ALABAMA DEPARTMENT OF EDUCATION

Makes Sense Strategies™ Toolkit

applications for

MATH

How graphic organizers & MSS Smart Visuals ENHANCE math instruction

Edwin Ellis, Ph.D.
University of Alabama

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Makes Sense Strategies™ Toolkit

Why use graphic organizers when teaching MATH?

* Makes critical information more explicit
* Helps students focus on critical features
* Provides an alternative (visual) format for remembering semantic math information
* Organizes students' thinking
* Reveals structures that may not seem obvious to some students

Math competencies in which GOs are particularly useful….

Math concepts / terms / definitions

For example…

Rhombus **Trapezoid**

Monomial **Binomial** **Trinomial** **Polynomial**

Math rules

For example…

When to apply different systems of linear inequalities

Pythagorean Theorem – when it applies

Math processes / calculation procedures

For example…

Steps to computing unknown angles

Steps to computing DOTS (Differences in Two Squares)

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Knowledge of a math concept

Main idea (gist)
Critical features
Always / Sometimes / Never
} Definition

Comparison to other concepts

Examples of the concept
and
Non-examples of the concept

When the the concept **IS** applied
When the the concept is NOT applied
Always / Sometimes / Never
} Manifestations & Applications

Relationships to other concepts
Factors that affect the concept
Things the concept affects
} Relational understanding

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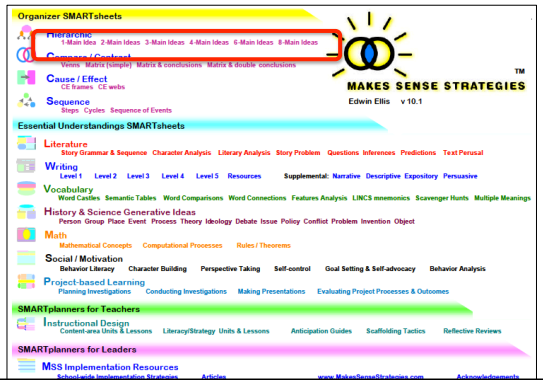
Always / Sometimes / Never
Relationships to other concepts
Factors that affect the concept
Things the concept affects

Hierarchic Organizers

4 sections in the Makes Sense Strategies toolkit are particularly useful for teaching math concepts and related terms….



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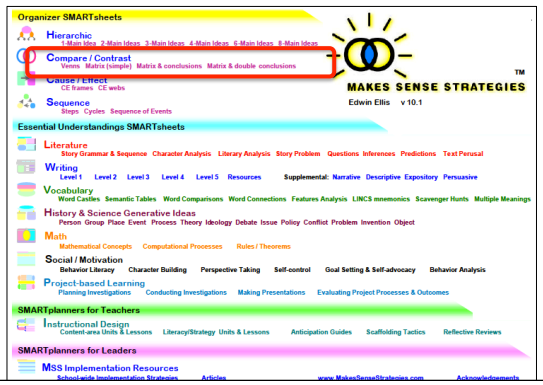

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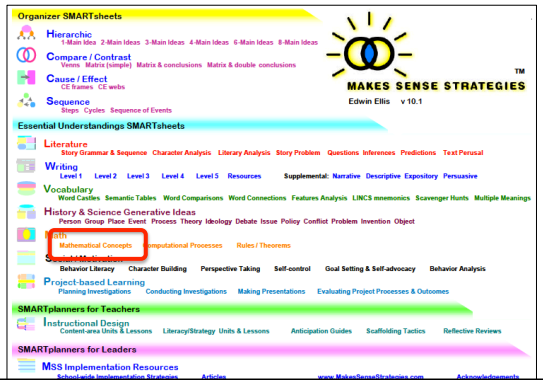
Hierarchic Organizers
Comparison Organizers
Math Concept Smart Visuals



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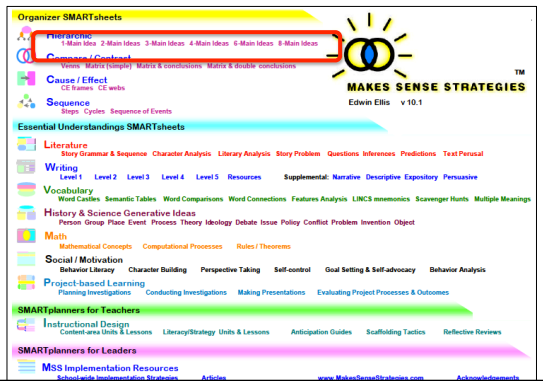

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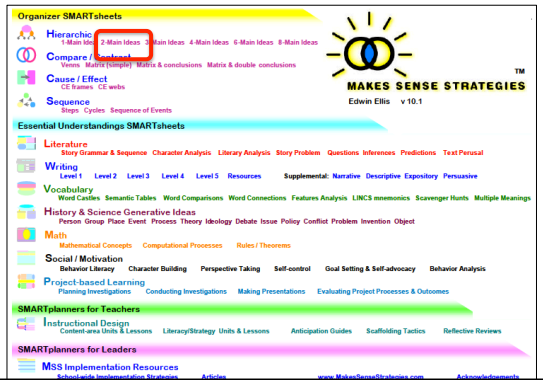

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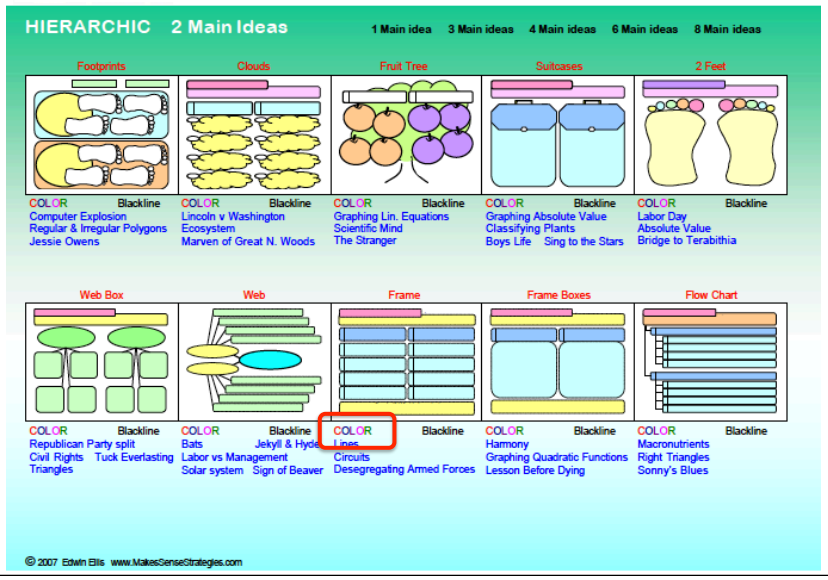
Organizer SMARTsheets
HOME



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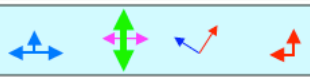
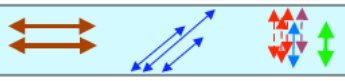
MATH CONCEPTS

HIERARCHIC (Main Ideas & Details)

Lines — Is about ...

Lines can be classified based on their direction relative to the direction of other lines

Main idea: Perpendicular	Main idea: Parallel
Intersect/meet	Never intersect, meet, or touch
Form right angles	Same plane
Forms a square corner	Go in same direction
	

So what? What is important to understand about this?

Lines can only be classified as parallel or perpendicular when there are at least two of the same type

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MATH CONCEPTS

HIERARCHIC (Main Ideas & Details)

Classifying Triangles — Is about ...

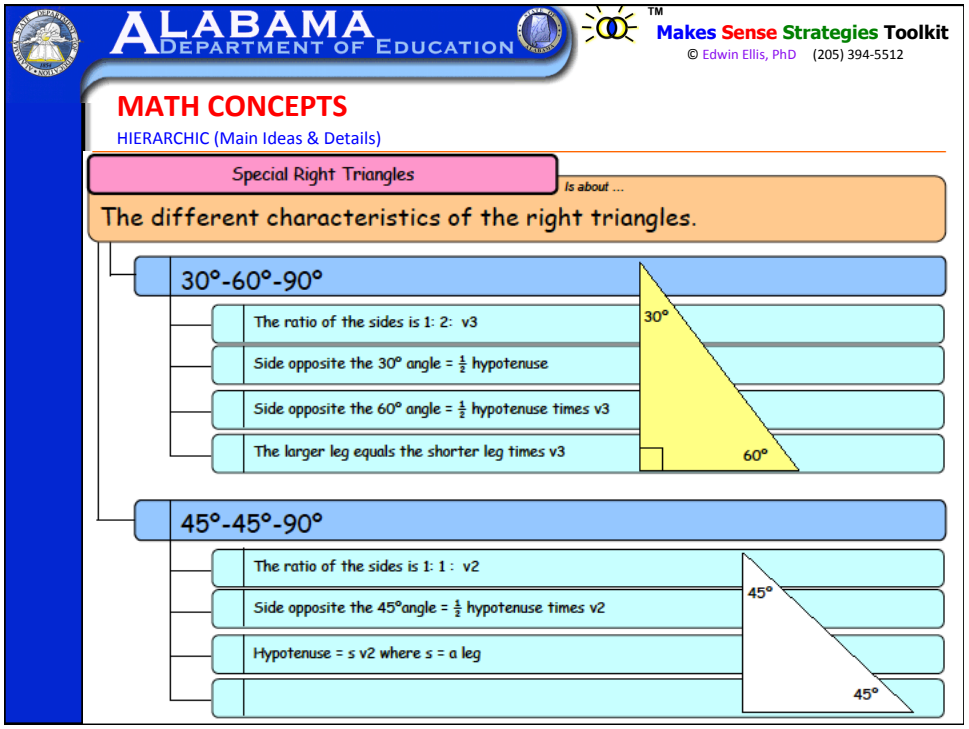
Triangles are classified by the kind of angle they have or by comparing the lengths of their sides

Check the degrees in the ANGLES

- **Right Triangle** - a triangle that has one right angle. RIGHT ANGLE means 90 degrees
- **Obtuse Triangle** - a triangle that has one obtuse angle. OBTUSE ANGLE means more than 90 degrees
- **Acute Triangle** - a triangle that has three acute angles. ACUTE ANGLE means each angle = same degrees
- **All Acute Triangles are also Equilateral triangles** (all angles are same, and all sides have same length)

