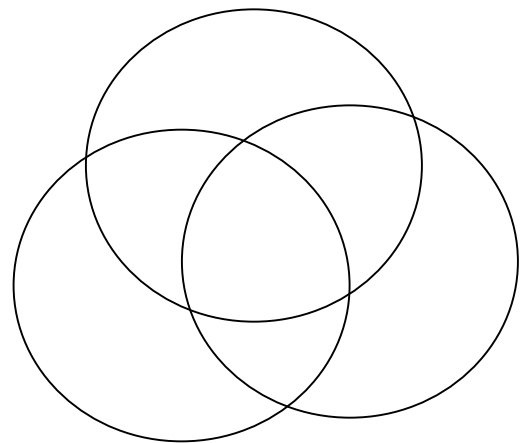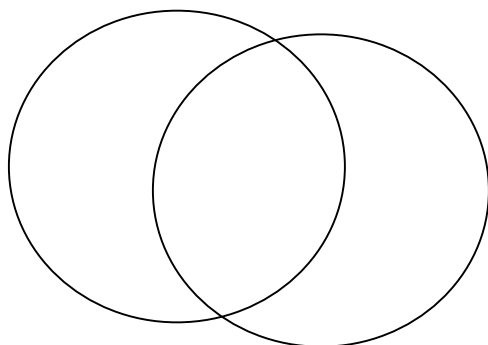 Graphic Example

+ Written annotations

Teachers' Models

How do you

Clemente Teachers' Math Strategies Using Graphic Organizers

• Many organizers can be used with geometry or math. It's all about ideas/creativity.

• In math we use charts, tables, graphs, Venn diagrams and many forms of time lines to organize material or solve problems.

• Chart and Venn diagram can be used to compare different types of numbers in algebra.
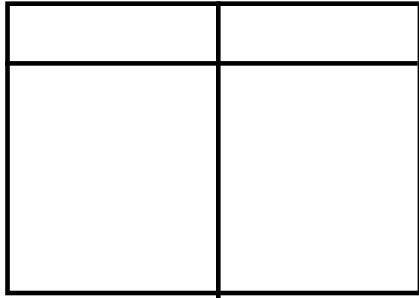
• I use a Venn diagram to categorize real numbers. Charts work well in geometry. (A word column, definition column, simple definition column, and picture or example column.)

• I use charts to introduce new words, and outlines to show the steps of a problem.

• Students will be given a math article, they will be asked to find words that are exclusively math words and to write those words in the left circle (not in the intersection part). Similarly they will write exclusively non-math words in the right circle and the words that can be used commonly in math and non math areas in the intersection part.

• I use the circle to teach angles in my geometry class. They learn:
    o How to use a protractor
    o How to read a protractor
    o Acute, obtuse and right angles
    o x and y axis
    o quadrants
    o Negative-positive numbers.
    o
• I use the chart to compare/change fractions to decimals, etc.

• Use a Venn diagram to compare and contrast (similarities and differences of shapes/measures of different types of angles.)

rational

irrational

Real Numbers

x - 2   +2→   x = 6

Vertical angles and equations

140°
40°   40°
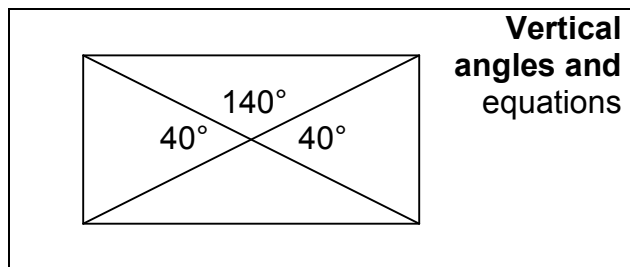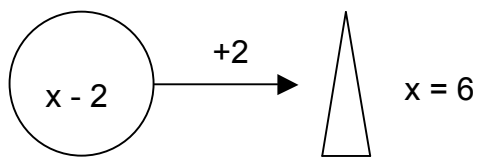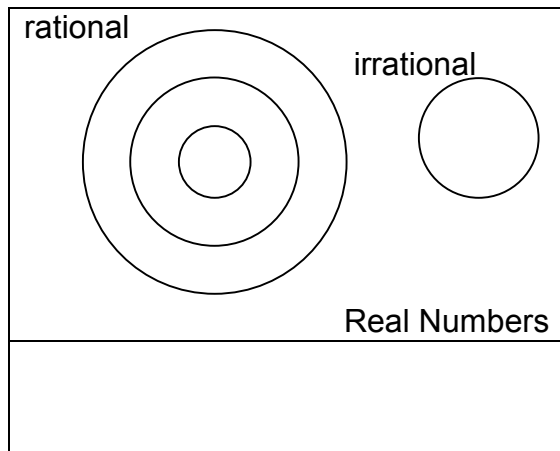
The following pages present graphic organizers designed by high school teachers at Thomas County High School, http://www.sw-georgia.resa.k12.ga.us/Math.

