

Making Math Meaningful

Supporting Students
With Autism in Math

Presenter: Randy Ewart



- 20 year math teacher
- Master's in special ed
- Adjunct USJ – sped math
- Math interventionist
- Candidate for National Board Certification in sped

Gabriel Ewart
9 year old with autistic disorder

Objectives

- Differentiate between a concept and a skills
- Make math topics meaningful

Initiation

Part 1: Task Analysis for Math Topics:

...strategies for identifying valid learning objectives, breaking them into small parts, and then using task analysis as an assessment tool.

Task Analysis

- Task Analysis is a formal procedure for breaking the topic into manageable little parts for the students
- It can be used to guide assessment:
 - For all steps
 - For subset of steps

Given Objective

*Objective: Compute total to pay given tax rate and price of multiple items to be purchased.
(solve multi-step real life problem)*

Used Task Analysis to Identify Gaps

Steps		Outcome C = correct, 2 = prompt, 3 =
1	Discern difference between money amounts and tax rate	
2	Find total cost , before tax	
3	Write total with proper notation	
4	Discern difference between tax rate and tax as money amount	
5	compute tax	
6	Identify need to add (pay both total cost and tax)	
7	Compute total to pay	
8	Write total to pay with proper notation.	
9	Identify total to pay orally.	

Initiation

Part 2: Making Math Meaningful for Students with an Autism Spectrum Disorder:

...strategies for making math topics meaningful for students

Agenda

- Foundation for meaning
- Strategies to make math meaningful

Documents to Share

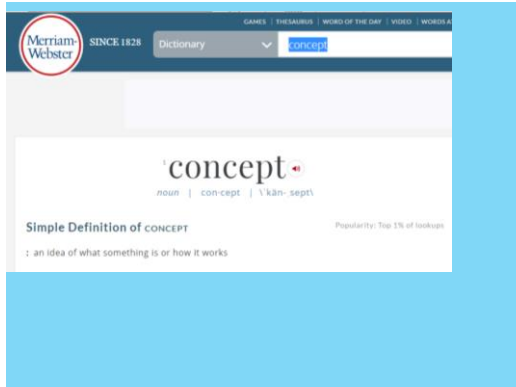
- www.ctspedmathdude.com
- Categories: webinar, presentations
- Provides link to Dropbox folder containing documents

Foundation for Meaning

What do we mean by a concept?



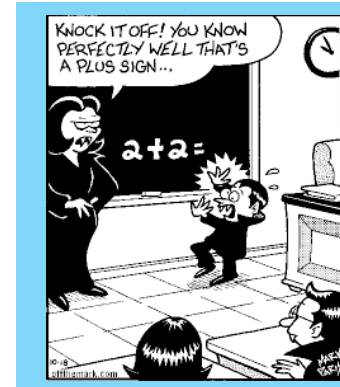
- A. How to perform a math task
- B. The idea behind a math topic
- C. A fact about a math topic
- D. None of the above



Concept

Collection of facts about a topic that results in an idea that is greater than the sum of the individual facts.

The underlying idea of what a topic is as opposed to how to perform steps to "do" the topic.



Math is a language with its own symbols

You have 90 seconds to memorize the following words. Do not write any of the words as you memorize them.

- Bill carrot legos cat train duck John celery puzzle boat pig Mary car spinach ball

Which strategy would you use to memorize the words?



- A. Rehearsal – rote memorization
- B. Make up a story
- C. Focus on categories
- D. Create visuals for each word

Gestalt Theory

- Brain wants to make meaning out of information so most people choose B, C or D.
- The brain wants to see the big picture – see the forest among the trees.

What do you see in each image?

Panel A: Three black semi-circles arranged in a triangular pattern, each with a white notch pointing towards the center.

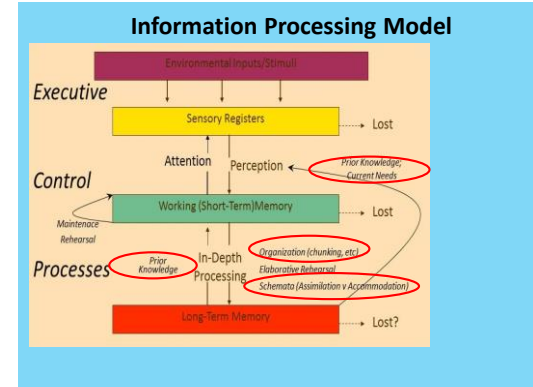
Panel B: A black shape resembling a stylized letter 'S' or a curved line with a hook.