Check the length of the SIDES

- **Scalene Triangle** - a triangle that has no congruent sides. NO CONGRUENT means not same length sides
- **Isosceles Triangle** - has at least 2 congruent sides. CONGRUENT means same length sides
- **All Equilateral Triangles are also Acute triangles** (all sides have same length & all angles are same)
- **Equilateral Triangle** - a triangle that has three congruent sides. CONGRUENT means same length sides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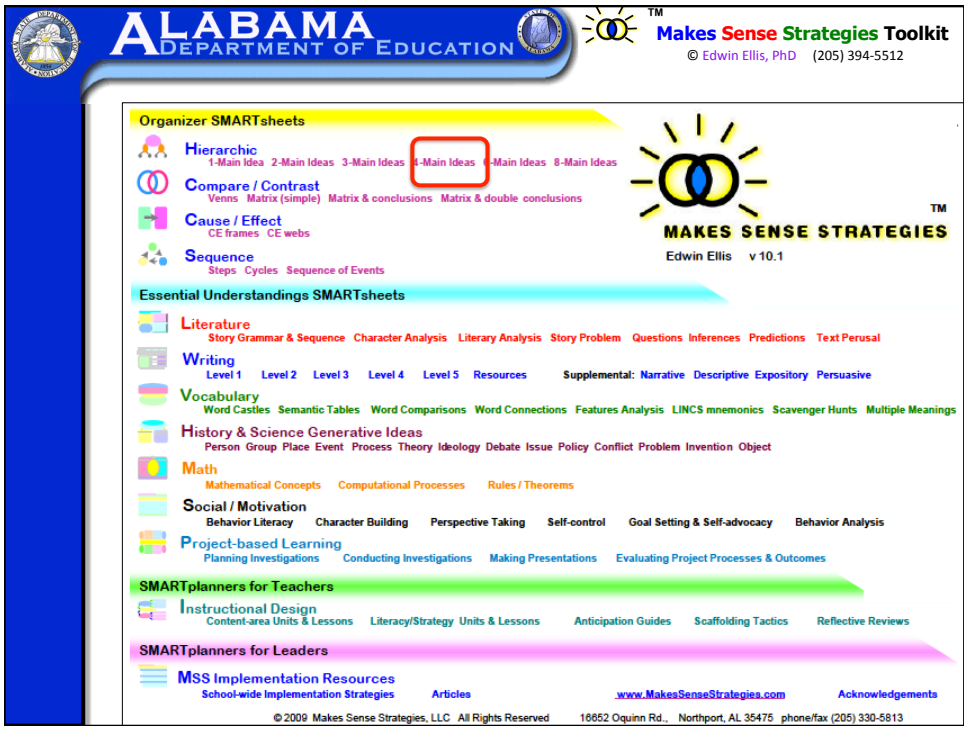
MATH CONCEPTS
HIERARCHIC (Main Ideas & Details)
Special Right Triangles
Is about ...
The different characteristics of the right triangles.
30°-60°-90°
The ratio of the sides is 1: 2: √3
Side opposite the 30° angle = ½ hypotenuse
Side opposite the 60° angle = ½ hypotenuse times √3
The larger leg equals the shorter leg times √3
30°
60°
45°-45°-90°
The ratio of the sides is 1: 1 : √2
Side opposite the 45°angle = ½ hypotenuse times √2
Hypotenuse = s √2 where s = a leg
45°
45°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Organizer SMARTsheets
Hierarchic
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Compare / Contrast
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CE frames CE webs
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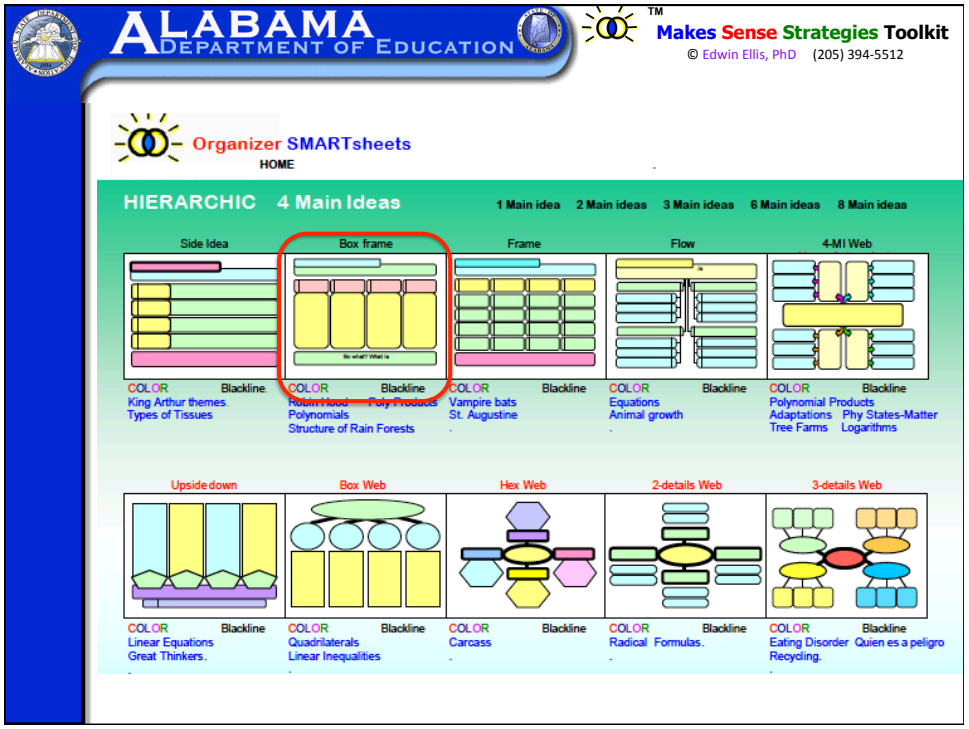
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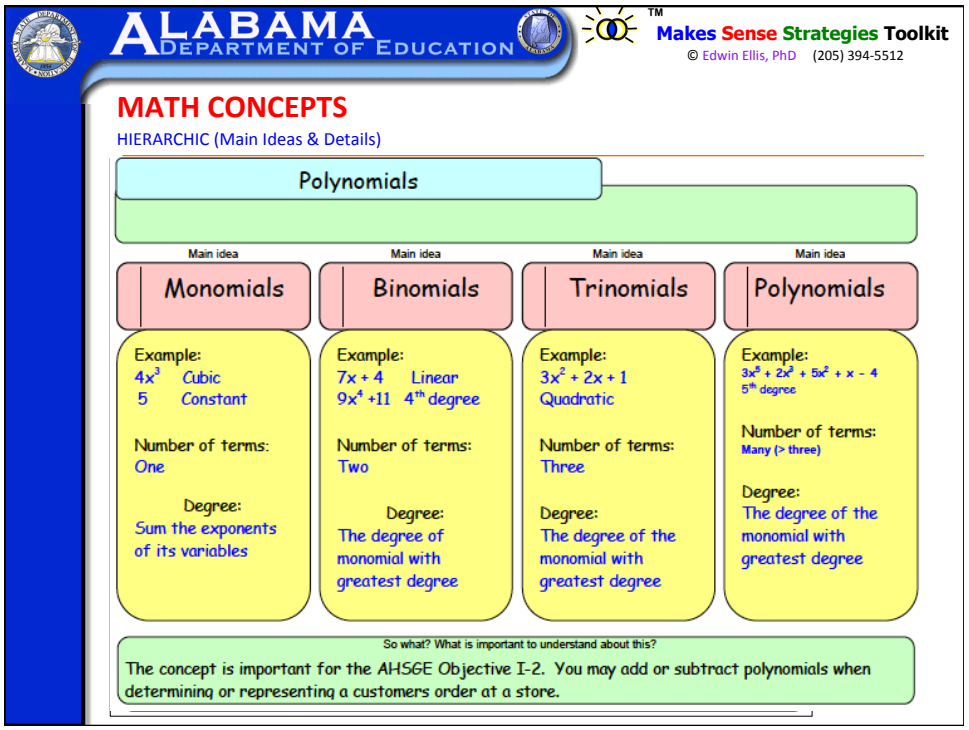
Organizer SMARTsheets
HOME
HIERARCHIC 4 Main Ideas
1 Main idea 2 Main ideas 3 Main ideas 6 Main ideas 8 Main ideas
Side Idea
Box frame
Frame
Flow
4-MI Web
COLOR Blackline
King Arthur themes.
Types of Tissues
COLOR Blackline
Polynomials
Structure of Rain Forests
COLOR Blackline
Vampire bats
St. Augustine
COLOR Blackline
Equations
Animal growth
COLOR Blackline
Polynomial Products
Adaptations Phy States-Matter
Tree Farms Logarithms
Upside down
Box Web
Hex Web
2-details Web
3-details Web
COLOR Blackline
Linear Equations
Great Thinkers.
COLOR Blackline
Quadrilaterals
Linear Inequalities
COLOR Blackline
Carcass
COLOR Blackline
Radical Formulas.
COLOR Blackline
Eating Disorder Quien es a peligro
Recycling.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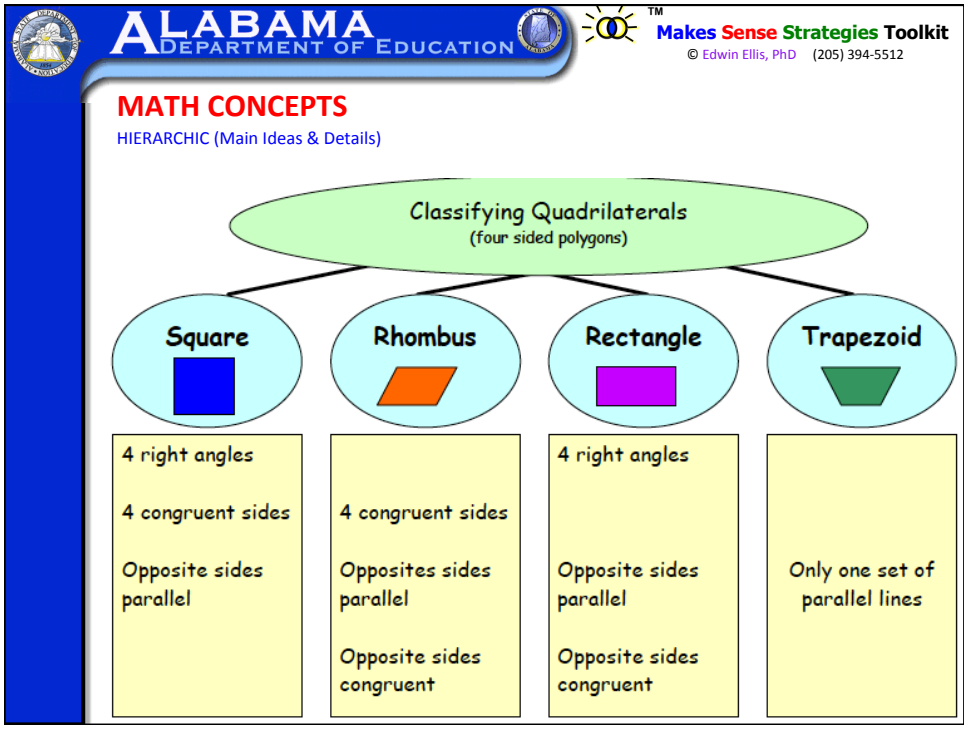
MATH CONCEPTS
HIERARCHIC (Main Ideas & Details)
Polynomials
Main idea
Monomials
Example:
4x3 Cubic
5 Constant
Number of terms:
One
Degree:
Sum the exponents of its variables
Main idea
Binomials
Example:
7x + 4 Linear
9x4 +11 4th degree
Number of terms:
Two
Degree:
The degree of monomial with greatest degree
Main idea
Trinomials
Example:
3x2 + 2x + 1
Quadratic
Number of terms:
Three
Degree:
The degree of the monomial with greatest degree
Main idea
Polynomials
Example:
3x5 + 2x3 + 5x2 + x - 4
5th degree
Number of terms:
Many (> three)
Degree:
The degree of the monomial with greatest degree
So what? What is important to understand about this?
The concept is important for the AHSGE Objective I-2. You may add or subtract polynomials when determining or representing a customers order at a store.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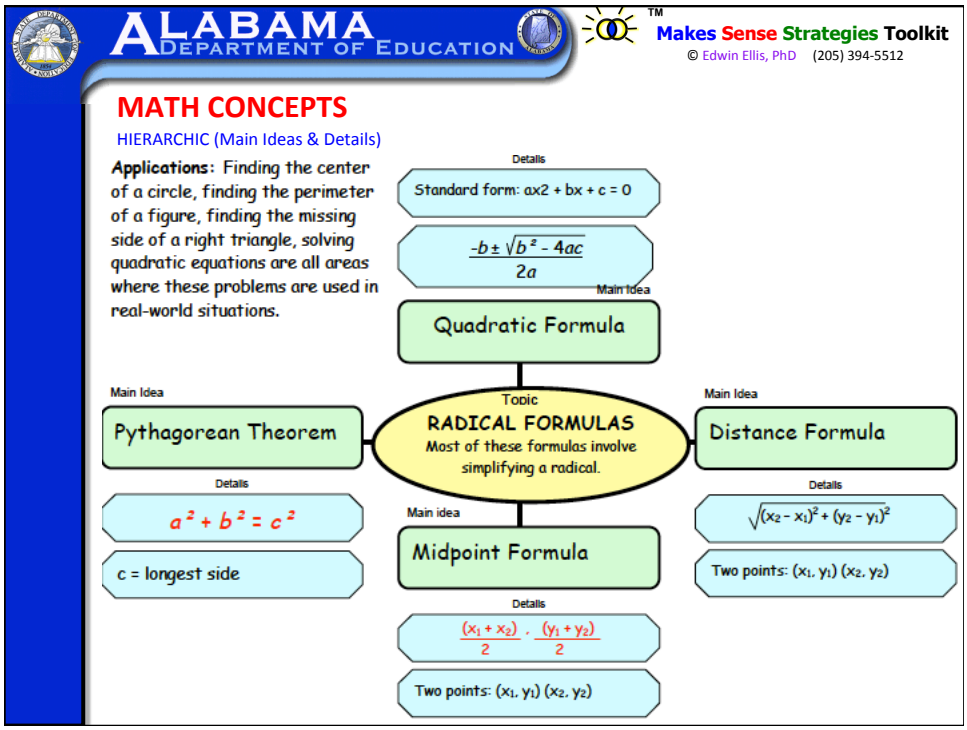
MATH CONCEPTS
HIERARCHIC (Main Ideas & Details)
Classifying Quadrilaterals
(four sided polygons)
Square
4 right angles
4 congruent sides
Opposite sides parallel
Rhombus
4 congruent sides
Opposites sides parallel
Opposite sides congruent
Rectangle
4 right angles
Opposite sides parallel
Opposite sides congruent
Trapezoid
Only one set of parallel lines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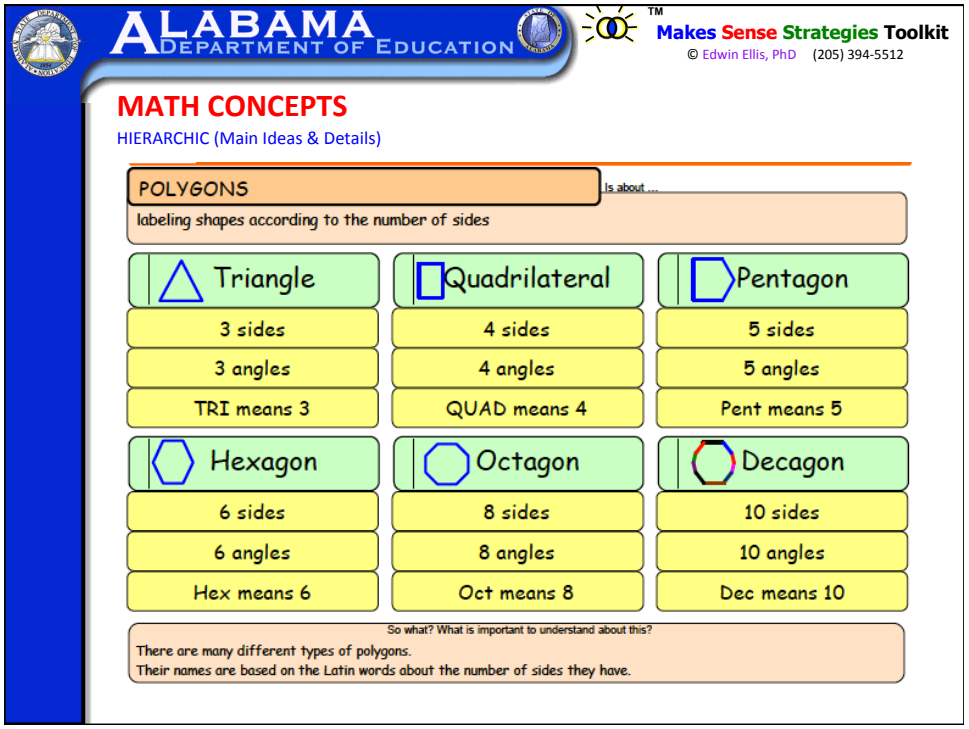
MATH CONCEPTS
HIERARCHIC (Main Ideas & Details)
Applications: Finding the center of a circle, finding the perimeter of a figure, finding the missing side of a right triangle, solving quadratic equations are all areas where these problems are used in real-world situations.
Details
Standard form: ax2 + bx + c = 0
$\frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
Main Idea
Quadratic Formula
Topic
RADICAL FORMULAS
Most of these formulas involve simplifying a radical.
Main Idea
Pythagorean Theorem
Details
$a^2 + b^2 = c^2$
c = longest side
Main Idea
Distance Formula
Details
$\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$
