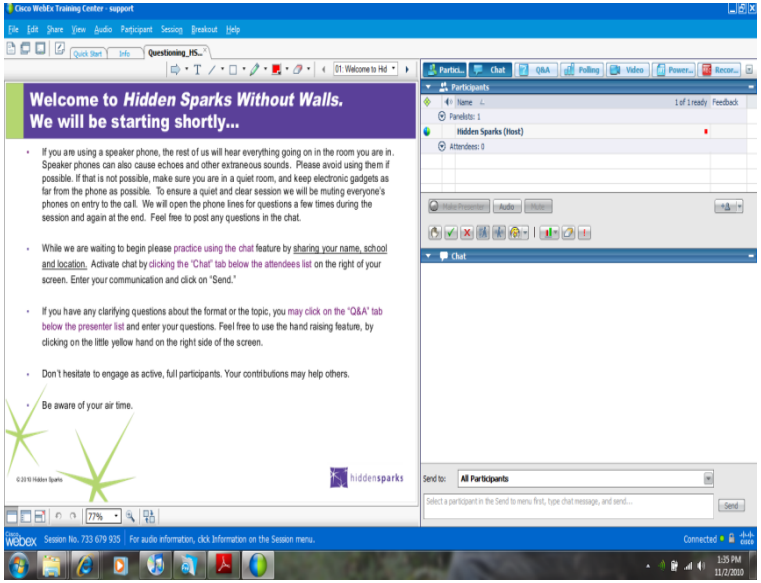
Welcome to Hidden Sparks Without Walls. We will be starting shortly…

To alleviate background noise and ensure a quiet session, your phones have been automatically muted. Questions and comments can be submitted via the **CHAT FEATURE**.



While we are waiting, activate the chat feature by clicking in the "Chat" tab that is located below the attendees list on the right of your screen.

- **When chatting, please remember:**

Select "**All Participants**" if you would like everyone to see your message. Select "**All Panelists**" if you would like only the presenter and facilitator to see your message.

If you have any clarifying questions about the format , or the topic, you may click on the "**Q&A**" tab located below the presenter list and enter your questions.

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About Hidden Sparks

Hidden Sparks is a non-profit whose purpose is to help children with learning differences reach their full potential in school and life. Hidden Sparks develops and supports professional development programs for Jewish day schools to help increase understanding and support for teaching to diverse learners.

Guided by a philosophy that helping schools meet the needs of children with learning and behavioral differences will ultimately benefit all students, Hidden Sparks' programs combine professional development in learning and positive behavioral support, guided classroom observation and one on one coaching. The Hidden Sparks model and program is currently in 45 Jewish Day Schools/Yeshivot in NY, NJ, Baltimore and Chicago.

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The Math/Brain Connection: Using Cognitive Research to inform instruction for Struggling Learners

With Hollis Dannaham

January 6, 2016

hiddensparks®
helping children reach their potential™

Our Guest: Hollis Dannaham

Hollis Dannaham, M.Ed., is a Hidden Sparks External Coach, a mentor to new Internal Coaches, and a regional meeting facilitator. She has been empowering complex learners for 30 years as a learning specialist, special educator, administrator, and consultant in public, private, and charter schools. Hollis created Transform Boundaries, an organization dedicated to helping schools create programs and creative solutions for reaching their complex learners. She served as the Director of Academic Intervention at Explore Charter School and co-created the Carmel Alternative High School for at-risk teens. Hollis also worked as a learning specialist at the Student Success Center of All Kinds of Minds. It is Hollis' passion to understand the unique cognitive underpinnings of each learner's triumphs and challenges to create more targeted interventions and solutions to facilitate joyful learning and student success.

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Overview of the Session

In this webinar you will…

- ***Experience a variety of math problems (have pencil and paper ready)***
- ***Look at the cognitive pathways that are required to successfully complete each type of problem***
- ***See what a student who struggles with a particular pathway looks like in your classroom***
- ***Learn strategies you can use to support students in math***

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Session Goals

- To identify and intervene early when students struggle with number sense
- To be able to use observable behaviors in math class to better understand a student's strengths and weaknesses
- To recognize which cognitive pathways are required to perform a particular task in math
- To utilize a variety of strategies to support struggling math students