Long Division Algorithm

Procedure

Example

$$\frac{4x^3 - 11x - 4}{2x - 3}$$

1st Divide first terms.

2nd Multiply times the divisor.

3rd Subtract by changing the signs and adding.

Your Turn

$$\frac{6x^3 + x^2 + 4x - 5}{3x + 2}$$

4th Bring down the next term and begin the process again.
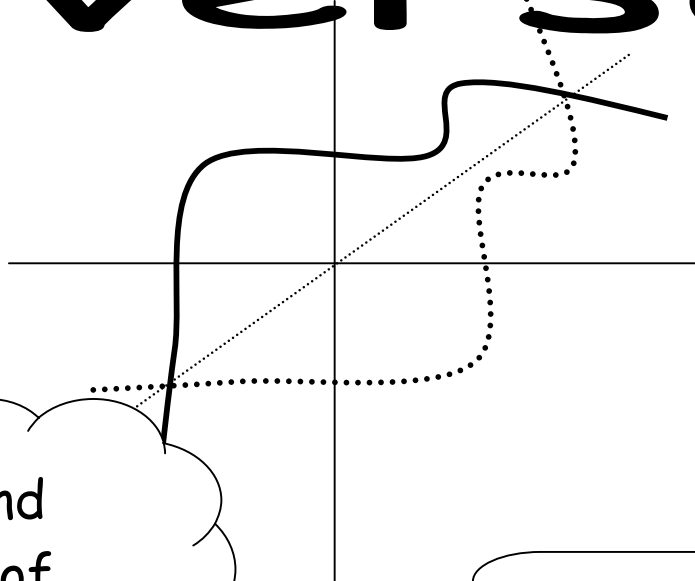
Inverses

How do I find the inverse of a function?

Switch to the y = notation from the f(x) =.

Exchange x and y in the problem and solve for y.

Rewrite as $f^{-1}(x) = .$

EXAMPLE
$f(x) = 3x^2 - 8$

Graphic Organizer by Dale Graham and Linda Meyer
Thomas County Central High School; Thomasville GA

A

b

C   *a*   **B**

c

How do you use the Pythagorean Theorem?
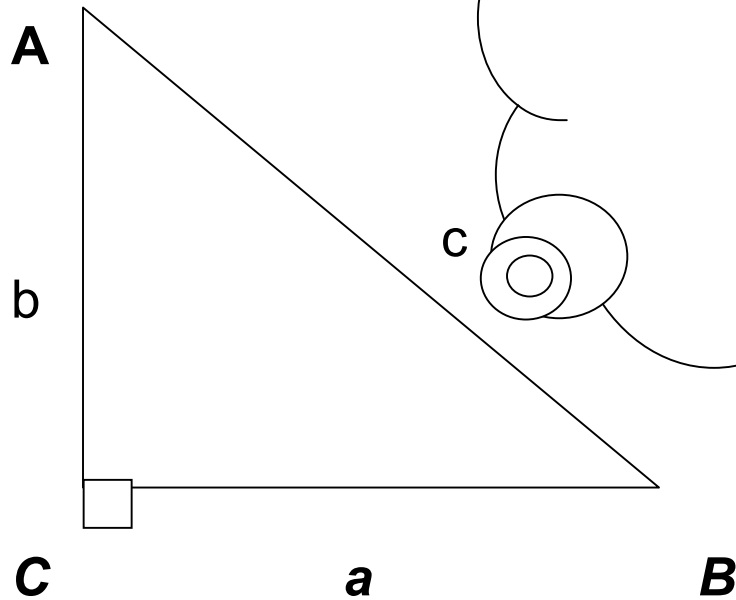
$$c^2 = a^2 + b^2$$