Two points: (x_1, y_1) (x_2, y_2)
Main idea
Midpoint Formula
Details
$\frac{(x_1 + x_2)}{2}$, $\frac{(y_1 + y_2)}{2}$
Two points: (x_1, y_1) (x_2, y_2)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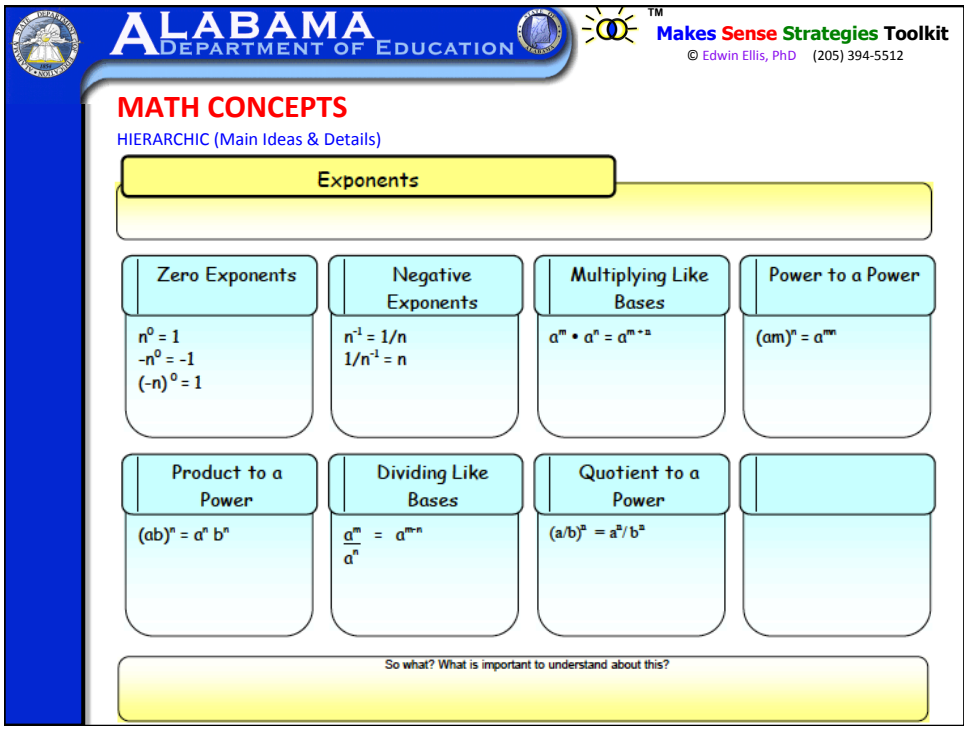
MATH CONCEPTS
HIERARCHIC (Main Ideas & Details)
POLYGONS
Is about ...
labeling shapes according to the number of sides
Triangle
3 sides
3 angles
TRI means 3
Quadrilateral
4 sides
4 angles
QUAD means 4
Pentagon
5 sides
5 angles
Pent means 5
Hexagon
6 sides
6 angles
Hex means 6
Octagon
8 sides
8 angles
Oct means 8
Decagon
10 sides
10 angles
Dec means 10
So what? What is important to understand about this?
There are many different types of polygons.
Their names are based on the Latin words about the number of sides they have.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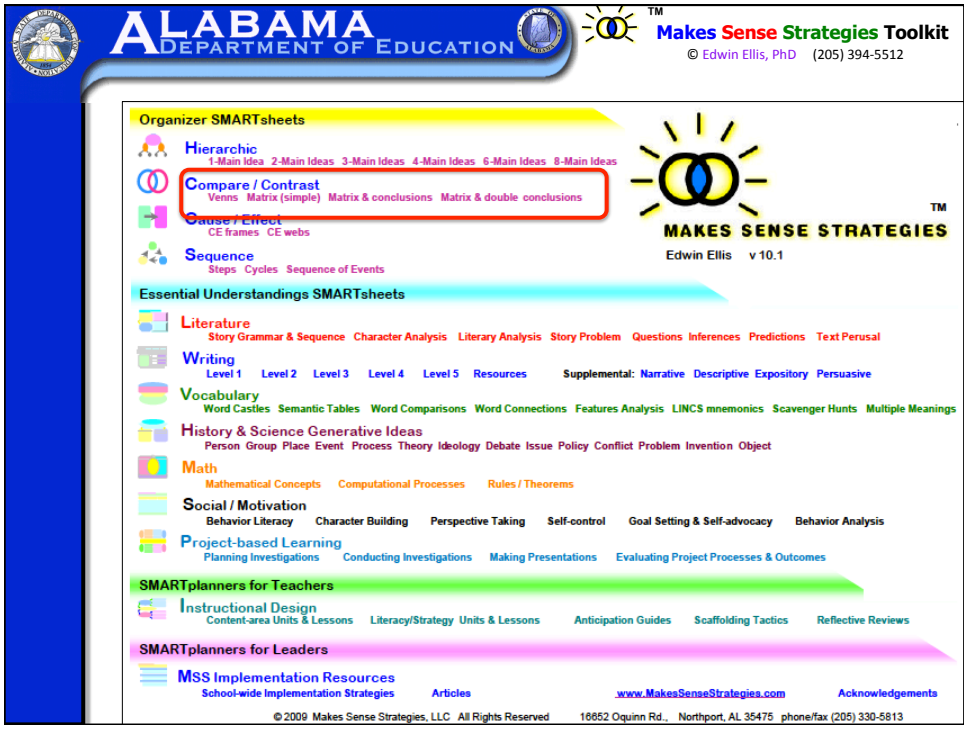
MATH CONCEPTS
HIERARCHIC (Main Ideas & Details)
Exponents
Zero Exponents
$n^0 = 1$
$-n^0 = -1$
$(-n)^0 = 1$
Negative Exponents
$n^{-1} = 1/n$
$1/n^{-1} = n$
Multiplying Like Bases
$a^m \bullet a^n = a^{m+n}$
Power to a Power
$(am)^n = a^{mn}$
Product to a Power
$(ab)^n = a^n b^n$
Dividing Like Bases
$\frac{a^m}{a^n} = a^{m-n}$
Quotient to a Power
$(a/b)^a = a^b/b^a$
So what? What is important to understand about this?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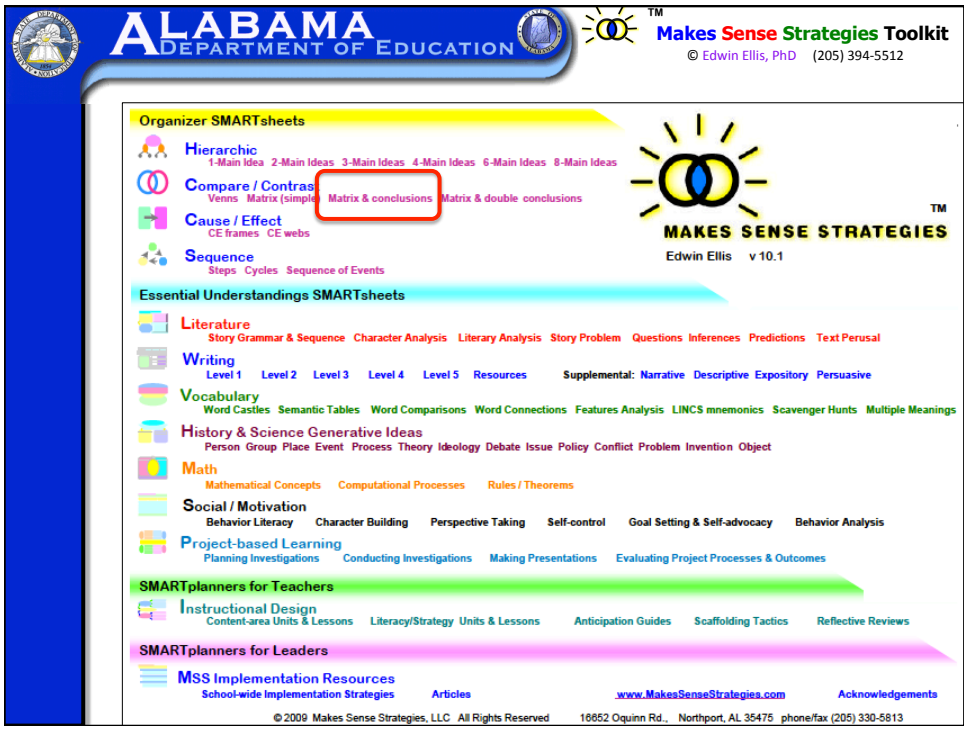
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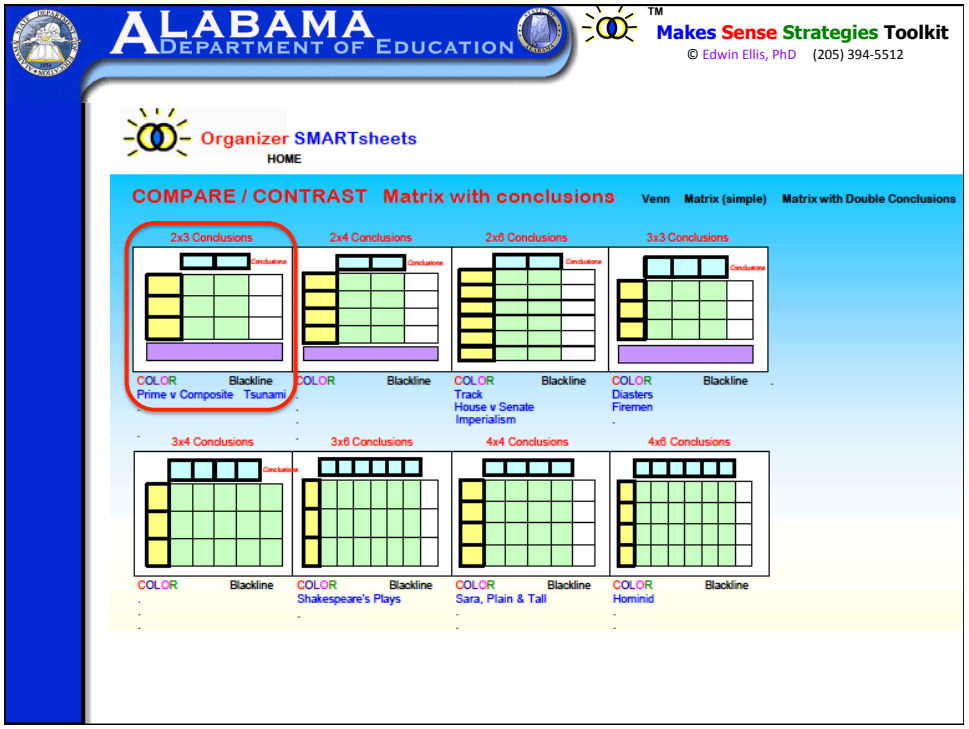
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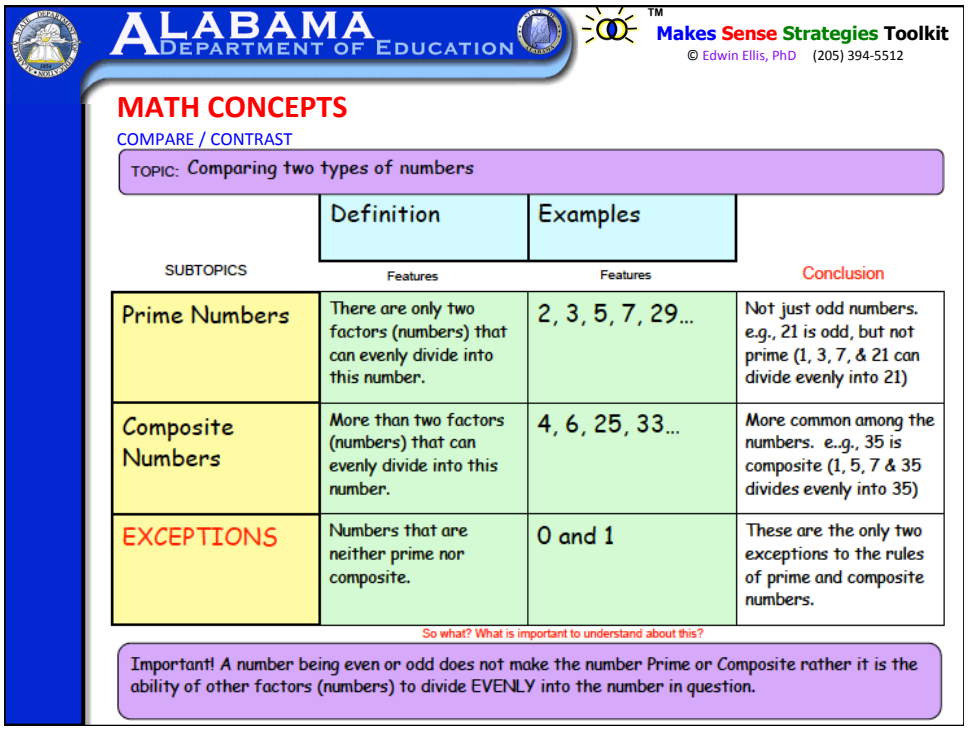
COMPARE / CONTRAST Matrix with conclusions
Venn
Matrix (simple)
Matrix with Double Conclusions
2x3 Conclusions
2x4 Conclusions
2x6 Conclusions
3x3 Conclusions
COLOR Blackline
Prime v Composite Tsunami
COLOR Blackline
COLOR Blackline
Track
House v Senate
Imperialism
COLOR Blackline
Diasters
Firemen
3x4 Conclusions
3x6 Conclusions
4x4 Conclusions
4x6 Conclusions
COLOR Blackline
COLOR Blackline
Shakespeare's Plays
COLOR Blackline
Sara, Plain & Tall
COLOR Blackline
Hominid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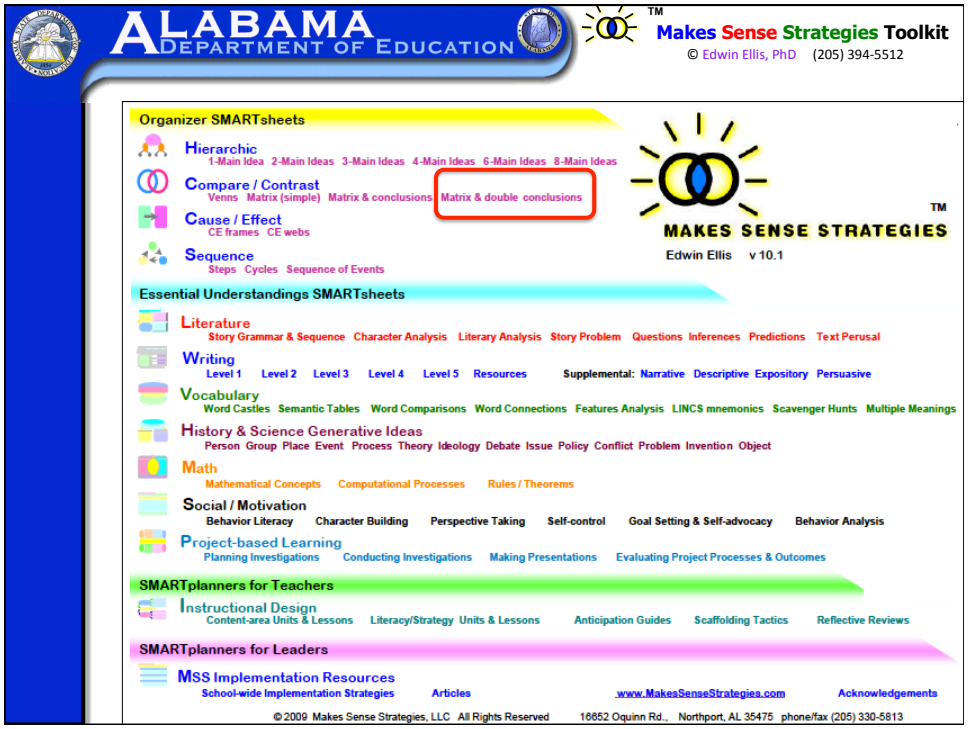
MATH CONCEPTS
COMPARE / CONTRAST
TOPIC: Comparing two types of numbers
Definition
Examples
SUBTOPICS
Features
Features
Conclusion
Prime Numbers
There are only two factors (numbers) that can evenly divide into this number.
2, 3, 5, 7, 29...
Not just odd numbers. e.g., 21 is odd, but not prime (1, 3, 7, & 21 can divide evenly into 21)
Composite Numbers
More than two factors (numbers) that can evenly divide into this number.
4, 6, 25, 33...
More common among the numbers. e..g., 35 is composite (1, 5, 7 & 35 divides evenly into 35)
EXCEPTIONS
Numbers that are neither prime nor composite.
0 and 1
These are the only two exceptions to the rules of prime and composite numbers.
So what? What is important to understand about this?
Important! A number being even or odd does not make the number Prime or Composite rather it is the ability of other factors (numbers) to divide EVENLY into the number in question.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CE frames CE webs
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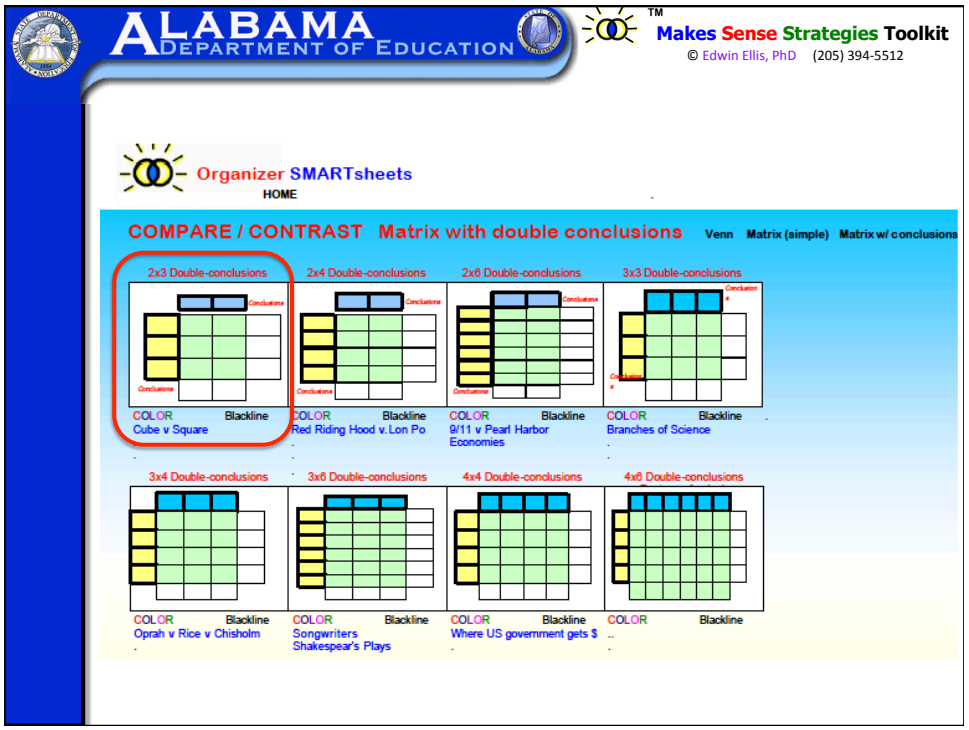
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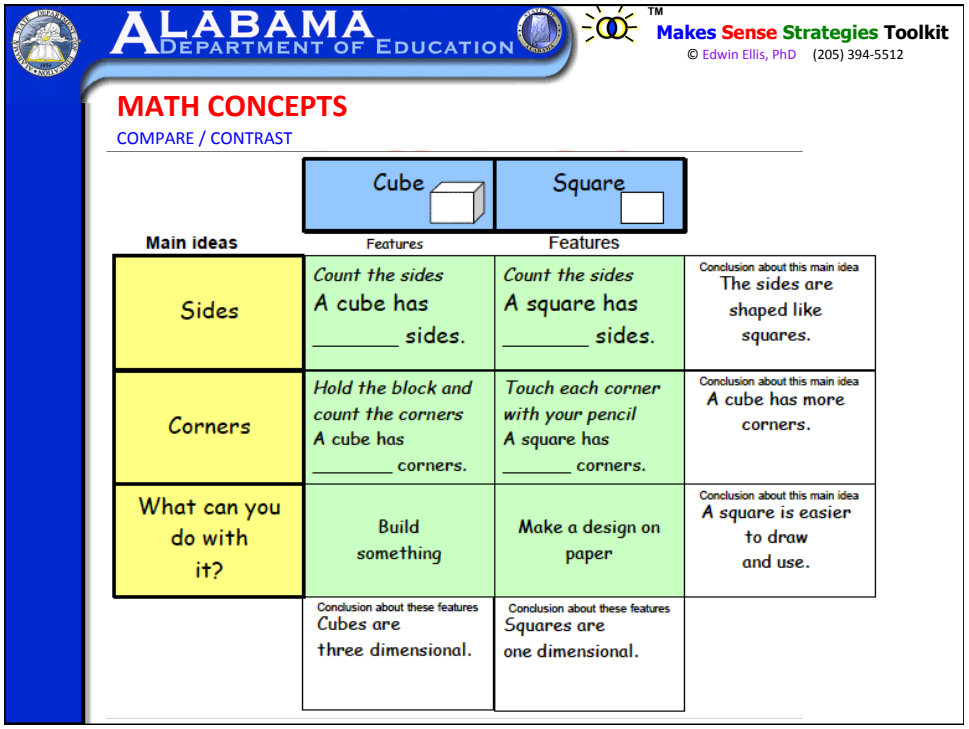
Organizer SMARTsheets
HOME
COMPARE / CONTRAST Matrix with double conclusions
Venn Matrix (simple) Matrix w/ conclusions
2x3 Double-conclusions
COLOR Blackline
Cube v Square
2x4 Double-conclusions
COLOR Blackline
Red Riding Hood v. Lon Po
2x6 Double-conclusions
COLOR Blackline
9/11 v Pearl Harbor
Economies
3x3 Double-conclusions
COLOR Blackline
Branches of Science
3x4 Double-conclusions
COLOR Blackline
Oprah v Rice v Chisholm
3x6 Double-conclusions
COLOR Blackline
Songwriters
Shakespear's Plays
4x4 Double-conclusions
COLOR Blackline
Where US government gets $
4x6 Double-conclusions
COLOR Blackline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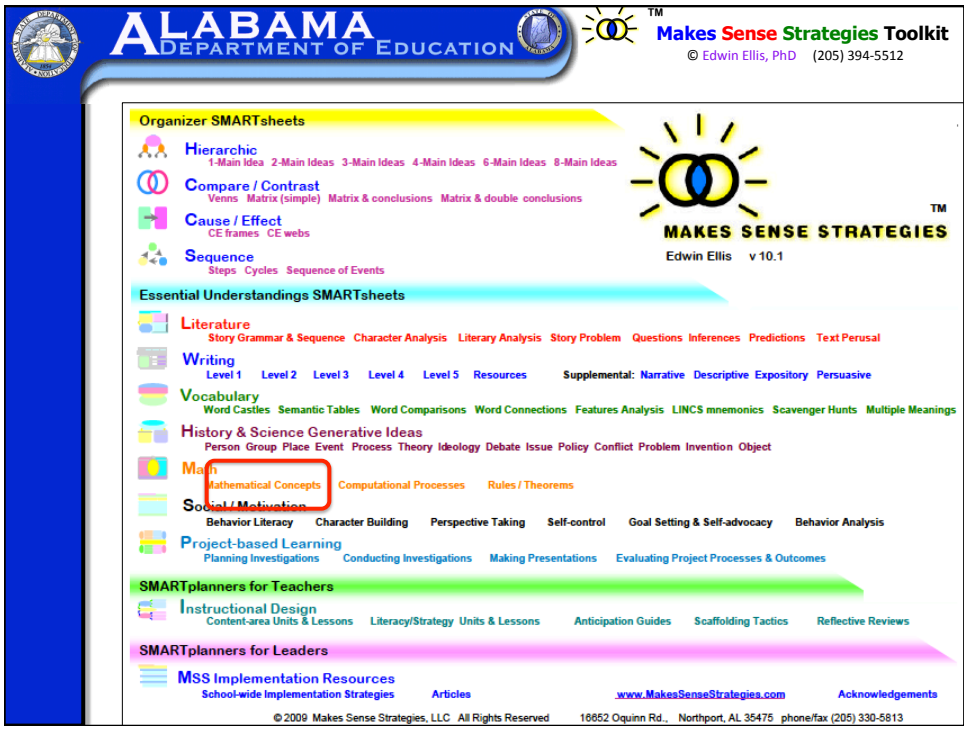
MATH CONCEPTS
COMPARE / CONTRAST
Cube
Square
Main ideas
Features
Features
Sides
Count the sides
A cube has _____ sides.
Count the sides
A square has _____ sides.
Conclusion about this main idea
The sides are shaped like squares.
Corners