Panel C: A white starburst shape with multiple sharp points radiating from a central point.

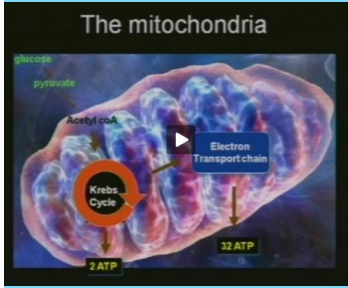
Panel D: A black shape resembling a stylized letter 'C' or a curved line with a hook, similar to panel B but with a different orientation.

What do you see?

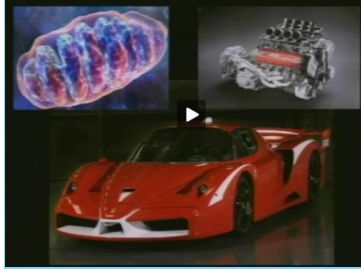
The image shows a series of black dots arranged in a pattern that suggests a shape or movement. The dots are arranged in a way that could be perceived as a series of connected points forming a path or a specific figure.



Explain Mitochondria



The Mitochondria is the Motor for the Cell



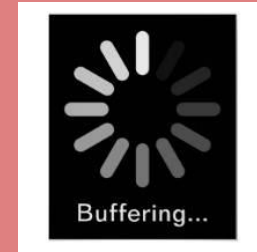
Strategies for Making Math Meaningful

**Strategies for
Making Math Meaningful**

- Highlighting parts
- Making topics concrete
 - Relevance
 - Manipulatives (hands on)

Highlighting Parts

Cut Down on Mental Tasks



8th Grader's Assessment Practice

6.15 The table below shows the total Connecticut government full-time employees for three years.

Number of Employees	Year
1999	528,962
2000	
2001	

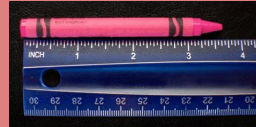
Explain the trend for the number of full-time employees.

The number of employees from 1999 to 2001 all together is 528,962. The number of employees of each year goes up.

Identify a challenge for a student in measuring object to nearest fourth inch.



- A. Lining up the ruler properly.
- B. Identifying whole inches
- C. Identifying fourths marks
- D. All of the above



Identifying fourths on a ruler



Identifying fourths on a ruler

a response to problems identified in data sheet the student was provided focused work on identify and understanding fourths.

Fourth's Handout - Respond to each group by identifying fourths (e.g. 3 out of 4) and EXPLAIN (e.g. 3 guys wearing a hat out of 4 guys total)

How many hats are there?				
How many are there?				
How many M&M's are there?				
How				

Identifying fourths on a ruler

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How many M&M's are there?				
How				

Combine Like Terms

$$7.5x + 1 - 3x - 5$$

$$7.5x + 1 - 3x - 5$$

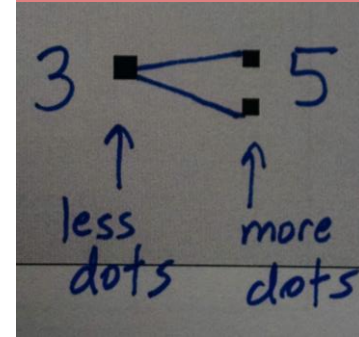
$$7.5x - 3x + 1 - 5$$

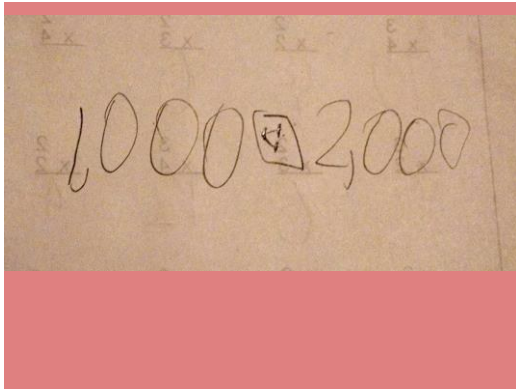
$$4.5x - 4$$

Identify Parts for an Inequality symbol > <

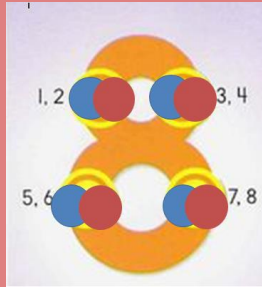


- A. Alligator eats the bigger number
- B. Direction
- C. One side is wider than the other

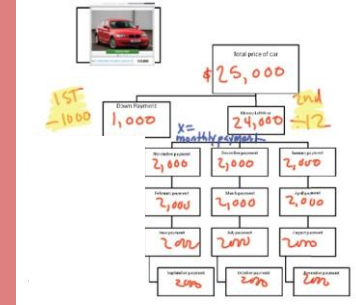




Revising Touch Math – Colorado PD



Divide total among 12 months



Ordered Pairs

what point is located at each ordered pair.