When c is unknown:

When a or b is unknown:

Graphic Organizer by Dale Graham and Linda Meyer
Thomas County Central High School; Thomasville GA

How Do You Solve a System of Equations by Linear Combination?

| Make sure equations are in standard form and then look at the coefficients and decide whether x or y would be easiest to eliminate by adding the two equations together. | Decide what to multiply each equation by so that when you add the two, the variable will be eliminated. Look for the least common multiple of the coefficients. | Add the two equations together. | Solve for the remaining variable. | Substitute the value back into one of the original equations and solve for the other variable |

First example row:

$3x + 2y = -6$ — (-2) → $-6x - 4y = 12$

$2x + 5y = 7$ — (3) → $6x + 15y = 21$

Eliminate x or y? ___ *(Choose x)*

Multiply 1st by _____
Multiply 2nd by _____

$-6x - 4y = 12$
$6x + 15y = 21$
Add _____ *(11y = 33)*

$11y = 33$
$y =$ ___ *(3)*

$3x + 2(3) = -6$
$3x + 6 = -6$
$3x = -12$
$x =$ ___ *(-4)*

Second (blank) row:

Eliminate x or y? _____

Multiply 1st by _____
Multiply 2nd by _____

Add

Eliminate x or y?_____

Multiply 1ˢᵗ by _____
Multiply 2ⁿᵈ by _____

Add

Eliminate x or y?_____

Multiply 1ˢᵗ by _____
Multiply 2ⁿᵈ by _____

Add

Eliminate x or y?_____

Multiply 1ˢᵗ by _____
Multiply 2ⁿᵈ by _____

Add

Eliminate x or y?_____

Multiply 1ˢᵗ by _____
Multiply 2ⁿᵈ by _____

Add

Eliminate x or y?_____

Multiply 1ˢᵗ by _____
Multiply 2ⁿᵈ by _____

Add

f'(x) > 0

f '(x) < 0

What does the first derivative tell you about the function?

f '(x) is increasing.

f '(x) is decreasing.

f '(x) = 0

f ' (x) has a relative max or min.

Graphic Organizer by Karen Capuano

Possible Answers

What does the first derivative tell you about the function?

f'(x) > 0

f(x) is increasing.

f '(x) < 0

f(x) is decreasing.

f '(x) is increasing.

f(x) is concave up.

f '(x) is decreasing.

f(x) is concave down.

f '(x) = 0

f(x) is horizontal at this x-value: relative max, relative min, or a step.

f ' (x) has a relative max or min.

f(x) has a point of inflection at this x-value.