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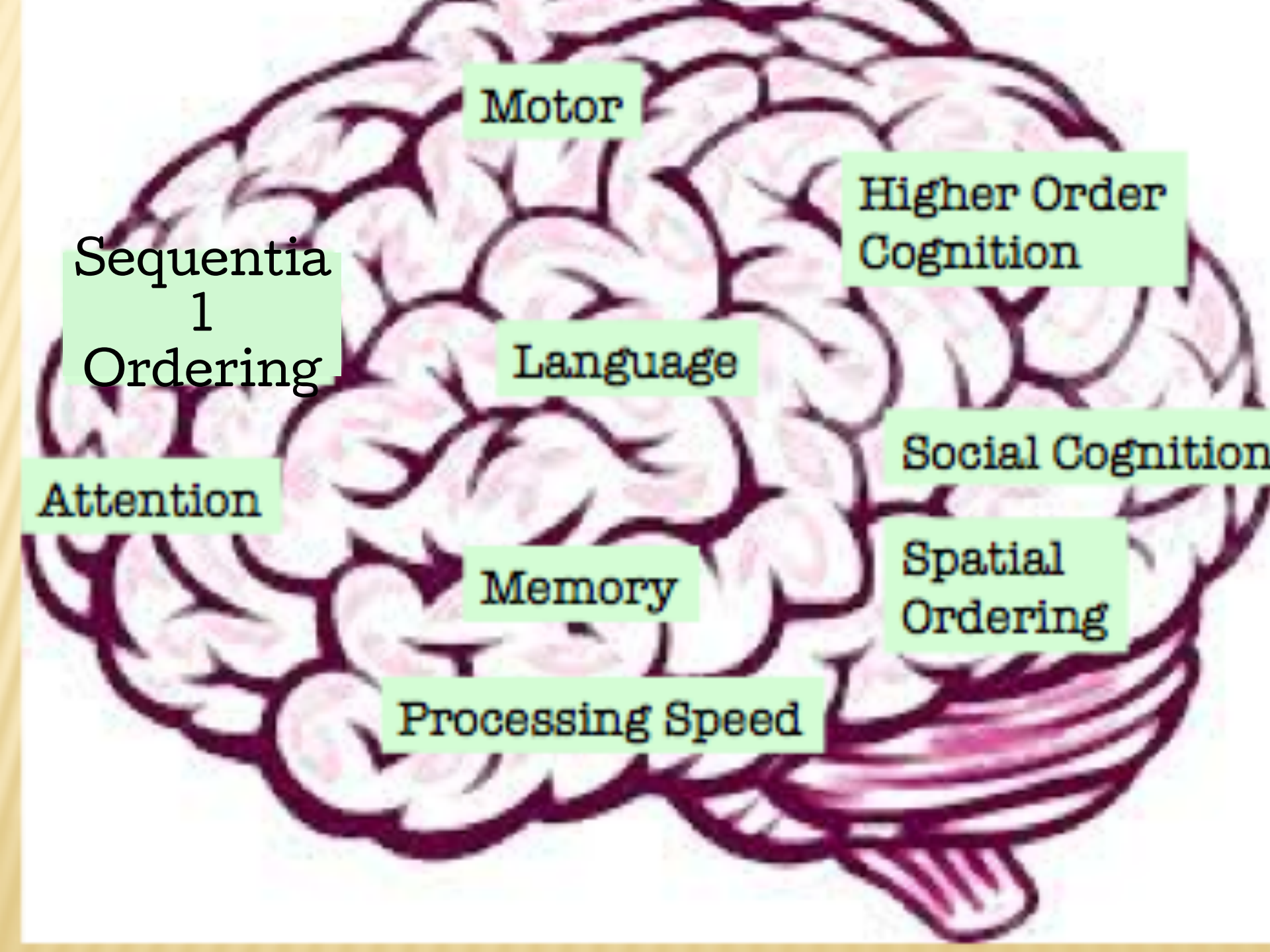
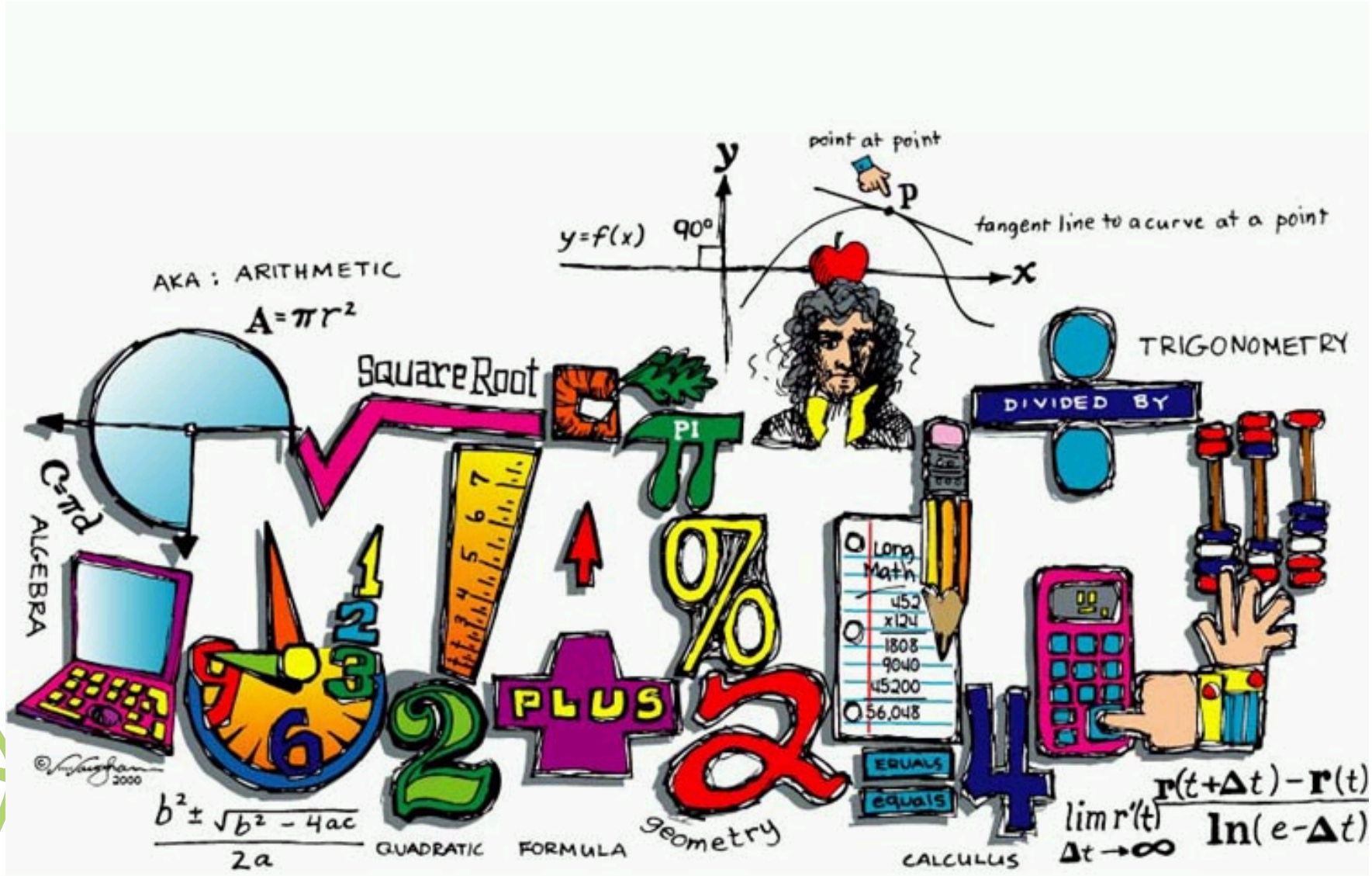