Hold the block and count the corners
A cube has _____ corners.
Touch each corner with your pencil
A square has _____ corners.
Conclusion about this main idea
A cube has more corners.
What can you do with it?
Build something
Make a design on paper
Conclusion about this main idea
A square is easier to draw and use.
Conclusion about these features
Cubes are three dimensional.
Conclusion about these features
Squares are one dimensional.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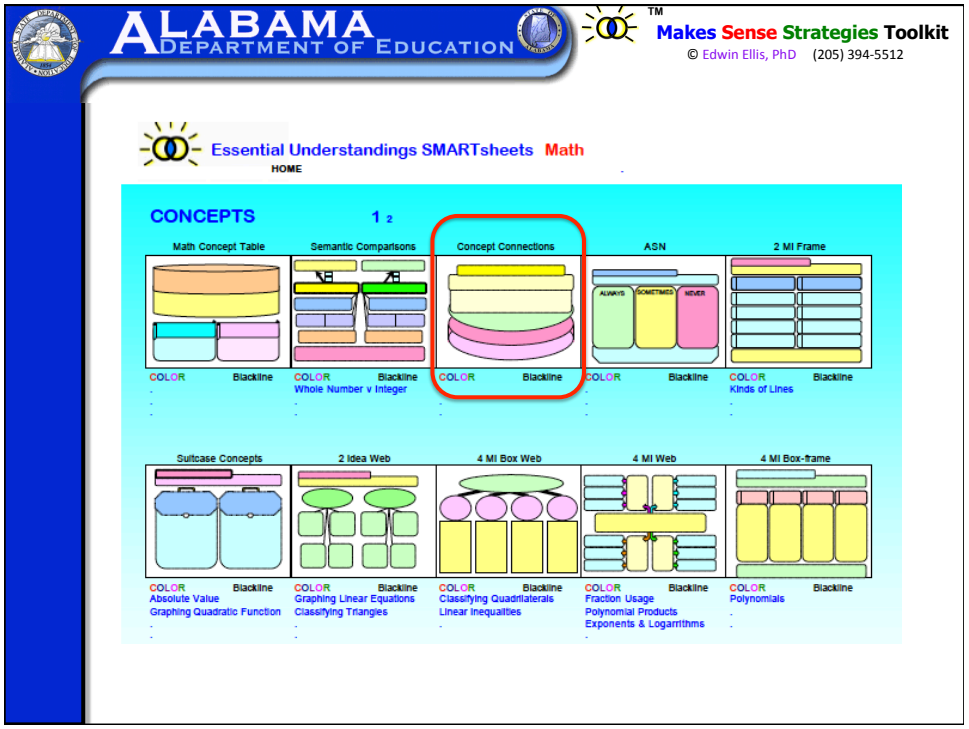
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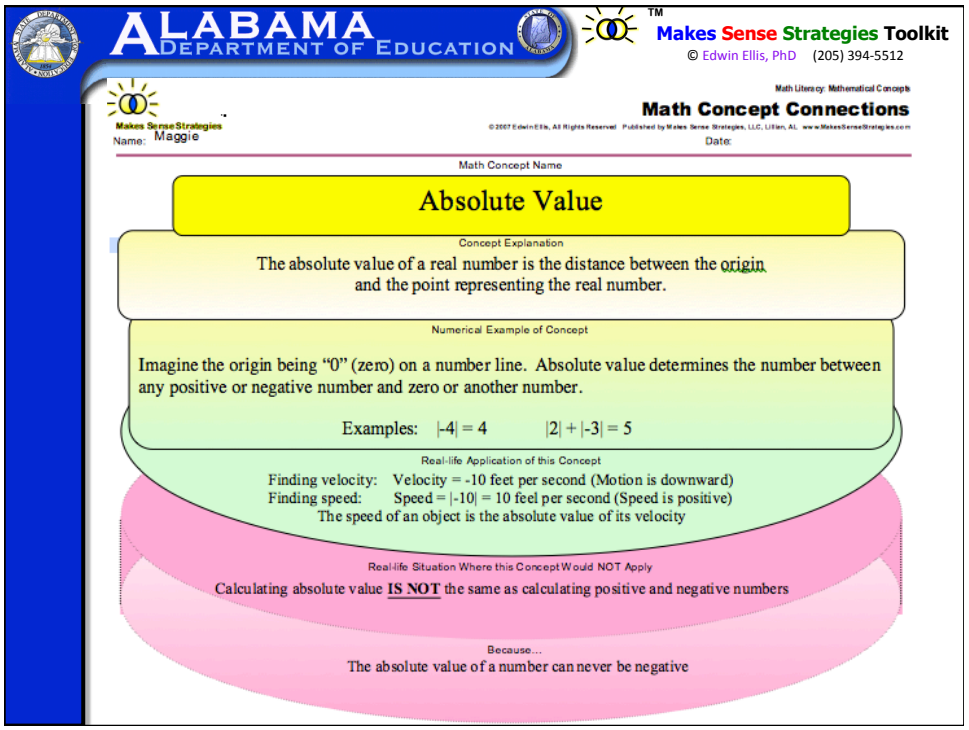
Math Concept Table
Semantic Comparisons
Concept Connections
ASN
2 MI Frame
COLOR Blackline
COLOR Blackline Whole Number v Integer
COLOR Blackline
COLOR Blackline
COLOR Blackline Kinds of Lines
Suitcase Concepts
2 Idea Web
4 MI Box Web
4 MI Web
4 MI Box-frame
COLOR Blackline Absolute Value Graphing Quadratic Function
COLOR Blackline Graphing Linear Equations Classifying Triangles
COLOR Blackline Classifying Quadrilaterals Linear Inequalities
COLOR Blackline Fraction Usage Polynomial Products Exponents & Logarithms
COLOR Blackline Polynomials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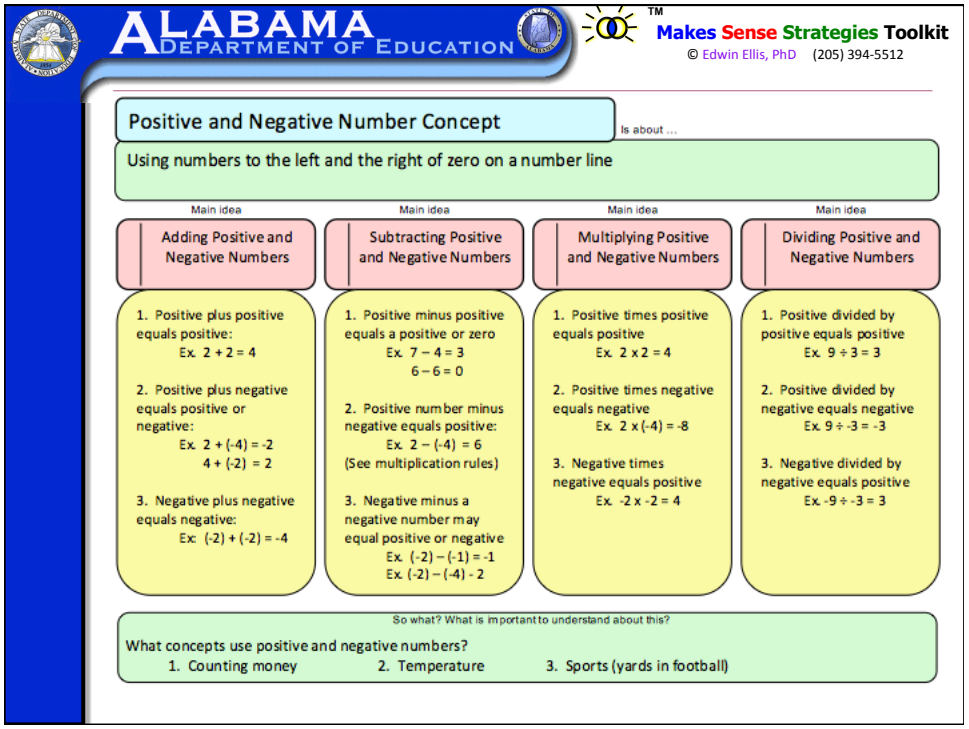
Makes Sense Strategies
Name: Maggie
Math Literacy: Mathematical Concepts
Math Concept Connections
Date:
Math Concept Name
Absolute Value
Concept Explanation
The absolute value of a real number is the distance between the origin and the point representing the real number.
Numerical Example of Concept
Imagine the origin being "0" (zero) on a number line. Absolute value determines the number between any positive or negative number and zero or another number.
Examples: |-4| = 4 |2| + |-3| = 5
Real-life Application of this Concept
Finding velocity: Velocity = -10 feet per second (Motion is downward)
Finding speed: Speed = |-10| = 10 feel per second (Speed is positive)
The speed of an object is the absolute value of its velocity
Real-life Situation Where this Concept Would NOT Apply
Calculating absolute value IS NOT the same as calculating positive and negative numbers
Because...
The absolute value of a number can never be negative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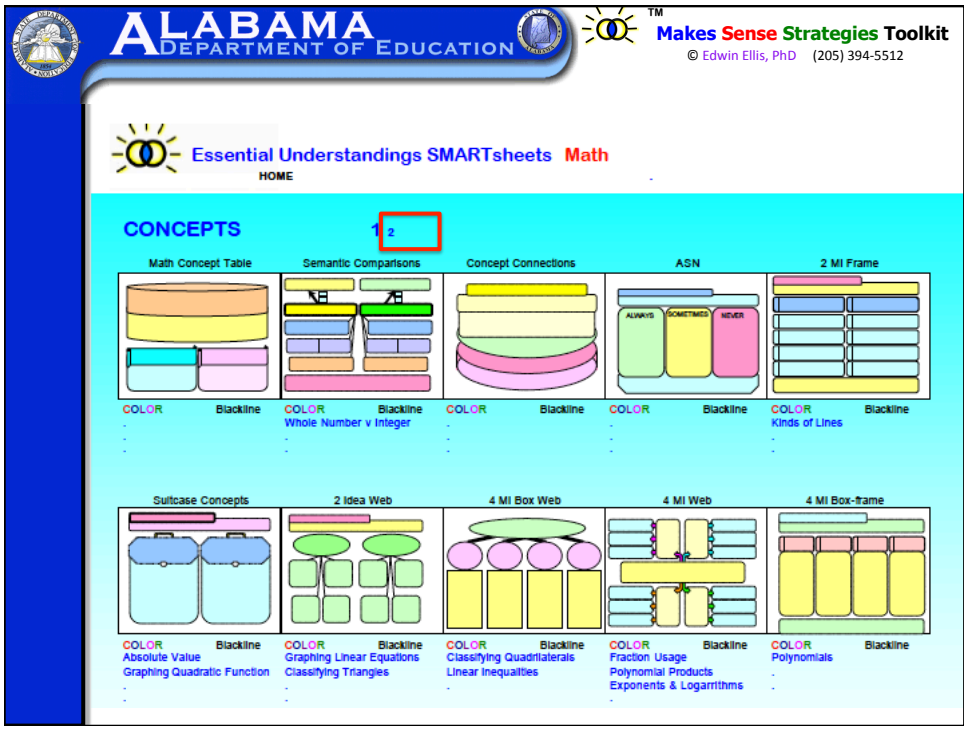
Positive and Negative Number Concept
Is about ...
Using numbers to the left and the right of zero on a number line
Main idea
Adding Positive and Negative Numbers
1. Positive plus positive equals positive:
Ex. 2 + 2 = 4
2. Positive plus negative equals positive or negative:
Ex. 2 + (-4) = -2
4 + (-2) = 2
3. Negative plus negative equals negative:
Ex: (-2) + (-2) = -4
Main idea
Subtracting Positive and Negative Numbers
1. Positive minus positive equals a positive or zero
Ex. 7 – 4 = 3
6 – 6 = 0
2. Positive number minus negative equals positive:
Ex. 2 – (-4) = 6
(See multiplication rules)
3. Negative minus a negative number may equal positive or negative
Ex. (-2) – (-1) = -1
Ex. (-2) – (-4) - 2
Main idea
Multiplying Positive and Negative Numbers
1. Positive times positive equals positive
Ex. 2 x 2 = 4
2. Positive times negative equals negative
Ex. 2 x (-4) = -8
3. Negative times negative equals positive
Ex. -2 x -2 = 4
Main idea
Dividing Positive and Negative Numbers
1. Positive divided by positive equals positive
Ex. 9 ÷ 3 = 3
2. Positive divided by negative equals negative
Ex. 9 ÷ -3 = -3
3. Negative divided by negative equals positive
Ex. -9 ÷ -3 = 3
So what? What is important to understand about this?
What concepts use positive and negative numbers?
1. Counting money
2. Temperature
3. Sports (yards in football)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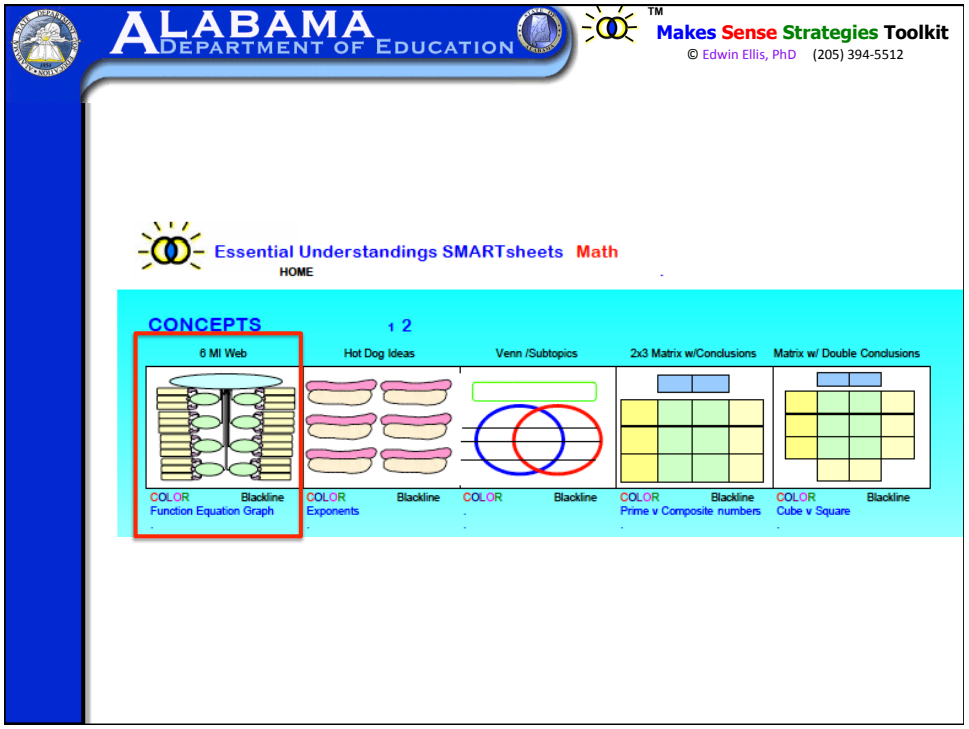
COLOR Blackline
Whole Number v Integer
COLOR Blackline
COLOR Blackline
ALWAYS SOMETIMES NEVER
COLOR Blackline
Kinds of Lines
Suitcase Concepts
2 Idea Web
4 MI Box Web
4 MI Web
4 MI Box-frame
COLOR Blackline
Absolute Value
Graphing Quadratic Function
COLOR Blackline
Graphing Linear Equations
Classifying Triangles
COLOR Blackline
Classifying Quadrilaterals
Linear Inequalities
COLOR Blackline
Fraction Usage
Polynomial Products
Exponents & Logarithms
COLOR Blackline