22
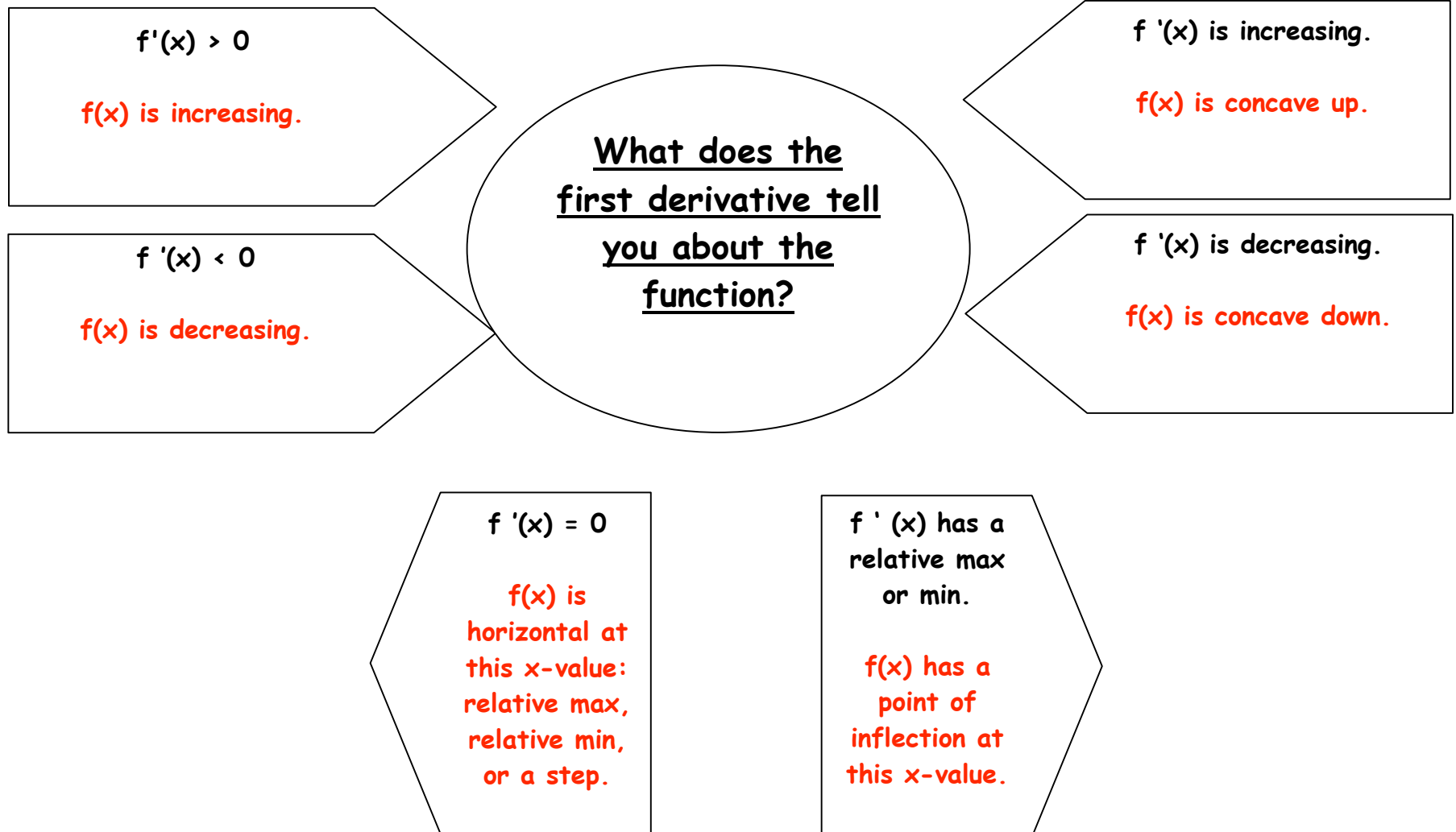
What are the different types of numbers?