Motor
Higher Order Cognition
Sequentia 1 Ordering
Language
Social Cognition
Attention
Spatial Ordering
Memory
Processing Speed

MATH


AKA : ARITHMETIC
$A=\pi r^2$
Square Root
PI
$C=\pi d$
ALGEBRA
TRIGONOMETRY
DIVIDED BY
point at point
P
tangent line to a curve at a point
$y=f(x)$
90°
y
x
Long Math
452
x124
1808
9040
45200
56,048
EQUALS
equals
PLUS
$\frac{b^2 \pm \sqrt{b^2-4ac}}{2a}$
QUADRATIC FORMULA
geometry
CALCULUS
$\lim_{\Delta t \to \infty} r'(t)$
$\frac{r(t+\Delta t)-r(t)}{\ln(e-\Delta t)}$
©2000

Simulation from Misunderstood Minds

0	**1**	**2**	**3**
1	2	3	4
2	3	4	5
3	4	5	6

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Simulation from Misunderstood Minds

0	1	2	3
1	2	3	4
2	3	4	5
3	4	5	6

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Simulation from Misunderstood Minds

Use the addition and multiplication tables and sample equations below to solve the following problems.

Addition Table

0	1	2	3	4	5
1	2	3	4	5	10
2	3	4	5	10	11
3	4	5	10	11	12
4	5	10	11	12	13
5	10	11	12	13	14

Multiplication Table

0	1	2	3	4	5
1	1	2	3	4	5
2	2	4	10	12	14
3	3	10	13	20	23
4	4	12	20	24	32
5	5	14	23	32	41

Problems*:*

1. 11
   +11

2. 21
+ 3

3. 223
+15

4. 4522
+2540

5. 5230
+3423

6. 3
x 2

7. 12
x 5

8. 24
x13

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Answers

Problems:

1. 11 + 11 = **22**

2. 21 + 3 = **24**

3. 223 + 15 = **242**

4. 4522 + 2540 = **11502**

5. 5230 + 3423 = **13053**

6. 3 x 2 = **10**

7. 12 x 5 = **104**

8. 24 x 13 = **400**

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What got in your way?

- **Lack of automaticity**
  - Processing Speed
  - Ordering Systems
  - Memory

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Processing Speed - Observable Behaviors

- Lack of automaticity
- Knows math facts but can't access them quickly
- Does poorly on minute math sheets
- Student takes longer on tests/assignments (can do the problems accurately when given more time)
- Slow to complete assignments in all subjects

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Processing Speed - Strategies

- Flash Cards
- Practice, practice, practice
- Fact fluency motivational charts
- Extra time
- Less problems to complete

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The Ordering Systems: Recent Research

Spatial Ordering + Sequential Ordering = Number Sense

Numeracy is innate!