Polynomials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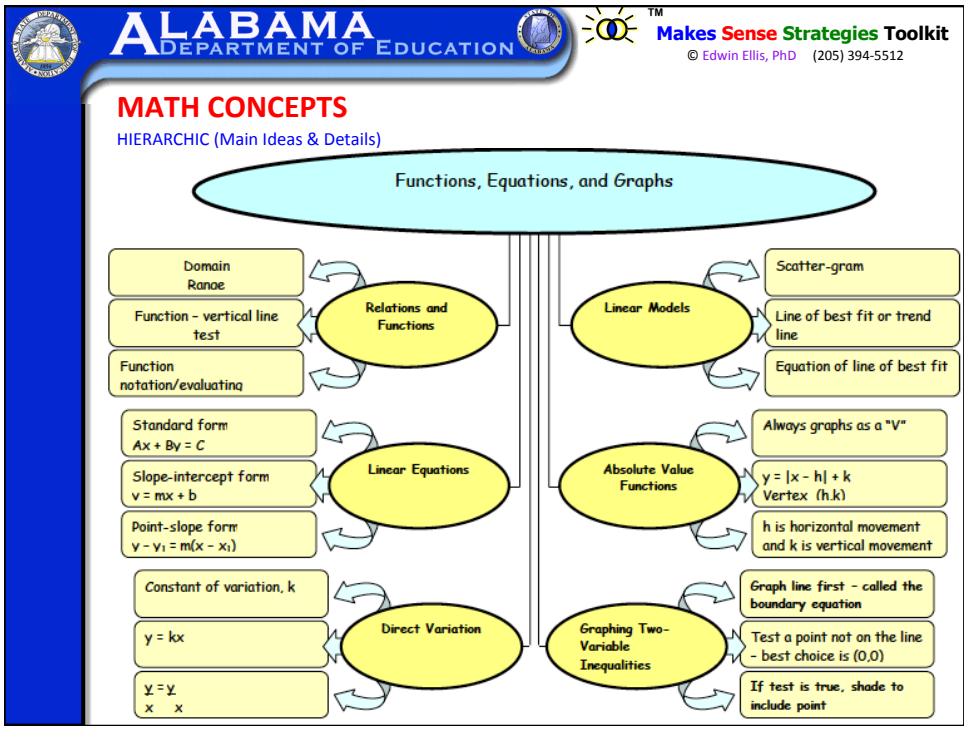
6 MI Web
Hot Dog Ideas
Venn /Subtopics
2x3 Matrix w/Conclusions
Matrix w/ Double Conclusions
COLOR Blackline
Function Equation Graph
COLOR Blackline
Exponents
COLOR Blackline
COLOR Blackline
Prime v Composite numbers
COLOR Blackline
Cube v Square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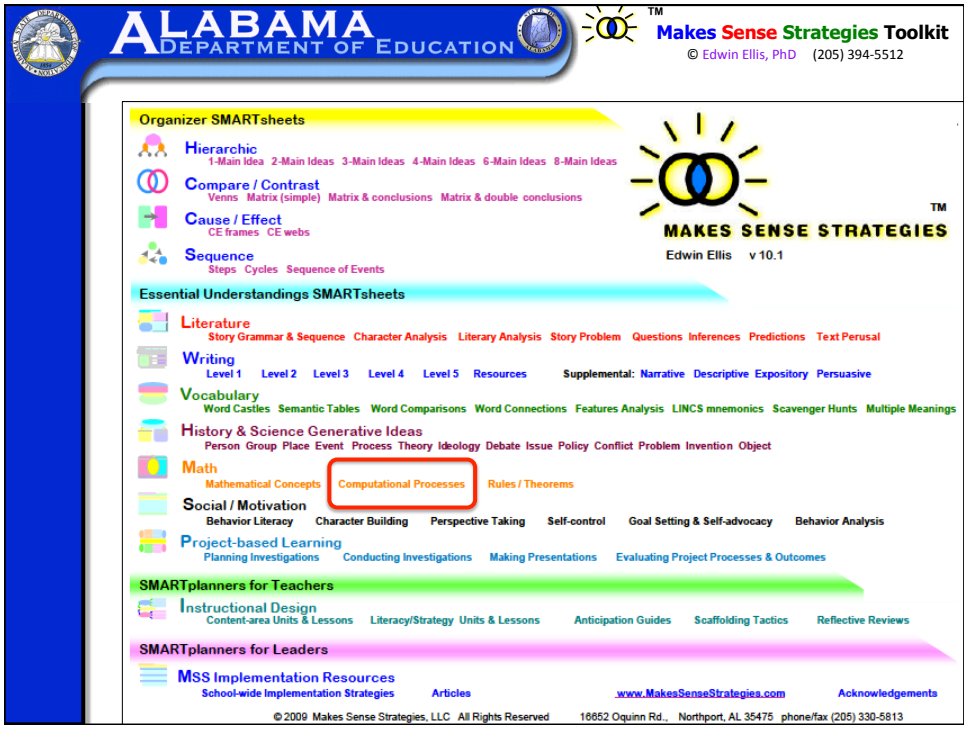
MATH CONCEPTS
HIERARCHIC (Main Ideas & Details)
Functions, Equations, and Graphs
Relations and Functions
Domain
Range
Function - vertical line test
Function notation/evaluating
Linear Models
Scatter-gram
Line of best fit or trend line
Equation of line of best fit
Linear Equations
Standard form
Ax + By = C
Slope-intercept form
y = mx + b
Point-slope form
y - y1 = m(x - x1)
Absolute Value Functions
Always graphs as a "V"
y = |x - h| + k
Vertex (h,k)
h is horizontal movement and k is vertical movement
Direct Variation
Constant of variation, k
y = kx
y = y
x x
Graphing Two-Variable Inequalities
Graph line first - called the boundary equation
Test a point not on the line - best choice is (0,0)
If test is true, shade to include point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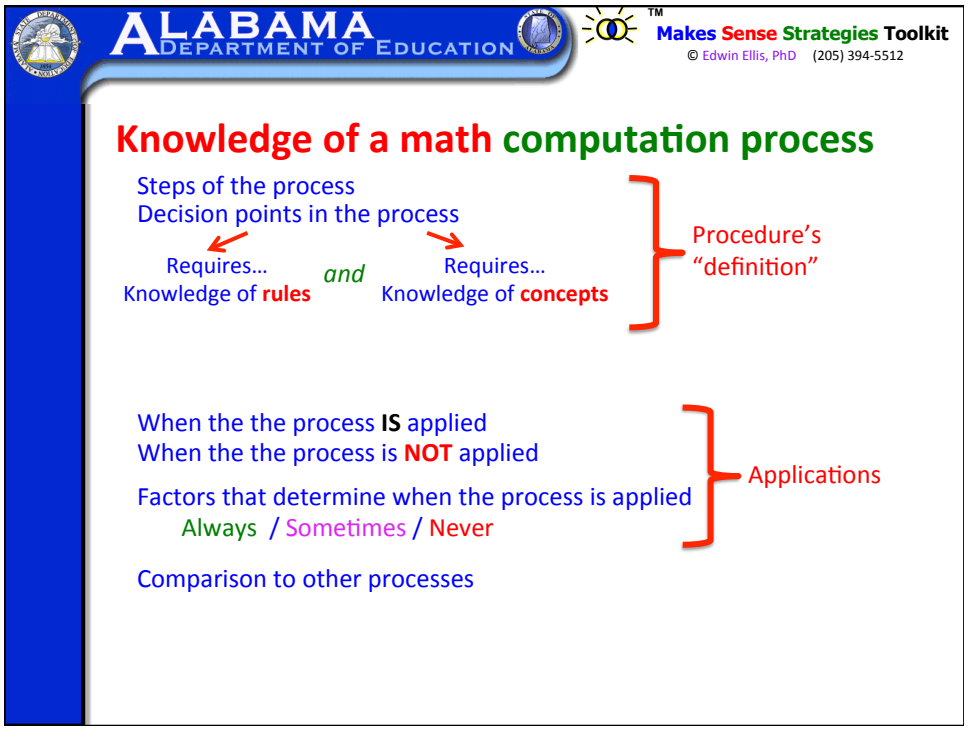
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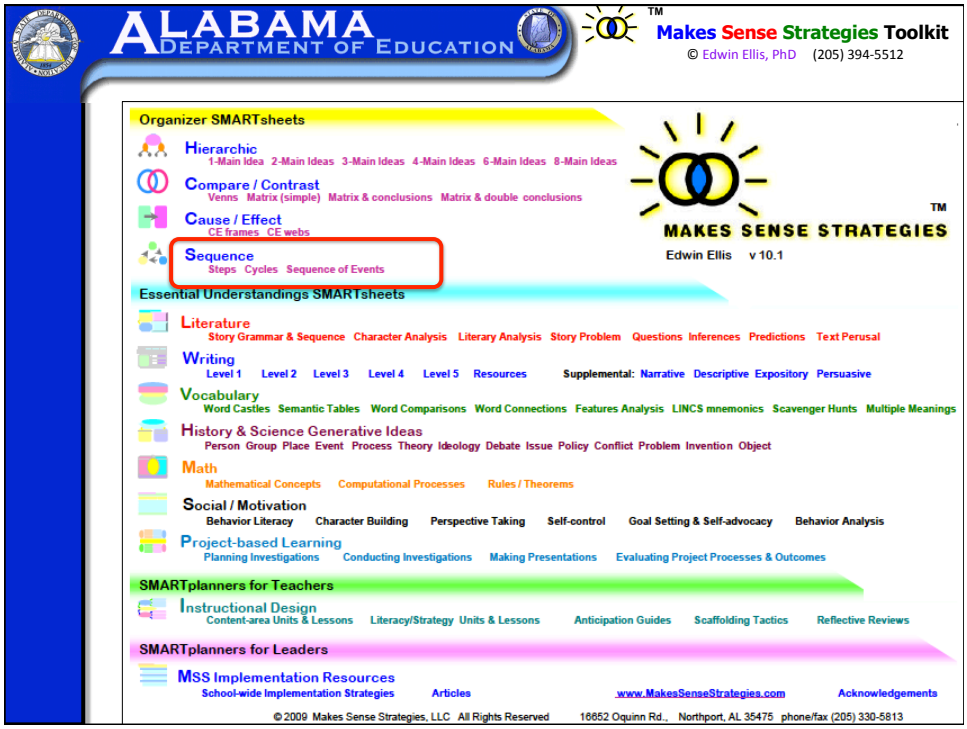
Knowledge of a math computation process
Steps of the process
Decision points in the process
Requires…
Knowledge of rules
and
Requires…
Knowledge of concepts
Procedure's "definition"
When the the process IS applied
When the the process is NOT applied
Factors that determine when the process is applied
Always / Sometimes / Never
Applications
Comparison to other processes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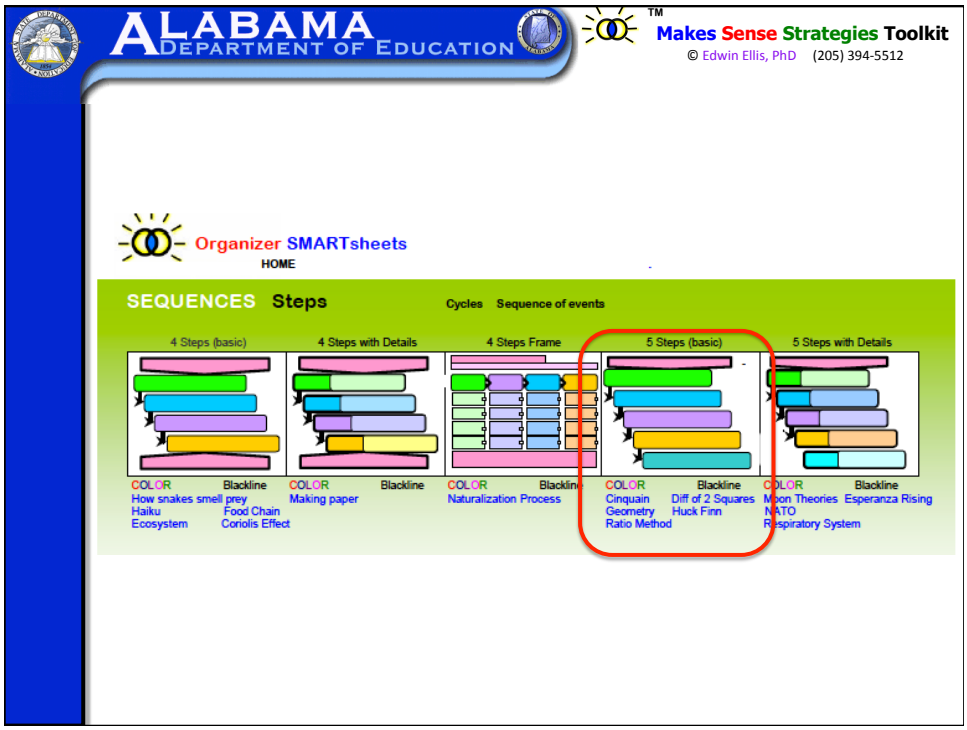
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Haiku
Ecosystem
COLOR Blackline
Food Chain
Coriolis Effect
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Making paper
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Naturalization Process
COLOR Blackline
Cinquain
Geometry
Ratio Method
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Diff of 2 Squares
Huck Finn
COLOR Blackline
Moon Theories
NATO
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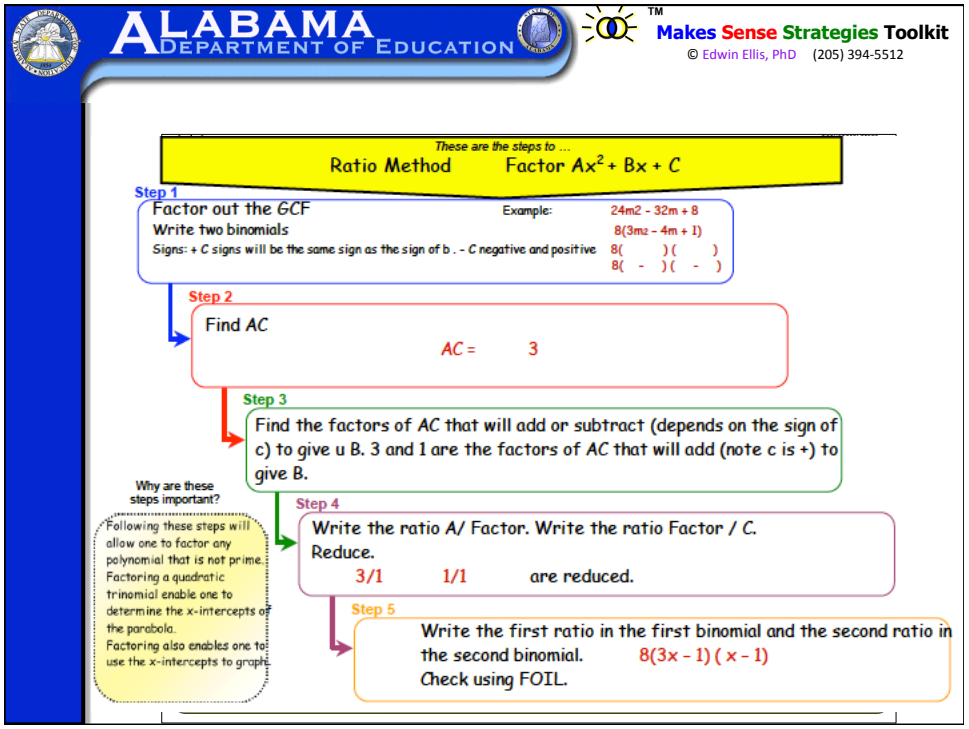
Esperanza Rising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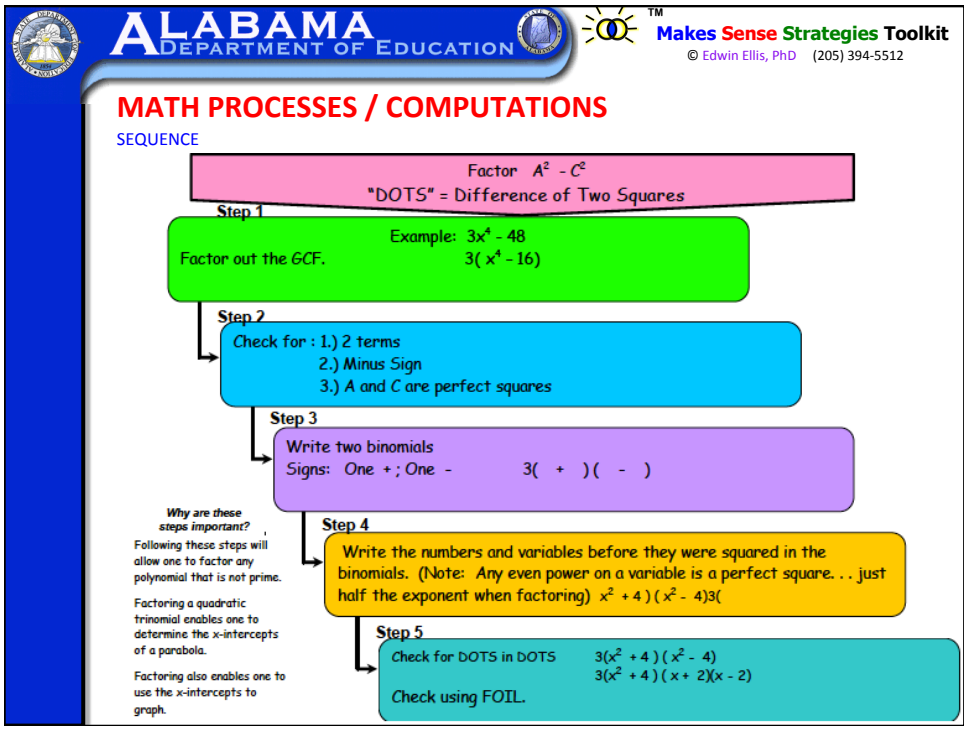
These are the steps to ...
Ratio Method Factor Ax² + Bx + C
Step 1
Factor out the GCF
Write two binomials
Signs: + C signs will be the same sign as the sign of b . - C negative and positive
Example: 24m2 - 32m + 8
8(3m2 - 4m + 1)
8( )( )
8(-)(-)
Step 2
Find AC
AC = 3
Step 3
Find the factors of AC that will add or subtract (depends on the sign of c) to give u B. 3 and 1 are the factors of AC that will add (note c is +) to give B.
Step 4
Write the ratio A/ Factor. Write the ratio Factor / C.
Reduce.
3/1 1/1 are reduced.
Step 5
Write the first ratio in the first binomial and the second ratio in the second binomial. 8(3x - 1) (x - 1)
Check using FOIL.
Why are these steps important?
Following these steps will allow one to factor any polynomial that is not prime.
Factoring a quadratic trinomial enable one to determine the x-intercepts of the parabola.
Factoring also enables one to use the x-intercepts to graph.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MATH PROCESSES / COMPUTATIONS
SEQUENCE
Factor A² - C²
"DOTS" = Difference of Two Squares
Step 1
Example: 3x⁴ - 48
Factor out the GCF. 3(x⁴ - 16)
Step 2
Check for : 1.) 2 terms
2.) Minus Sign
3.) A and C are perfect squares
Step 3
Write two binomials
Signs: One + ; One - 3(+)(-)
Step 4
Write the numbers and variables before they were squared in the binomials. (Note: Any even power on a variable is a perfect square. . . just half the exponent when factoring) x² + 4) (x² - 4)3(
Step 5
Check for DOTS in DOTS 3(x² + 4) (x² - 4)
3(x² + 4) (x + 2)(x - 2)
Check using FOIL.
Why are these steps important?
Following these steps will allow one to factor any polynomial that is not prime.
Factoring a quadratic trinomial enables one to determine the x-intercepts of a parabola.
Factoring also enables one to use the x-intercepts to graph.