Real Numbers
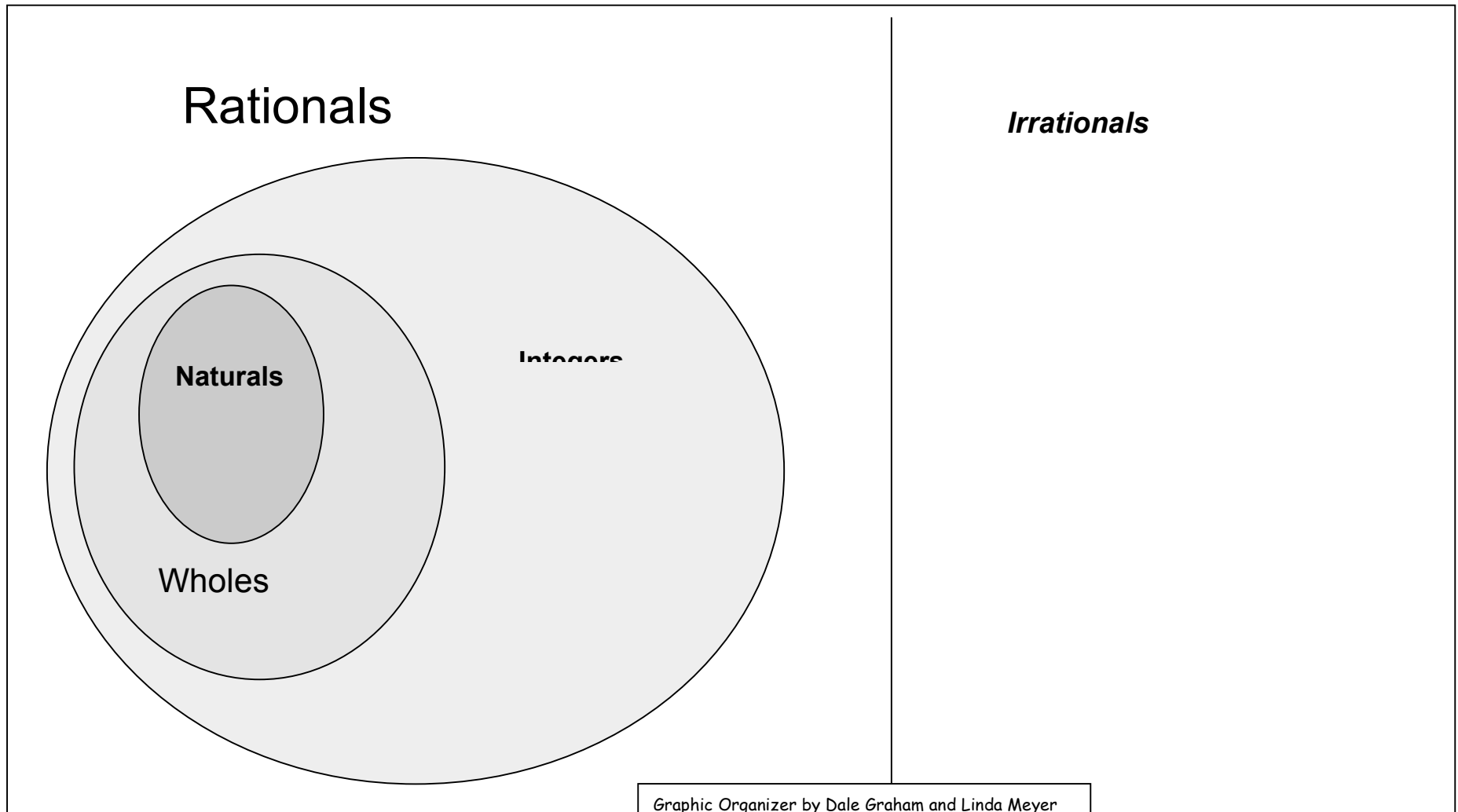
Rationals

Naturals

Integers

Wholes

Irrationals
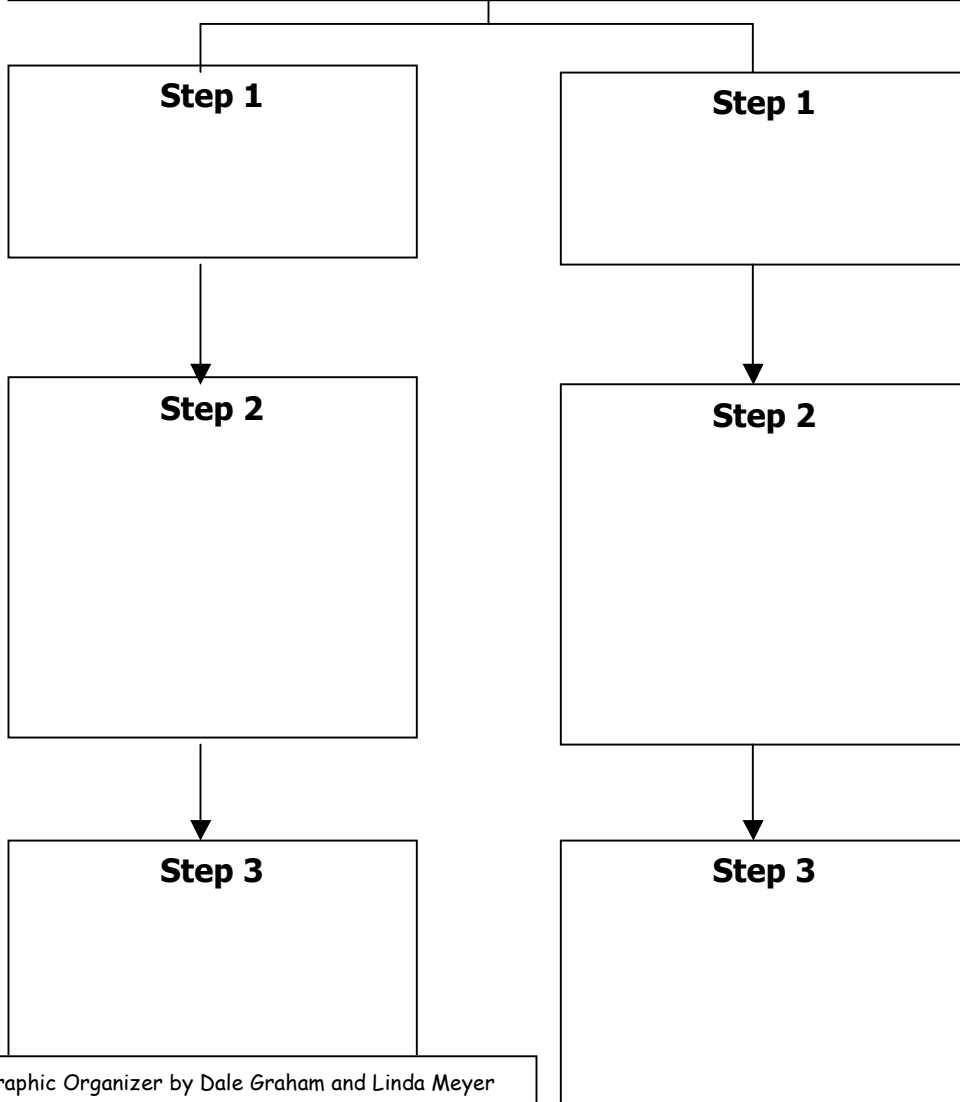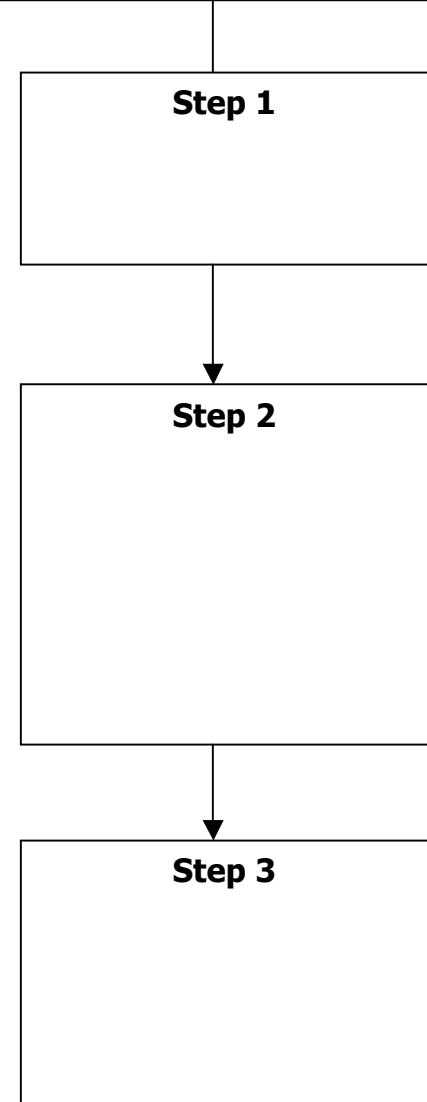
Graphic Organizer by Dale Graham and Linda Meyer
Thomas County Central High School; Thomasville GA

How do you find the slope of a line given two points on the line?