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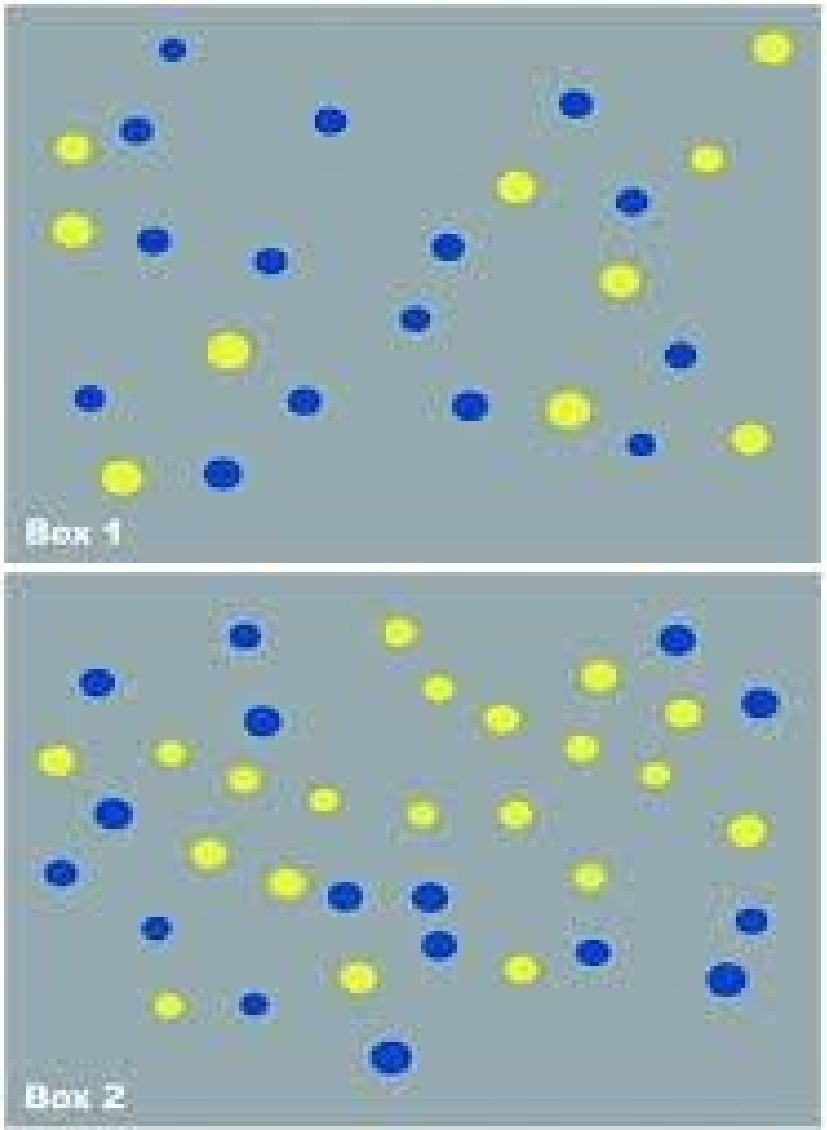
Spatial Ordering: Quantitative Understanding Number Sense



Example of Dyscalculia Test

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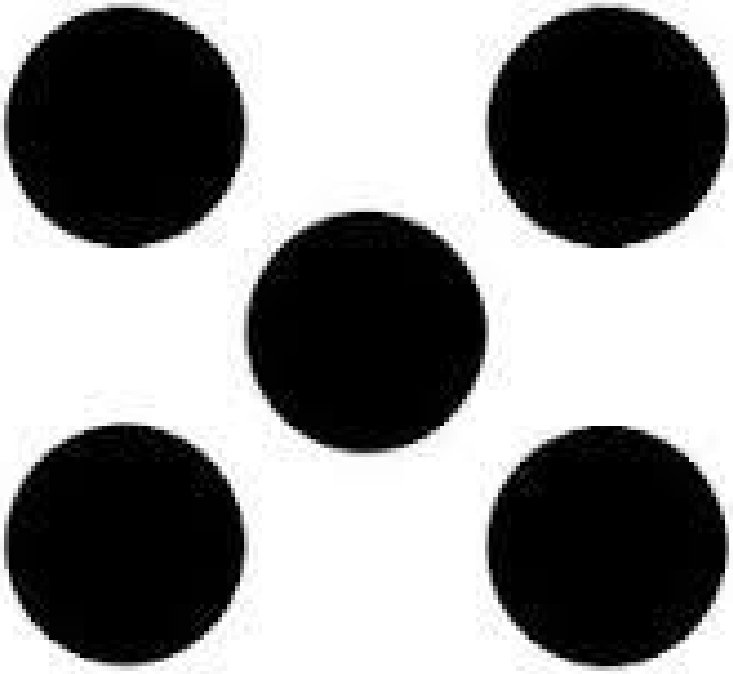
Spatial Ordering: Quantitative Understanding Number Sense