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MATH PROCESSES / CALCULATION PROCEDURES

HIERARCHIC (Main Ideas & Details)

Graphing Linear Equations

Main Idea

Slope-intercept form: $y = mx + b$

Example: $y = 2x - 1$

1. Identify the slope (m) & the y intercept (b).
   Example: m = 2, b = -1
2. Graph the y intercept on the y axis.
   Example:
3. Use the slope the locate a second point.
4. Draw a line through the two points.

Main Idea

Standard Form: $Ax + By = C$

Example: $3x - 2y = 6$

1. Find the x- intercept. Let y=0 & solve the equation for x.
   Example:
   $3x - 2(0) = 6$
   $3x = 6$
   $x = 2$
2. Find the y- intercept. Let x=0 and solve the equation for y.
   Example:
   $3(0) - 2y = 6$
   $-2y = 6$
   $y = -3$
3. Graph the x intercept on the x-axis and the y-intercept on the y-axis.
4. Draw a line through the two points.

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MATH PROCESSES / CALCULATION PROCEDURES

HIERARCHIC (Main Ideas & Details)

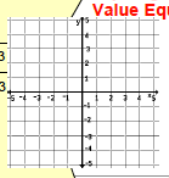
Graphing Absolute Value Equations

Find the vertex and make a table.
General form: $y = |mx + b| + c$

1. Find the vertex using (-b/m, c).
2. Make a table of values.
3. Choose values for x to the left and to the right of the vertex. Find the corresponding values of y.
4. Graph the function.

Example: $y = |2x - 4| + 1$
Vertex $(-(-4)/2, 1) = (2, 1)$

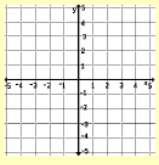
x	y
3	$\|2(3) - 4\| + 1 = \|2\| + 1 = 3$
1	$\|2(1) - 4\| + 1 = \|-2\| + 1 = 3$



Translate the parent function.
Parent function: $y = |mx|$
Translated form: $y = |mx \pm h| \pm k$

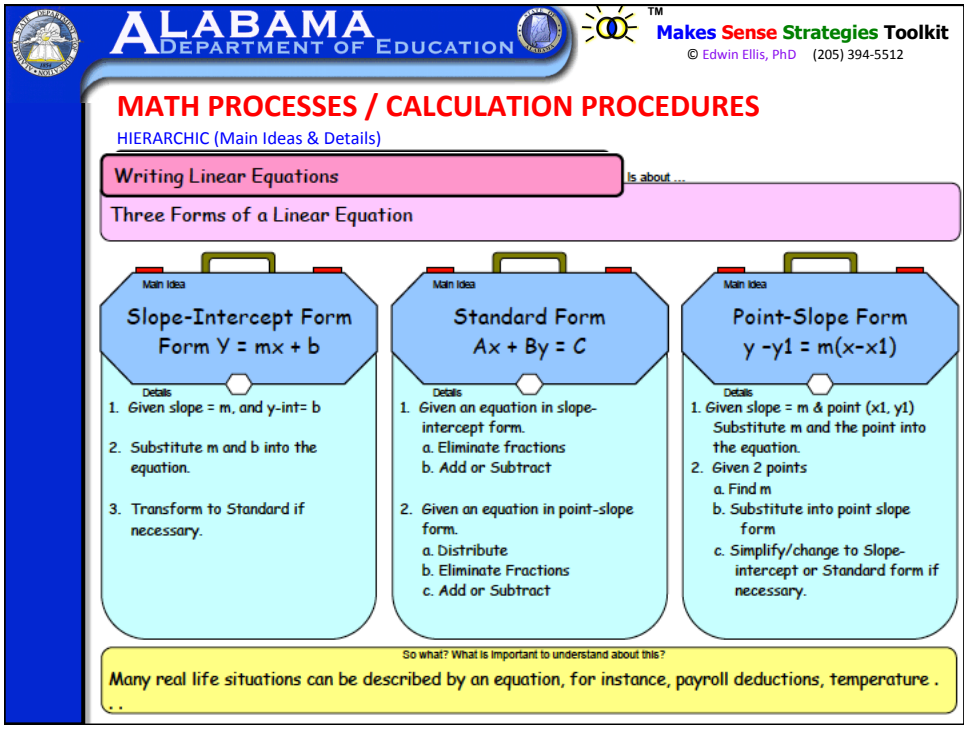
1. Graph the parent function. Its vertex is usually the origin.
2. Translate h units left (if h is positive) or right (if h is negative).
3. Translate k units up (if k is positive) or down (if k is negative).

Example: $y = -|2x - 4| + 1$
Parent function: $-|2x|$



So what?
What is important to understand about this?

The graph is always a "V". A minus sign outside the absolute value bars cause the "V" to be flipped upside down. The *m* value in the equation affects the slope of the sides of the "V".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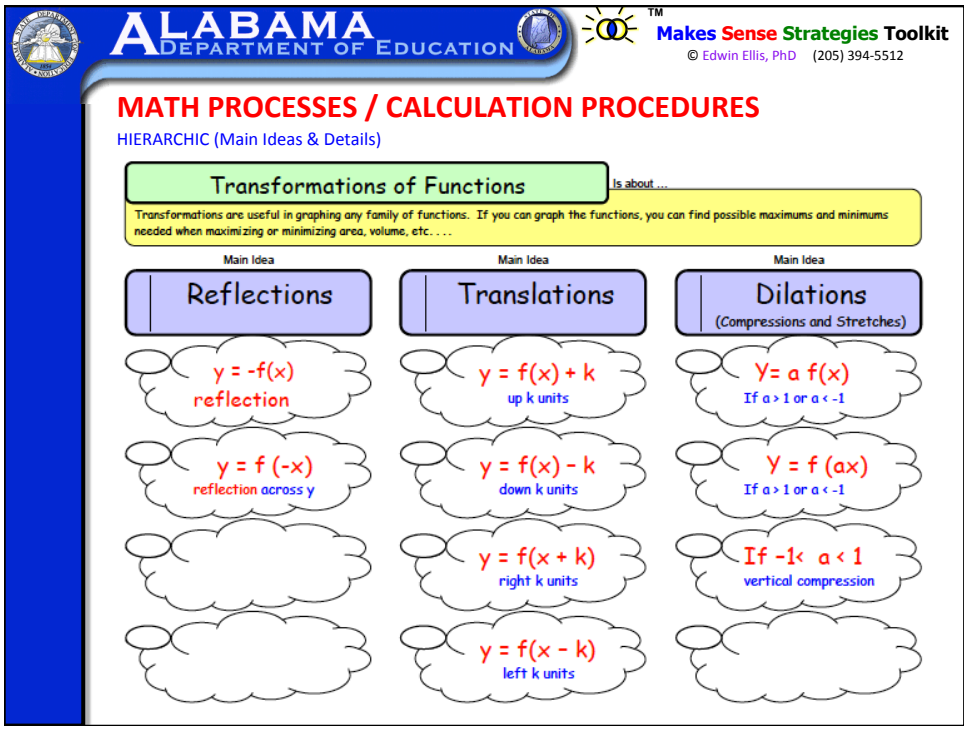
MATH PROCESSES / CALCULATION PROCEDURES
HIERARCHIC (Main Ideas & Details)
Writing Linear Equations
is about ...
Three Forms of a Linear Equation
Main Idea
Slope-Intercept Form
Form Y = mx + b
Details
1. Given slope = m, and y-int= b
2. Substitute m and b into the equation.
3. Transform to Standard if necessary.
Main Idea
Standard Form
Ax + By = C
Details
1. Given an equation in slope-intercept form.
a. Eliminate fractions
b. Add or Subtract
2. Given an equation in point-slope form.
a. Distribute
b. Eliminate Fractions
c. Add or Subtract
Main Idea
Point-Slope Form
y -y1 = m(x-x1)
Details
1. Given slope = m & point (x1, y1) Substitute m and the point into the equation.
2. Given 2 points
a. Find m
b. Substitute into point slope form
c. Simplify/change to Slope-intercept or Standard form if necessary.
So what? What is important to understand about this?
Many real life situations can be described by an equation, for instance, payroll deductions, temperature . . .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MATH PROCESSES / CALCULATION PROCEDURES
HIERARCHIC (Main Ideas & Details)
Transformations of Functions
is about ...
Transformations are useful in graphing any family of functions. If you can graph the functions, you can find possible maximums and minimums needed when maximizing or minimizing area, volume, etc. . . .
Main Idea
Reflections
y = -f(x)
reflection
y = f (-x)
reflection across y
Main Idea
Translations
y = f(x) + k
up k units
y = f(x) - k
down k units
y = f(x + k)
right k units
y = f(x - k)
left k units
Main Idea
Dilations
(Compressions and Stretches)
Y= a f(x)
If a > 1 or a < -1
Y = f (ax)
If a > 1 or a < -1
If -1< a < 1
vertical compression

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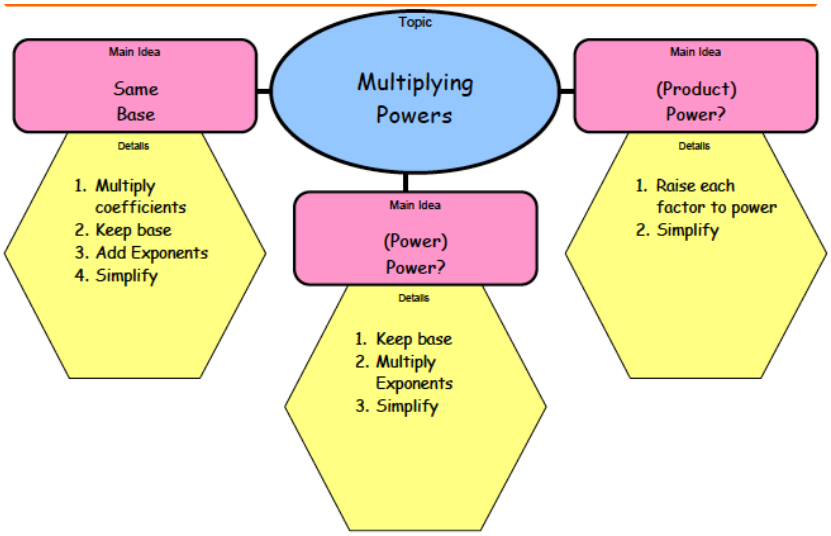
HIERARCHIC (Main Ideas & Details)



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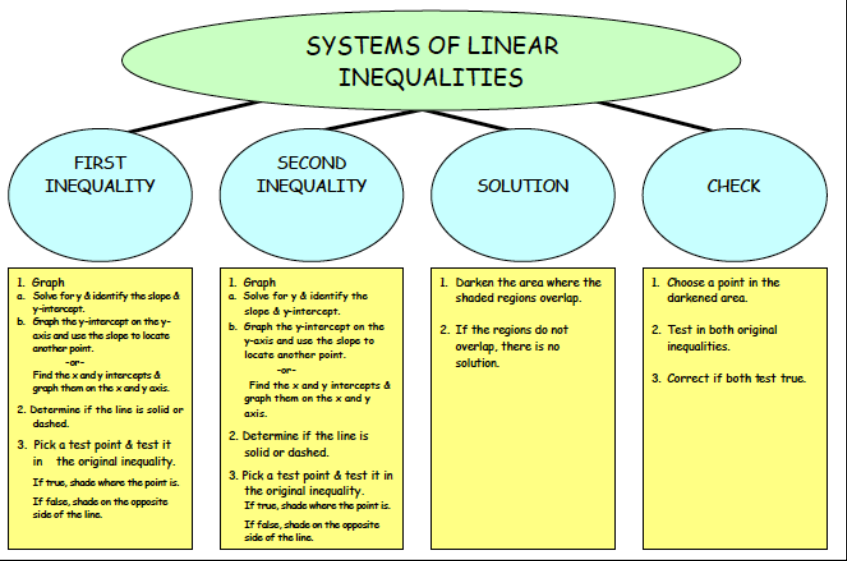
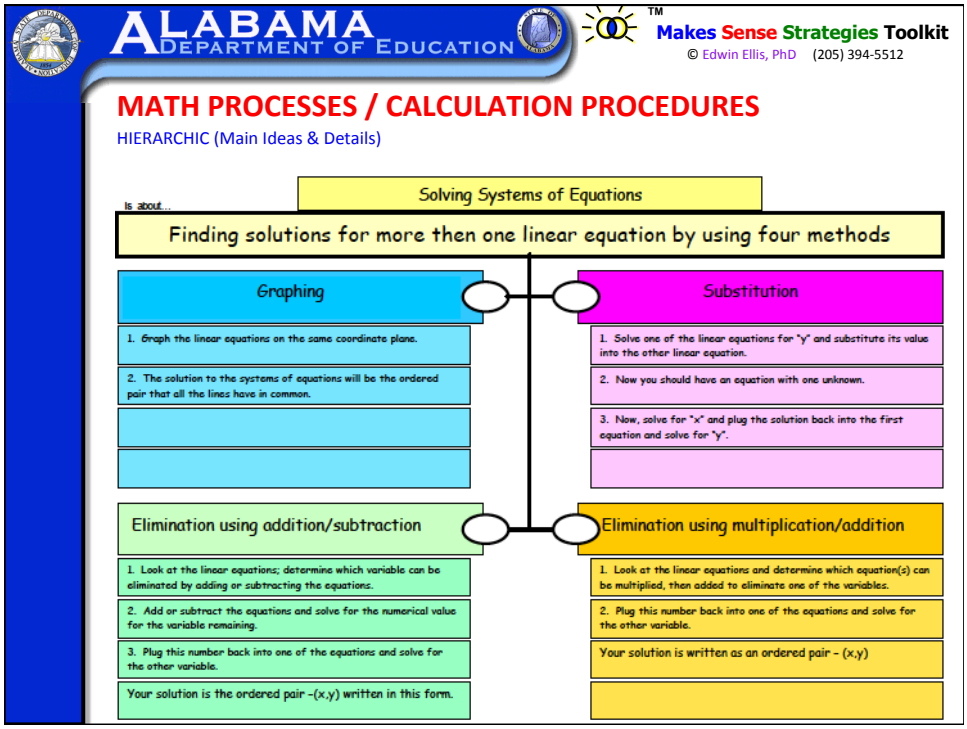
HIERARCHIC (Main Ideas & Details)