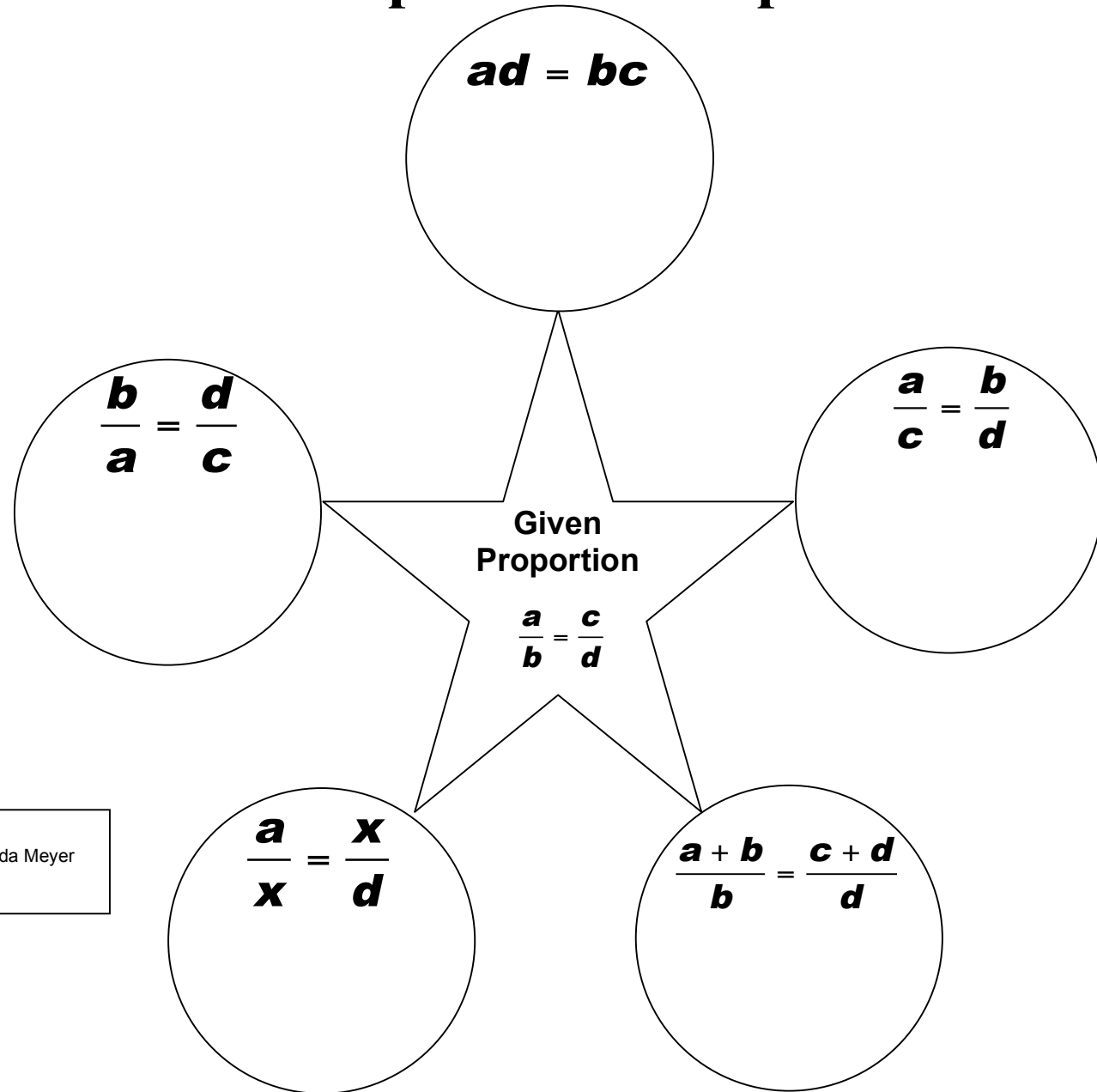| Given: A line that passes through (3,-6) and (1, 8) | Example: |