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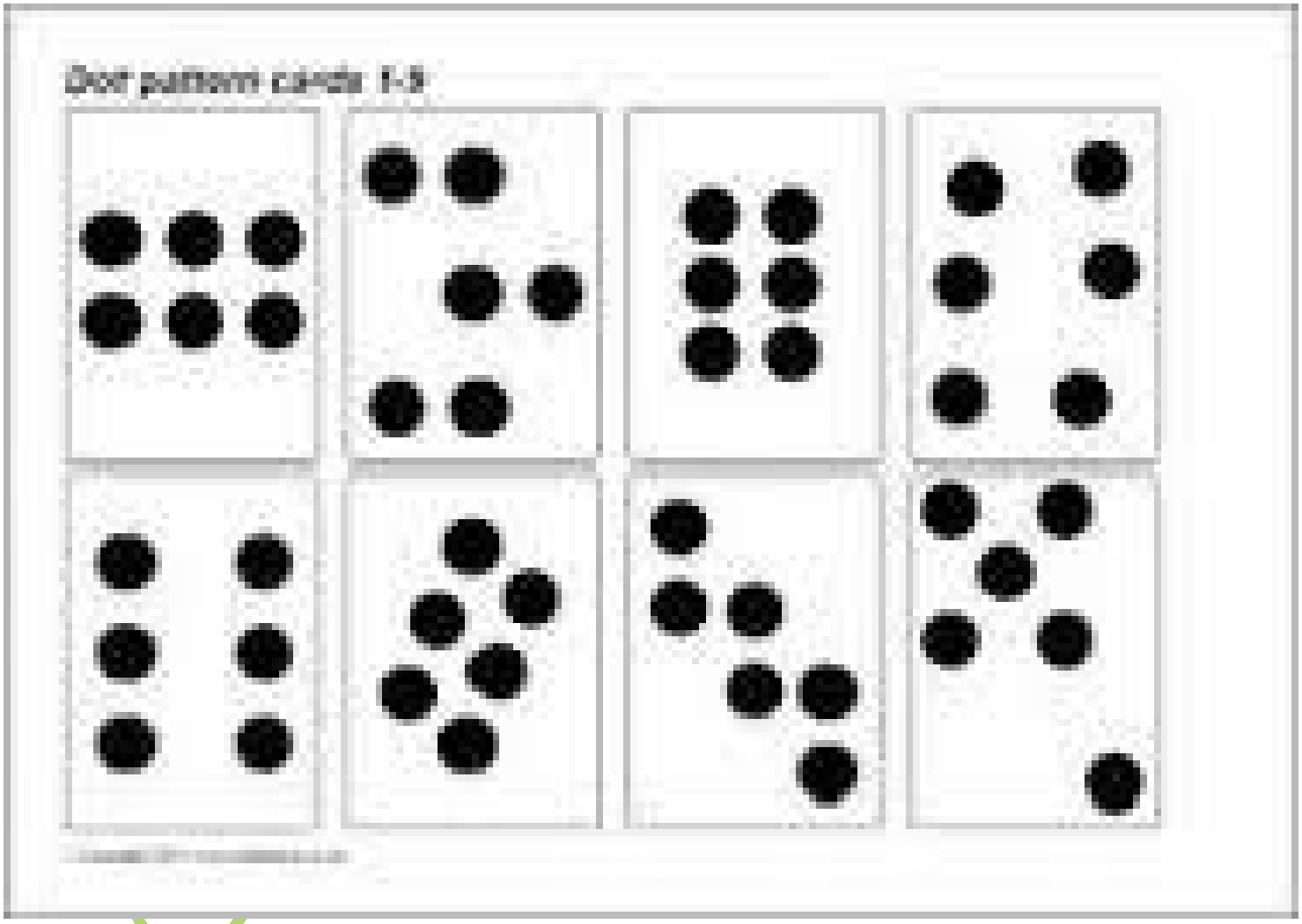

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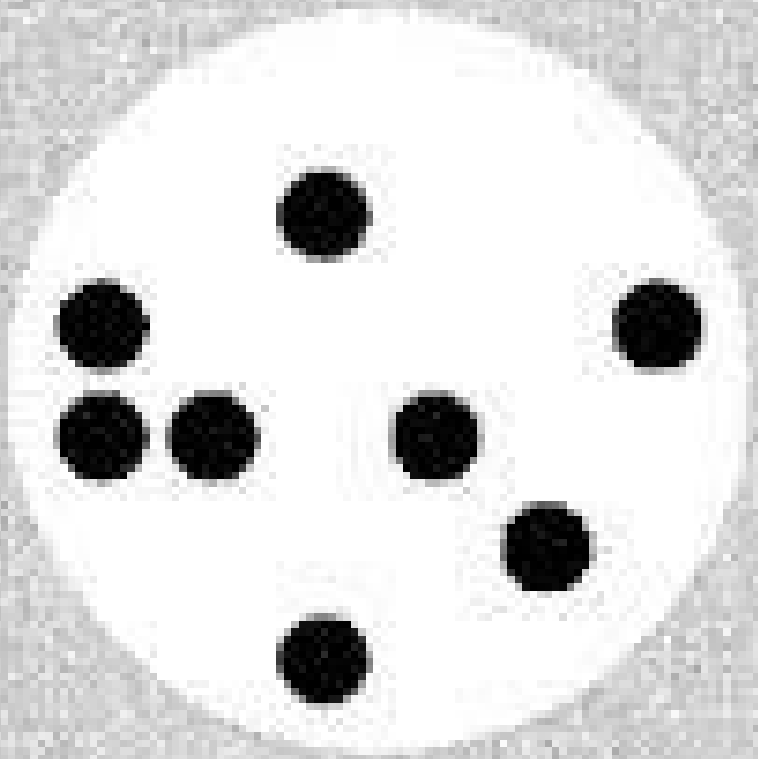
How many SPOTS are there, does this match the NUMBER?