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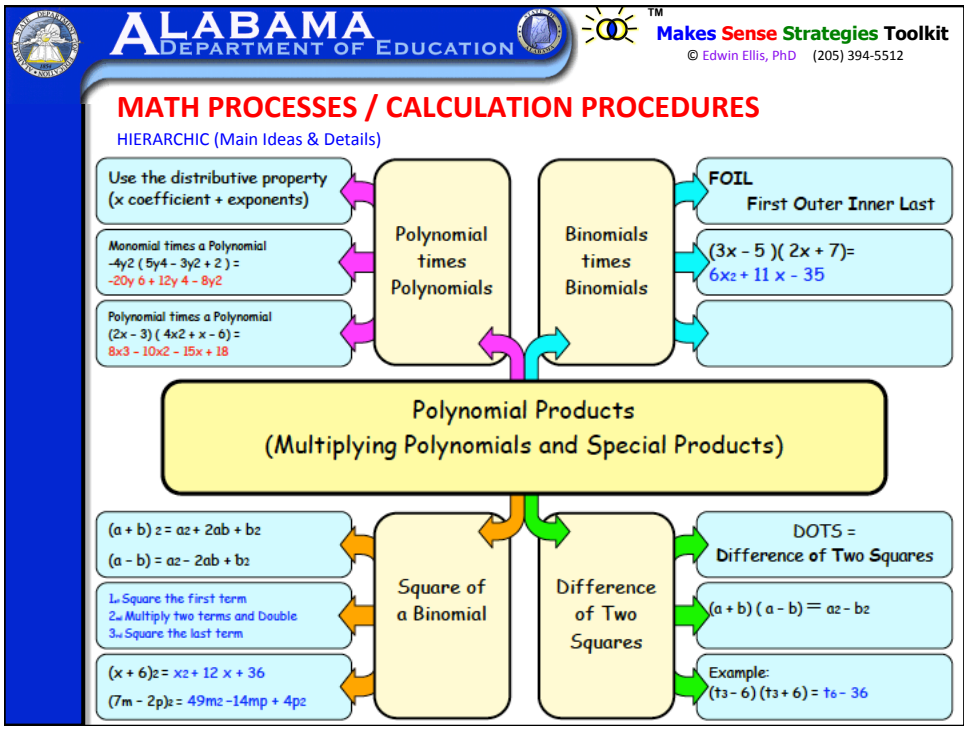
MATH PROCESSES / CALCULATION PROCEDURES
HIERARCHIC (Main Ideas & Details)
Solving Systems of Equations
Is about...
Finding solutions for more then one linear equation by using four methods
Graphing
1. Graph the linear equations on the same coordinate plane.
2. The solution to the systems of equations will be the ordered pair that all the lines have in common.
Substitution
1. Solve one of the linear equations for "y" and substitute its value into the other linear equation.
2. Now you should have an equation with one unknown.
3. Now, solve for "x" and plug the solution back into the first equation and solve for "y".
Elimination using addition/subtraction
1. Look at the linear equations; determine which variable can be eliminated by adding or subtracting the equations.
2. Add or subtract the equations and solve for the numerical value for the variable remaining.
3. Plug this number back into one of the equations and solve for the other variable.
Your solution is the ordered pair -(x,y) written in this form.
Elimination using multiplication/addition
1. Look at the linear equations and determine which equation(s) can be multiplied, then added to eliminate one of the variables.
2. Plug this number back into one of the equations and solve for the other variable.
Your solution is written as an ordered pair - (x,y)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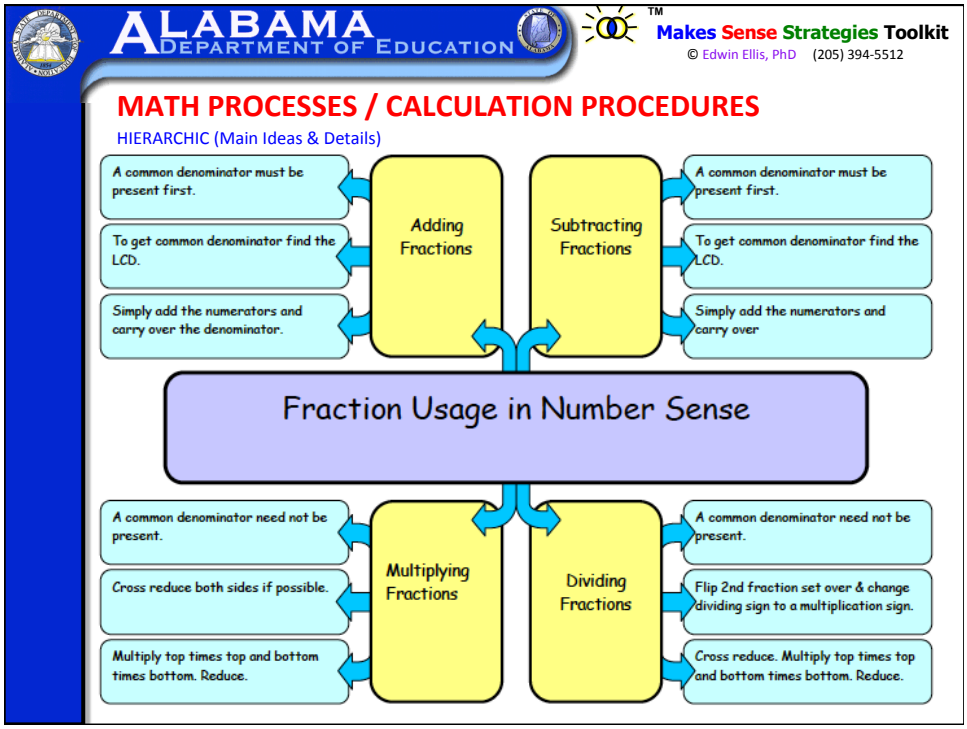
MATH PROCESSES / CALCULATION PROCEDURES
HIERARCHIC (Main Ideas & Details)
Use the distributive property (x coefficient + exponents)
Monomial times a Polynomial
-4y2 (5y4 - 3y2 + 2) =
-20y 6 + 12y 4 - 8y2
Polynomial times a Polynomial
(2x - 3) (4x2 + x - 6) =
8x3 - 10x2 - 15x + 18
Polynomial times Polynomials
Binomials times Binomials
FOIL
First Outer Inner Last
(3x - 5)(2x + 7)=
6x2 + 11 x - 35
Polynomial Products
(Multiplying Polynomials and Special Products)
(a + b) 2 = a2 + 2ab + b2
(a - b) = a2 - 2ab + b2
1. Square the first term
2. Multiply two terms and Double
3. Square the last term
(x + 6)2 = x2 + 12 x + 36
(7m - 2p)2 = 49m2 -14mp + 4p2
Square of a Binomial
Difference of Two Squares
DOTS =
Difference of Two Squares
(a + b) (a - b) = a2 - b2
Example:
(t3 - 6) (t3 + 6) = t6 - 36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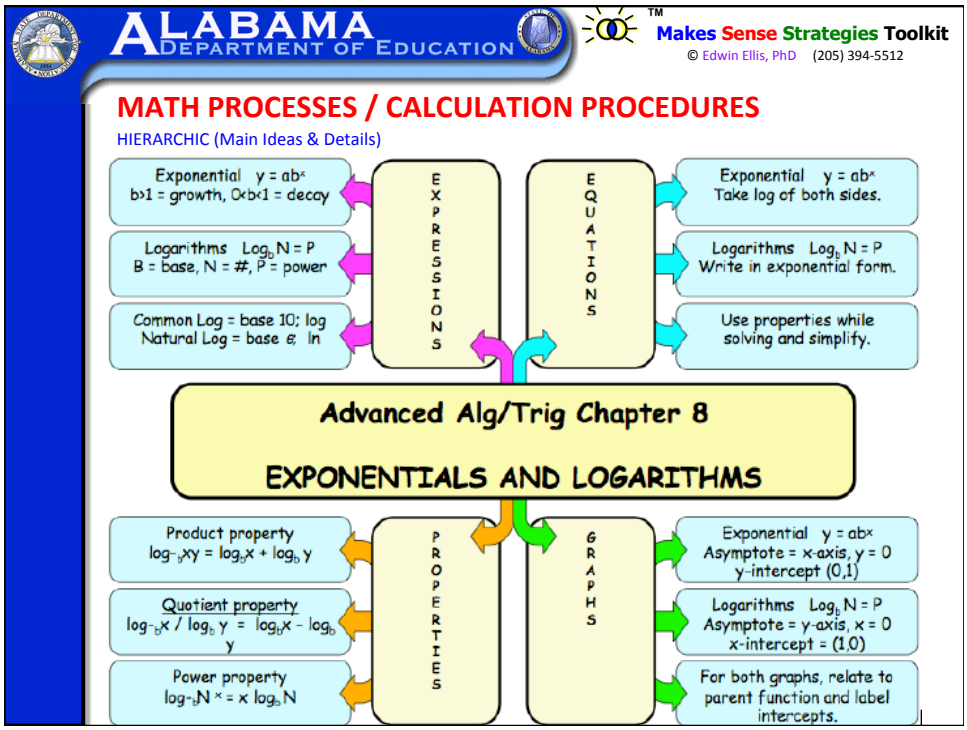
MATH PROCESSES / CALCULATION PROCEDURES
HIERARCHIC (Main Ideas & Details)
A common denominator must be present first.
To get common denominator find the LCD.
Simply add the numerators and carry over the denominator.
Adding Fractions
Subtracting Fractions
A common denominator must be present first.
To get common denominator find the LCD.
Simply add the numerators and carry over
Fraction Usage in Number Sense
A common denominator need not be present.
Cross reduce both sides if possible.
Multiply top times top and bottom times bottom. Reduce.
Multiplying Fractions
Dividing Fractions
A common denominator need not be present.
Flip 2nd fraction set over & change dividing sign to a multiplication sign.
Cross reduce. Multiply top times top and bottom times bottom. Reduce.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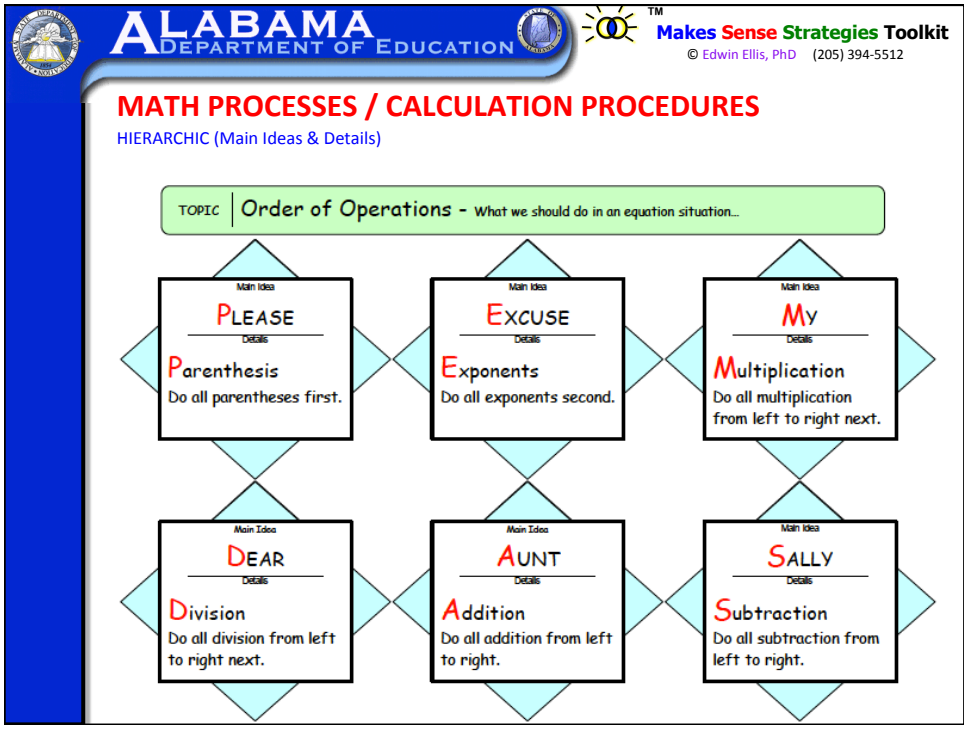
MATH PROCESSES / CALCULATION PROCEDURES
HIERARCHIC (Main Ideas & Details)
Exponential y = ab^x
b>1 = growth, 0<b<1 = decay
Logarithms Log_b N = P
B = base, N = #, P = power
Common Log = base 10; log
Natural Log = base e; ln
EXPRESSIONS
EQUATIONS
Exponential y = ab^x
Take log of both sides.
Logarithms Log_b N = P
Write in exponential form.
Use properties while solving and simplify.
Advanced Alg/Trig Chapter 8
EXPONENTIALS AND LOGARITHMS
Product property
log_b xy = log_b x + log_b y
Quotient property
log_b x / log_b y = log_b x - log_b y
Power property
log_b N^x = x log_b N
PROPERTIES
GRAPHS
Exponential y = ab^x
Asymptote = x-axis, y = 0
y-intercept (0,1)
Logarithms Log_b N = P
Asymptote = y-axis, x = 0
x-intercept = (1,0)
For both graphs, relate to parent function and label intercepts.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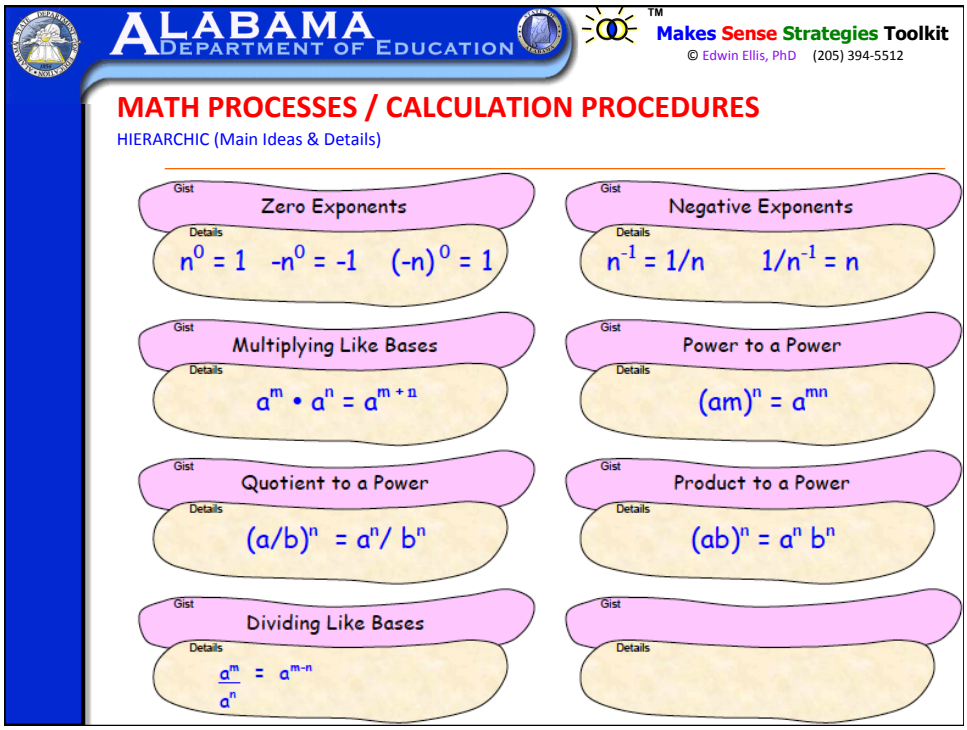
MATH PROCESSES / CALCULATION PROCEDURES
HIERARCHIC (Main Ideas & Details)
TOPIC | Order of Operations - What we should do in an equation situation...
Main Idea
PLEASE
Details
Parenthesis
Do all parentheses first.
Main Idea
EXCUSE
Details
Exponents
Do all exponents second.
Main Idea
MY
Details
Multiplication
Do all multiplication from left to right next.
Main Idea
DEAR
Details
Division
Do all division from left to right next.
Main Idea
AUNT
Details
Addition
Do all addition from left to right.
Main Idea
SALLY
Details
Subtraction
Do all subtraction from left to right.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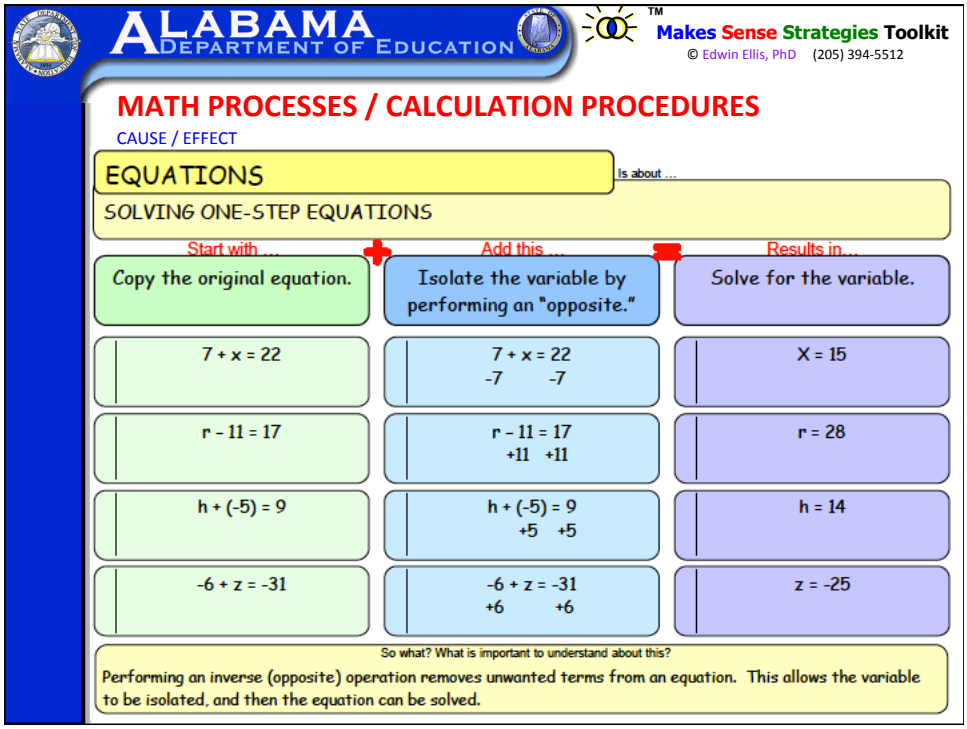
MATH PROCESSES / CALCULATION PROCEDURES
HIERARCHIC (Main Ideas & Details)
Gist
Zero Exponents
Details
$n^0 = 1$ $-n^0 = -1$ $(-n)^0 = 1$
Gist
Negative Exponents
Details
$n^{-1} = 1/n$ $1/n^{-1} = n$
Gist
Multiplying Like Bases
Details
$a^m \bullet a^n = a^{m+n}$
Gist
Power to a Power
Details
$(am)^n = a^{mn}$
Gist
Quotient to a Power
Details
$(a/b)^n = a^n / b^n$
Gist
Product to a Power
Details
$(ab)^n = a^n b^n$
Gist
Dividing Like Bases
Details
$\frac{a^m}{a^n} = a^{m-n}$
Gist
Details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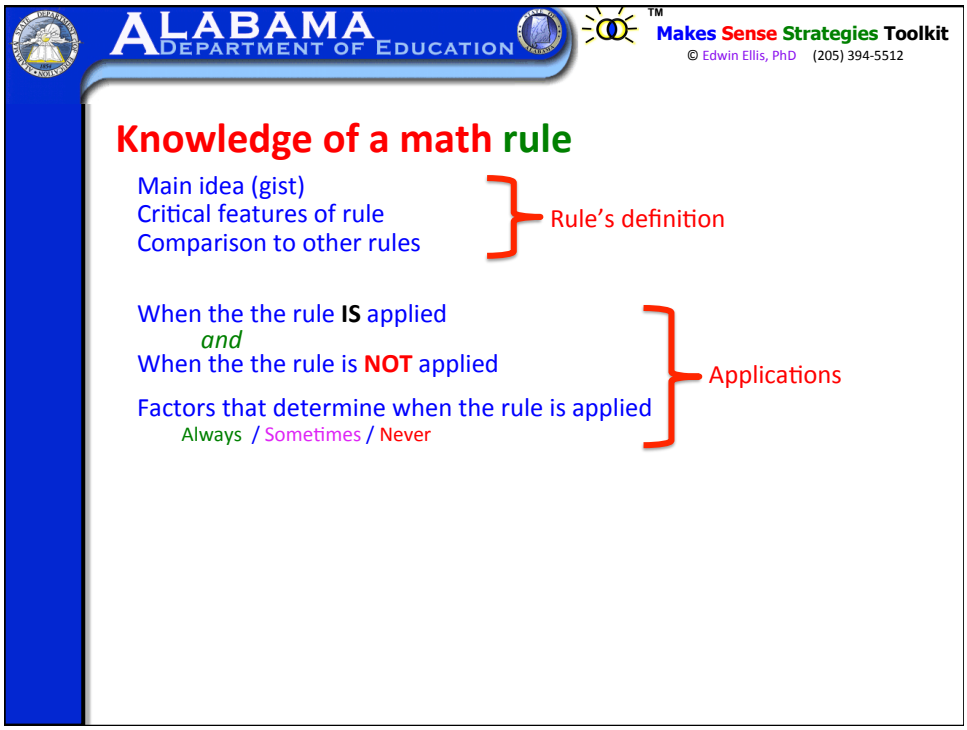
MATH PROCESSES / CALCULATION PROCEDURES
CAUSE / EFFECT
EQUATIONS
Is about ...
SOLVING ONE-STEP EQUATIONS
Start with ...
Add this ...
Results in...
Copy the original equation.
Isolate the variable by performing an "opposite."
Solve for the variable.
7 + x = 22
7 + x = 22
-7 -7
X = 15
r - 11 = 17
r - 11 = 17
+11 +11
r = 28
h + (-5) = 9
h + (-5) = 9
+5 +5
h = 14
-6 + z = -31
-6 + z = -31
+6 +6
z = -25
So what? What is important to understand about this?
Performing an inverse (opposite) operation removes unwanted terms from an equation. This allows the variable to be isolated, and then the equation can be solved.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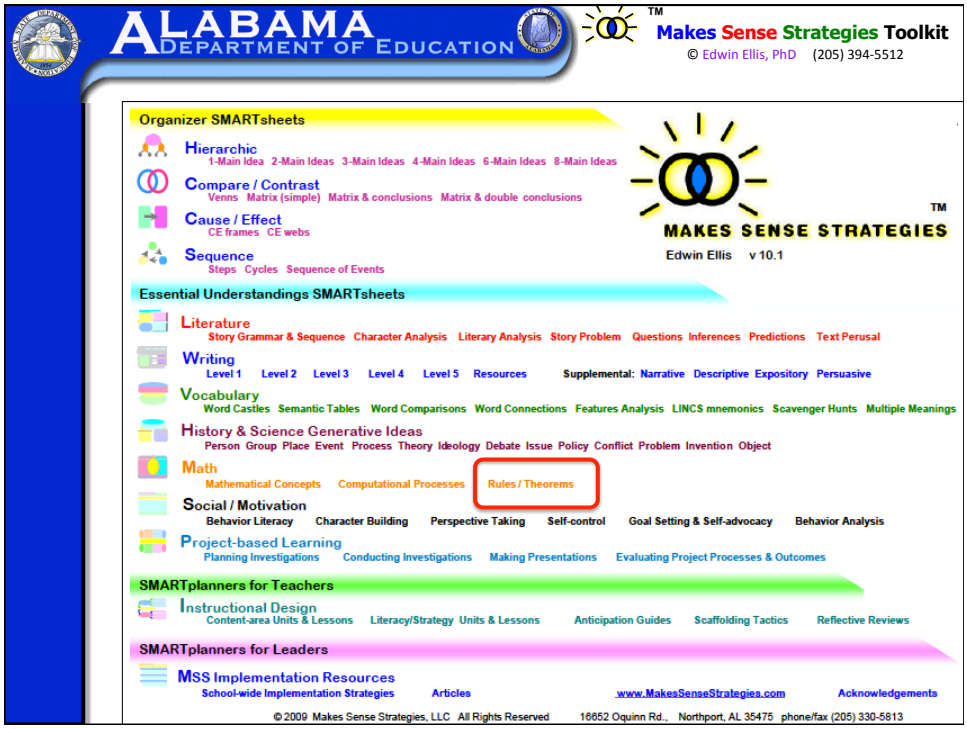
Knowledge of a math rule
Main idea (gist)
Critical features of rule
Comparison to other rules
Rule's definition
When the the rule IS applied
and
When the the rule is NOT applied
Factors that determine when the rule is applied
Always / Sometimes / Never
Applications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Organizer SMARTsheets
Hierarchic
1-Main Idea 2-Main Ideas 3-Main Ideas 4-Main Ideas 6-Main Ideas 8-Main Ideas
Compare / Contrast
Venns Matrix (simple) Matrix & conclusions Matrix & double conclusions
Cause / Effect
CE frames CE webs
Sequence
Steps Cycles Sequence of Events
MAKES SENSE STRATEGIES
Edwin Ellis v 10.1
Essential Understandings SMARTsheets
Literature
Story Grammar & Sequence Character Analysis Literary Analysis Story Problem Questions Inferences Predictions Text Perusal
Writing
Level 1 Level 2 Level 3 Level 4 Level 5 Resources Supplemental: Narrative Descriptive Expository Persuasive
Vocabulary
Word Castles Semantic Tables Word Comparisons Word Connections Features Analysis LINCS mnemonics Scavenger Hunts Multiple Meanings
History & Science Generative Ideas
Person Group Place Event Process Theory Ideology Debate Issue Policy Conflict Problem Invention Object
Math
Mathematical Concepts Computational Processes Rules / Theorems
Social / Motivation
Behavior Literacy Character Building Perspective Taking Self-control Goal Setting & Self-advocacy Behavior Analysis
Project-based Learning
Planning Investigations Conducting Investigations Making Presentations Evaluating Project Processes & Outcomes
SMARTplanners for Teachers
Instructional Design
Content-area Units & Lessons Literacy/Strategy Units & Lessons Anticipation Guides Scaffolding Tactics Reflective Reviews
SMARTplanners for Leaders
MSS Implementation Resources
School-wide Implementation Strategies Articles www.MakesSenseStrategies.com Acknowledgements
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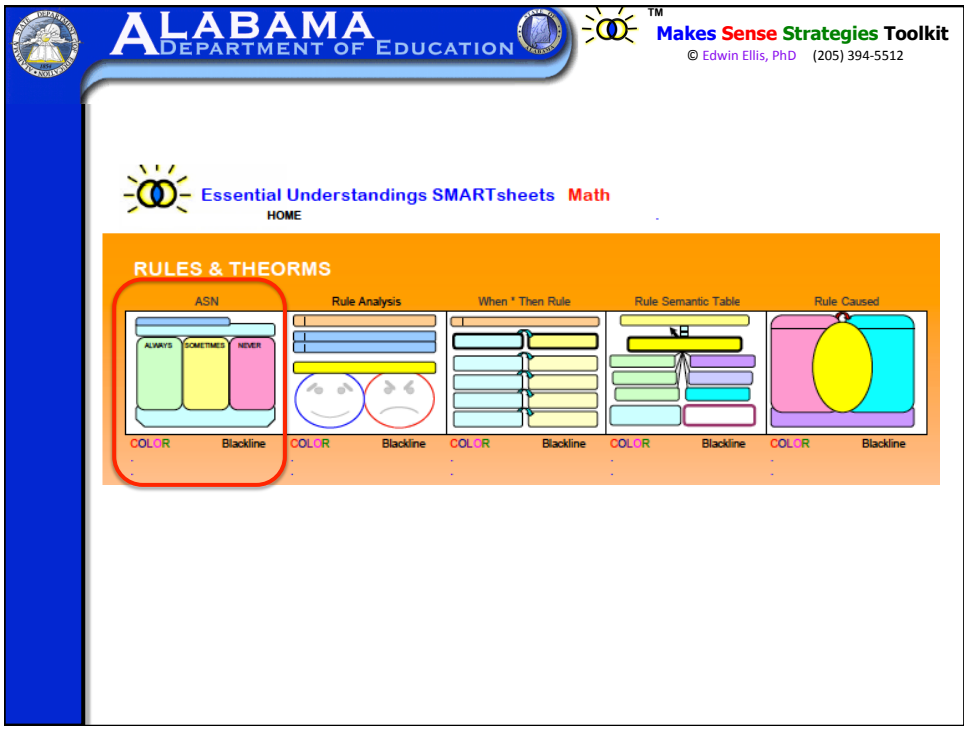
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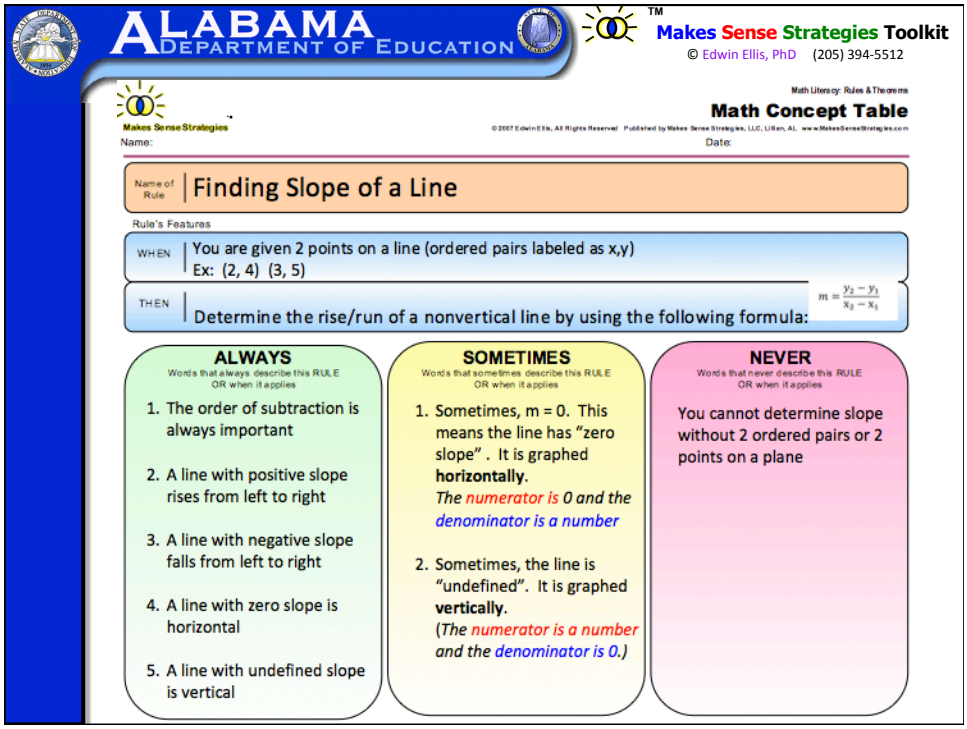
Essential Understandings SMARTsheets Math
HOME
RULES & THEORMS
ASN
Rule Analysis
When * Then Rule
Rule Semantic Table
Rule Caused
ALWAYS
SOMETIMES
NEVER
COLOR
Blackline