1. (2, 1)	2. (2, 3)	3. (-4, 3)
4. (2, 4)	5. (-4, 4)	6. (-6, 4)

write the ordered pair for each given point.

7. A	8. M	9. P
10. T	11. Q	12. N

plot the following points on the coordinate grid.

13. (-4, -3)	14. T (2, -4)	15. U (5, 1)
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**X axis
vs
y axis**

Buying a Car

The price of a used Toyota Camry as a function of miles driven is shown below.

Miles Driven	Price
0	19,600
10,000	17,600
20,000	15,600
30,000	13,600
40,000	11,600
50,000	9,600
60,000	7,600
70,000	5,600
80,000	3,600
90,000	1,600
100,000	0

1. What happens to price as mileage increases?
Price decreases

2. Price decreases as mileage increases. What does this mean?
price decreases

3. Price decreases as mileage increases. What does this mean?
no, it costs more

4. Price decreases as mileage increases. What does this mean?
no, it costs more

Scatter plot - Shows a relationship

price decreases (with a downward arrow)

miles increase (with a rightward arrow)

Y = 19,600 - 200X

Y = 19,600 - 50(0)
Y = 19,600

Y = 19,600 - 50(80)
Y = 15,600

**Focusing on
x variable
and
y variable**

Explain what is meant by $x > 2$

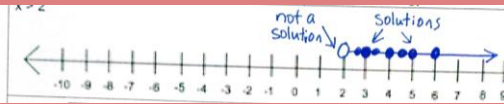
your turn

- A. Alligator eats the X
- B. Draw a line to the left and an open circle on the 2
- C. All numbers bigger than 2

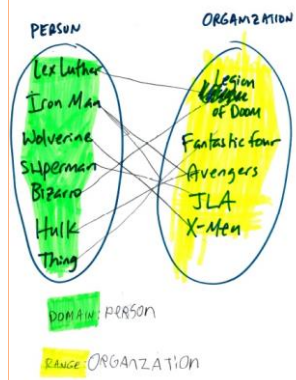
Graphing $x > 2$ typically is presented as drawing an open circle and a line.

Symbol	Meaning	Closed or Open Circle
$<$	Less Than	Open ○
$>$	Greater Than	Open ○
\leq	Less Than or Equal to	Closed ●
\geq	Greater Than or Equal to	Closed ●

Parts of $x > 2$



Relevance



HS Student with autism who likes comics

Teaching the Concept of **More**

Which one do you want? Why?





Counting Money



Counting Money


- Classroom café with students ordering then counting out money to pay for food.

		
How many tacos do you have?	and	How many tacos do you eat?
3		2
3T	+	-2T
What's left?		
1T		

Rates or Slope

Pizza Hut Pizza costs \$10 and \$2 per topping

3. How much would it cost to get pepperoni, mushrooms and peppers? Show work.



10
2
2
2
2
2
2
+
16

4. Write an equation to show the relationship between cost and # toppings.

Cost = y # toppings = x

$$\frac{\text{cost}}{y} = \frac{\cancel{10}}{\text{price for pizza}} + \frac{\cancel{2} \cdot \cancel{2} \cdot x}{\text{price per topping} \cdot \# \text{ toppings}}$$

Triangles



Word Problem for 7th Grader with Autism Who Loves Snowboarding



Concrete (hands on)

CRA

representational

abstract



concrete



abstract

representational

concrete

$15 + 4 = 19$

$15 + 4 = 19$

$\square \begin{matrix} \square & \square \\ \square & \square \end{matrix} + \square \begin{matrix} \square \\ \square \end{matrix} = 19$

$15 + 4 = 19$

4th Grade Class – Comparing Fractions

Circle the fraction that is greater.