8

Q W E R
A S D F
Z X C

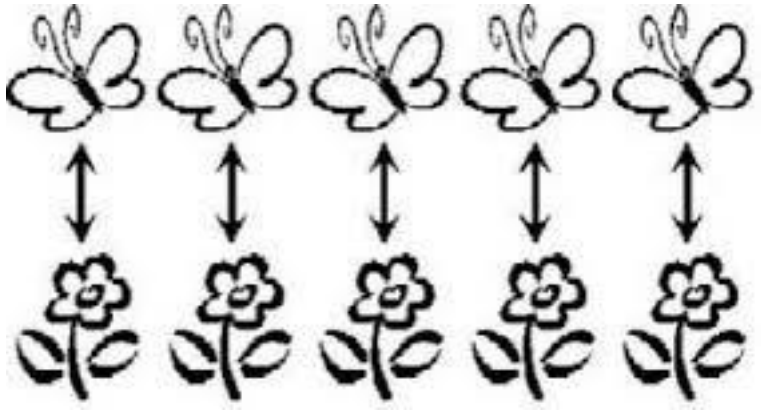
NO

YES

U I O P
J K L ;
N M ,

Ordering Systems: Observable Behaviors

- **Struggles with…**
  - naming numbers quickly and accurately
  - learning to count forwards and backwards
  - one-to-one correspondence
  - using efficient strategies for basic addition and subtraction
  - memorizing simple math facts
  - estimating
  - telling time
  - place value



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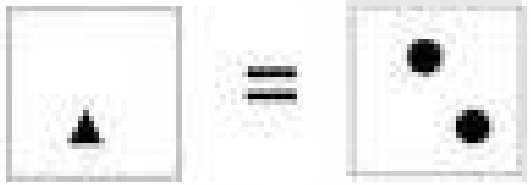
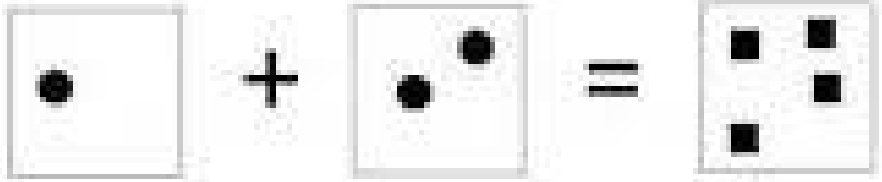
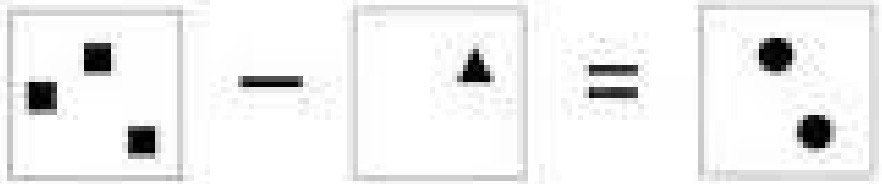
Work Samples



Number-matching



Addition



Subtraction

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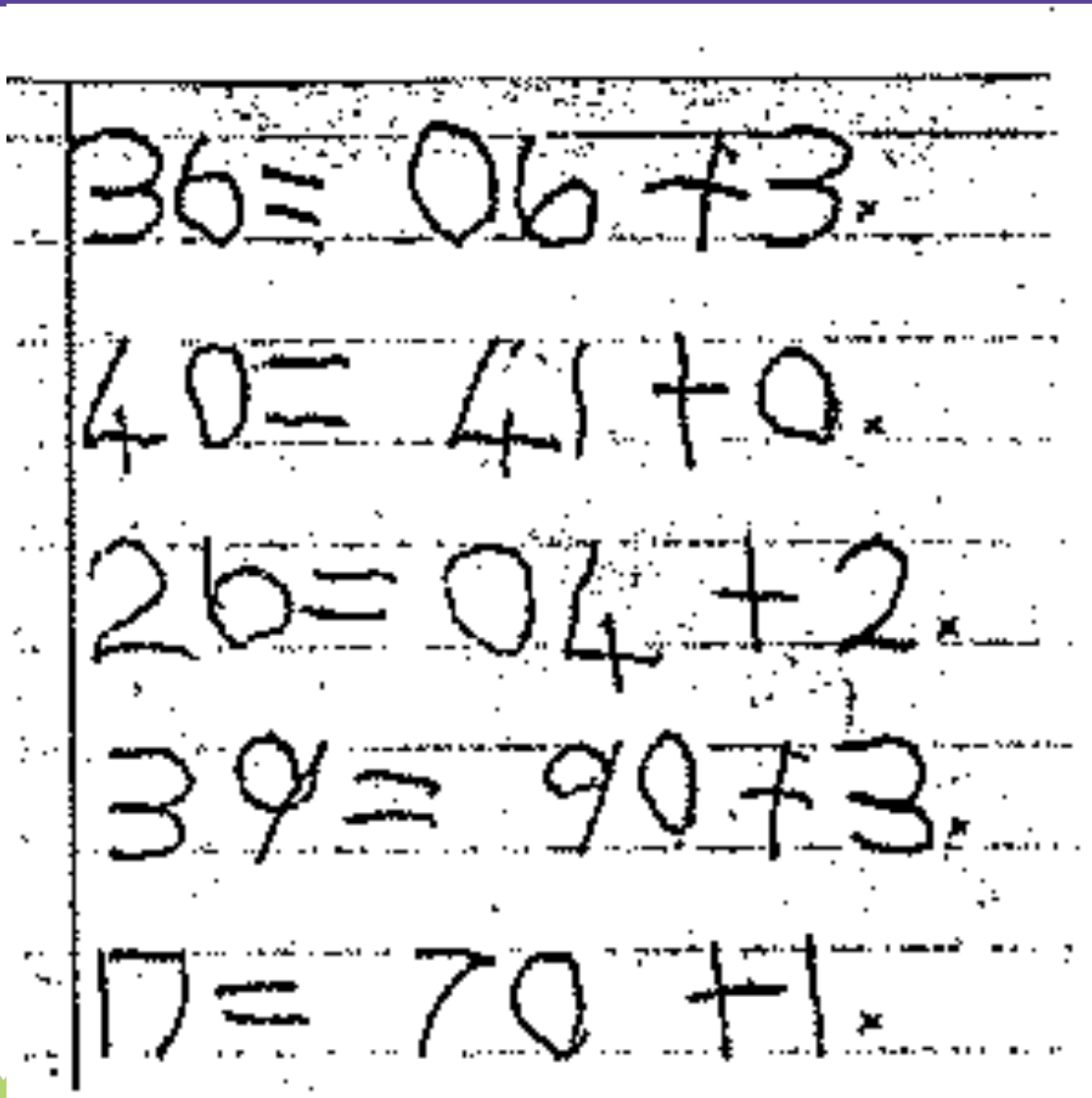
Work Samples