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Makes Sense Strategies

Math Literacy: Rules & Theorems

Math Concept Table

Name: Date:

Name of Rule | Finding Slope of a Line

Rule's Features

WHEN | You are given 2 points on a line (ordered pairs labeled as x,y)
Ex: (2, 4) (3, 5)

THEN | Determine the rise/run of a nonvertical line by using the following formula: $m = \frac{y_2 - y_1}{x_2 - x_1}$

ALWAYS
Words that always describe this RULE OR when it applies

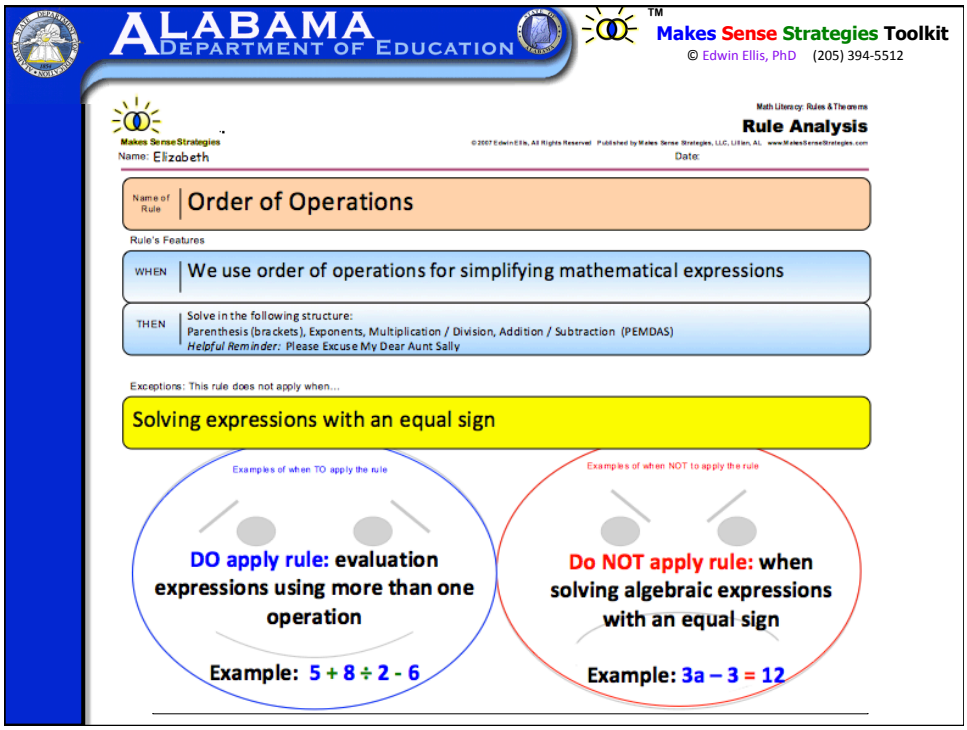
1. The order of subtraction is always important
2. A line with positive slope rises from left to right
3. A line with negative slope falls from left to right
4. A line with zero slope is horizontal
5. A line with undefined slope is vertical

SOMETIMES
Words that sometimes describe this RULE OR when it applies

1. Sometimes, m = 0. This means the line has "zero slope" . It is graphed **horizontally**.
   The numerator is 0 and the denominator is a number
2. Sometimes, the line is "undefined". It is graphed **vertically**.
   (*The numerator is a number and the denominator is 0.*)

NEVER
Words that never describe this RULE OR when it applies

You cannot determine slope without 2 ordered pairs or 2 points on a plane



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Math Literacy: Rules & Theorems

Rule Analysis

Name: Elizabeth Date:

Name of Rule | Order of Operations

Rule's Features

WHEN | We use order of operations for simplifying mathematical expressions

THEN | Solve in the following structure:
Parenthesis (brackets), Exponents, Multiplication / Division, Addition / Subtraction (PEMDAS)
Helpful Reminder: Please Excuse My Dear Aunt Sally

Exceptions: This rule does not apply when...

Solving expressions with an equal sign

Examples of when TO apply the rule

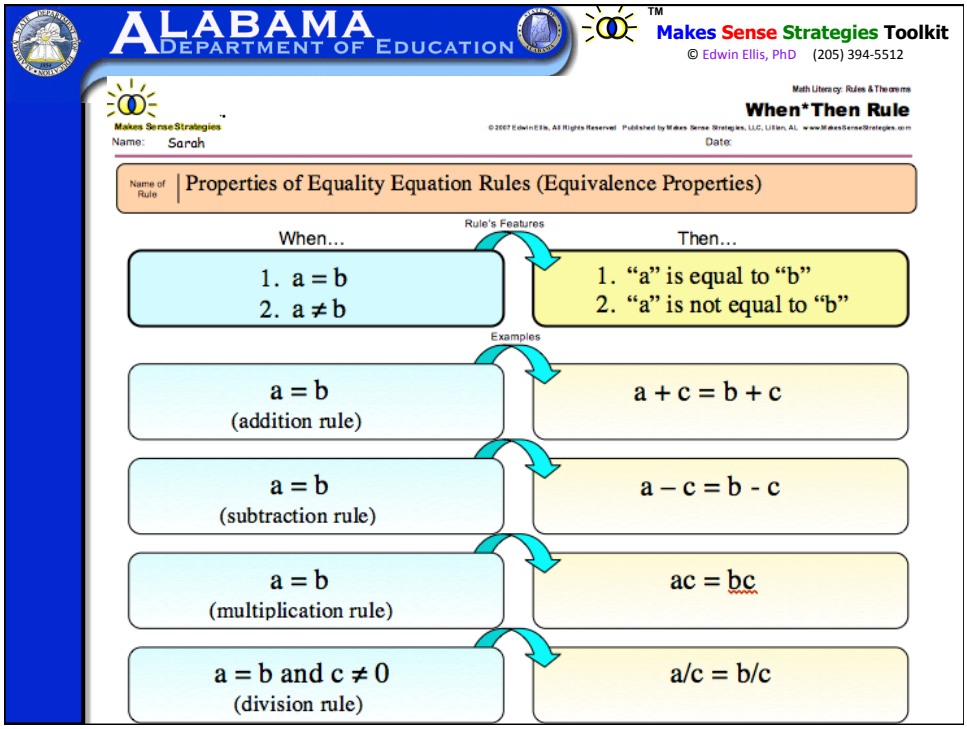
DO apply rule: evaluation expressions using more than one operation

Example: 5 + 8 ÷ 2 - 6

Examples of when NOT to apply the rule

Do NOT apply rule: when solving algebraic expressions with an equal sign

Example: 3a – 3 = 12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Math Literacy: Rules & Theorems
When*Then Rule
Makes Sense Strategies
Name: Sarah
Date:
Name of Rule
Properties of Equality Equation Rules (Equivalence Properties)
When...
Rule's Features
Then...
1. a = b
2. a ≠ b
1. "a" is equal to "b"
2. "a" is not equal to "b"
Examples
a = b
(addition rule)
a + c = b + c
a = b
(subtraction rule)
a – c = b - c
a = b
(multiplication rule)
ac = bc
a = b and c ≠ 0
(division rule)
a/c = b/c