2/6

$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$
---------------	---------------	---------------	---------------	---------------	---------------

4/6

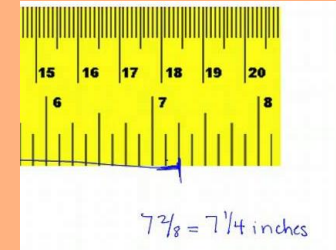
$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{6}$
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Making Temperature Meaningful

Degrees Fahrenheit	Item	Degrees Celsius	Hot Warm Cold

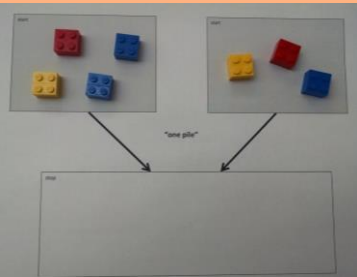
Count tick marks – 2 not 3 tick marks



digging Stones - later in Fractional Disk on Number Line

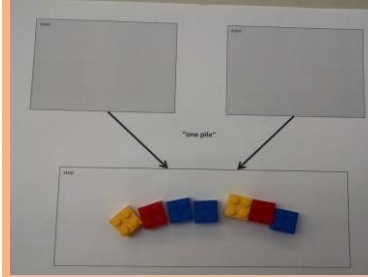
	← This is a step.
	How many steps does it take to get across?
	How many steps does it take to get across?
	How many steps does it take to get across?
	How many steps does it take to get across?
	How many steps does it take to get across?

Concept of Adding



The diagram illustrates the concept of adding. It shows two separate boxes, each labeled "one pile". The first box contains three blocks: one red, one blue, and one yellow. The second box contains two blocks: one red and one blue. Arrows from both boxes point to a larger box below, also labeled "one pile", which contains all five blocks combined: one red, one blue, one yellow, one red, and one blue.

Concept of Adding



The diagram illustrates the concept of adding. It shows two empty boxes, each labeled "one pile". Arrows from both boxes point to a larger box below, also labeled "one pile", which contains a row of five colored blocks: one yellow, one red, one blue, one yellow, and one blue.
















Simplify $7.5x + 1 - 3x - 5$

$7.5x$	$+ 1$	$- 3x$	$- 5$
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Simplify $7.5x + 1 - 3x - 5$

$7.5x$	$- 3x$	$+ 1$	$- 5$
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Counting Money

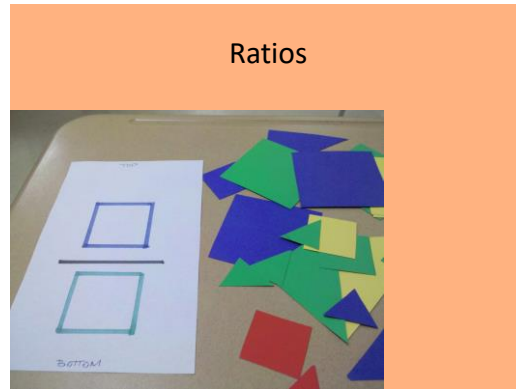
 3	 2	 0
 2	 0	 0
 1	 2	 2
 2	 0	 3
 0	 8	 7
How much money in all?	How much money in all?	How much money in all?




How can we make the concept of rate, e.g. \$ per gallon, concrete?







How can we effectively introduce the topics perimeter and area for a rectangle?



- A. Show the formula
- B. Show a rectangle
- C. Have students count sides of a rectangle

I gave the students pieces to build a fence for their animals



L

$$P=2L+2w$$

Adding + and Multiplying *

7th grader with autism who loves cars

Units of Area and Volume

Area and Volume Activities

Area

- Count the number of squares in the taped off area.
- Area =

--	--

 Squares Units
- Measure the sides of a square using a ruler.
- Write in the unit in the squares on your paper →

Volume

- Count the number of cubes that fit into the box.
- Volume =

--	--

 Squares Units

Length, area and volume units

Length	Area	Volume
	$A(6) = 24 \text{ Squares}$ (4x3)	

Carl and Beneta are playing a game using this spinner.



Carl will win the game on his next spin if the arrow lands on a section labeled 6, 7, or 8.

Carl claims 6 is likely, but not certain, that he will win the game on his next spin.



How can we make the concept of **likely** concrete

5th grader with anxiety who loves horses



10 barns make a ranch



Summary

- Math is a language with its own symbols
- The symbols represent concepts
- Make the language and the symbols meaningful
- Strategies:
 - Highlight the parts of the topic
 - Make the concept relevant
 - Make the concept more concrete