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Strategies

- **Pair numbers with objects**
- **Count at any opportunity**
- **Extend counting with other numbers** *(i.e.,101-110)*
- **Use finger patterns**
- **Plan estimation experiences** *(e.g., "How many shoes are in class today? Give me a number between forty and seventy.")*
- **Count-off in line**
  - lower grades count off each time in line
  - upper grades *(Have students count off when in line using a "quiet voice" but have each person who is a multiple of a certain number (say a multiple of five) say his or her number louder.)*
- **Stress numbers in other subjects**
- **Emphasize Measurement**
- **Chart making money** - *higher grades mock stock market*

From Differentiating Math Instruction: Strategies That Work for K-8 Classrooms Kindle Edition.

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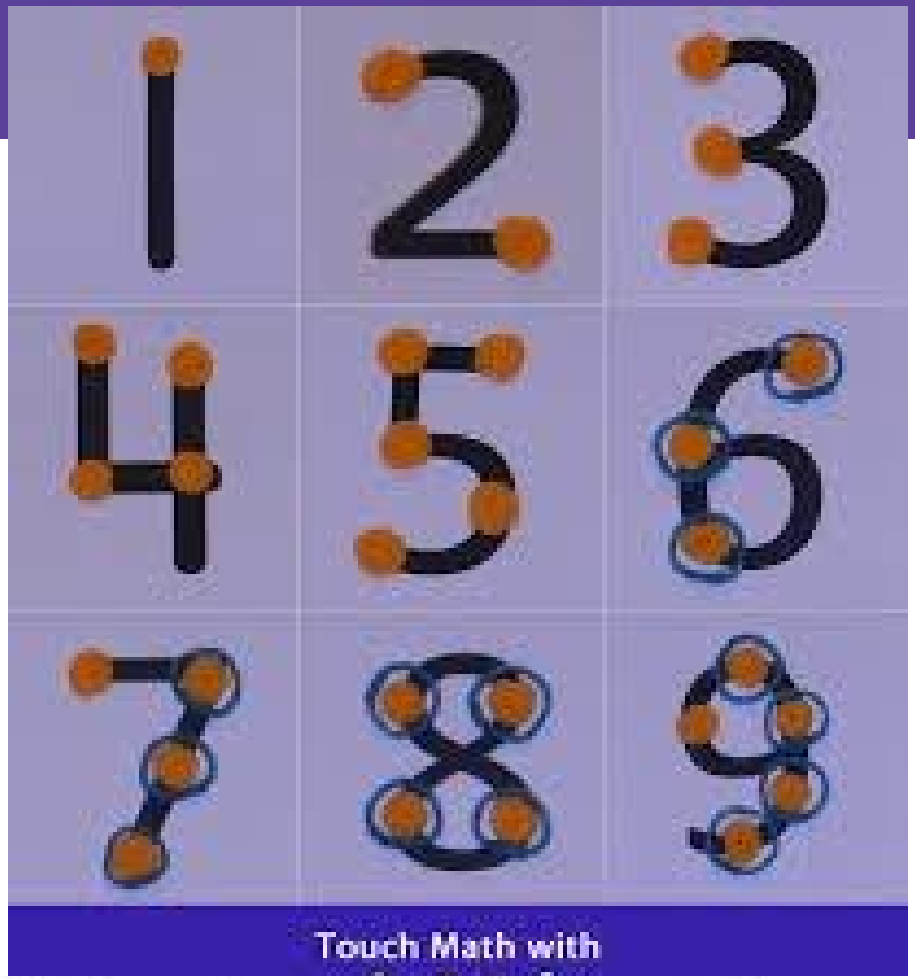
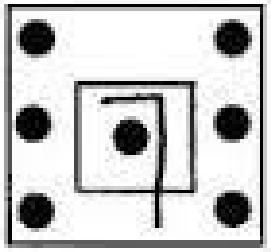
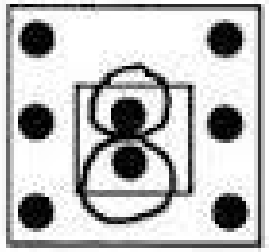
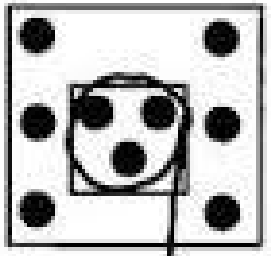
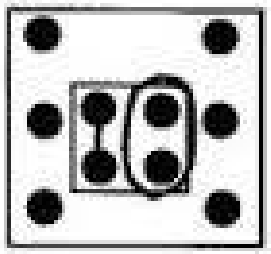
Strategies