Step 1

Step 1

Step 1

Step 2

Step 2

Step 2

Step 3

Step 3

Step 3
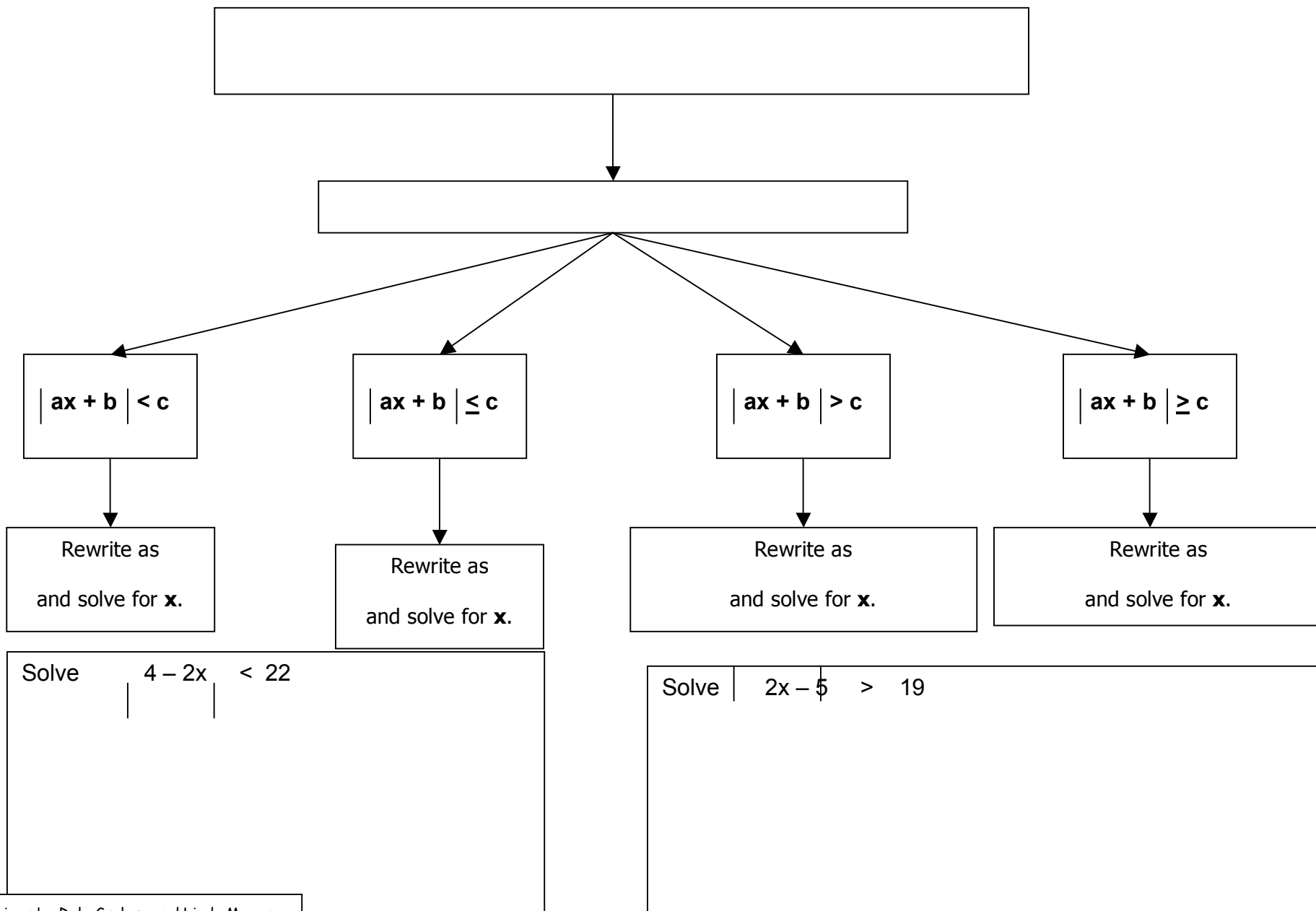
Graphic Organizer by Dale Graham and Linda Meyer
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What Are the Properties of Proportions?

$$ad = bc$$

$$\frac{b}{a} = \frac{d}{c}$$

$$\frac{a}{c} = \frac{b}{d}$$

Given Proportion

$$\frac{a}{b} = \frac{c}{d}$$

$$\frac{a}{x} = \frac{x}{d}$$

$$\frac{a+b}{b} = \frac{c+d}{d}$$

Graphic Organizer by Dale Graham and Linda Meyer

How do you solve absolute value inequalities?

```
┌─────────────────────────────────┐
│                                 │
└─────────────────────────────────┘
              │
              ▼
      ┌───────────────┐
      │               │
      └───────────────┘
```

$\mid ax + b \mid < c$	$\mid ax + b \mid \leq c$	$\mid ax + b \mid > c$	$\mid ax + b \mid \geq c$

Rewrite as and solve for **x**.	Rewrite as and solve for **x**.	Rewrite as and solve for **x**.	Rewrite as and solve for **x**.

Solve $\mid 4 - 2x \mid < 22$

Solve $\mid 2x - 5 \mid > 19$