Semple Math

Strategies

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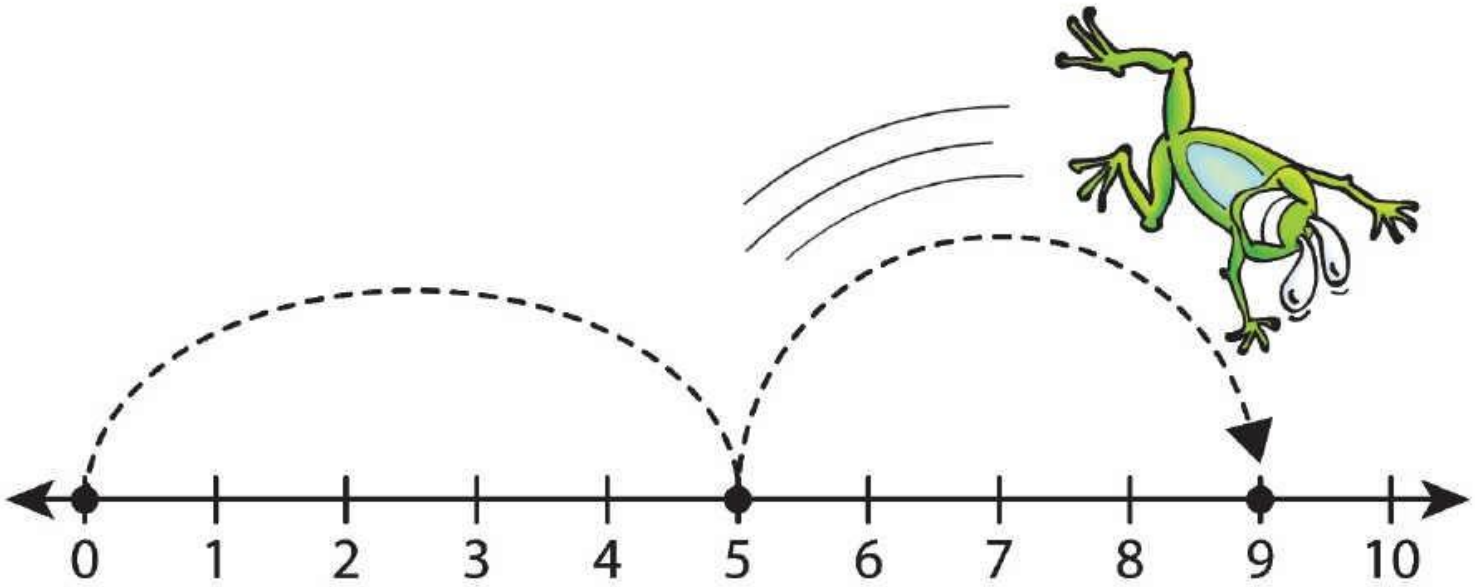
Strategies



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Strategies

12 X 12 Multiplication Table

X	0	1	2	3	4	5	6	7	8	9	10	11	12
0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	1	2	3	4	5	6	7	8	9	10	11	12
2	0	2	4	6	8	10	12	14	16	18	20	22	24
3	0	3	6	9	12	15	18	21	24	27	30	33	36
4	0	4	8	12	16	20	24	28	32	36	40	44	48
5	0	5	10	15	20	25	30	35	40	45	50	55	60
6	0	6	12	18	24	30	36	42	48	54	60	66	72
7	0	7	14	21	28	35	42	49	56	63	70	77	84
8	0	8	16	24	32	40	48	56	64	72	80	88	96
9	0	9	18	27	36	45	54	63	72	81	90	99	108
10	0	10	20	30	40	50	60	70	80	90	100	110	120
11	0	11	22	33	44	55	66	77	88	99	110	121	132
12	0	12	24	36	48	60	72	84	96	108	120	132	144

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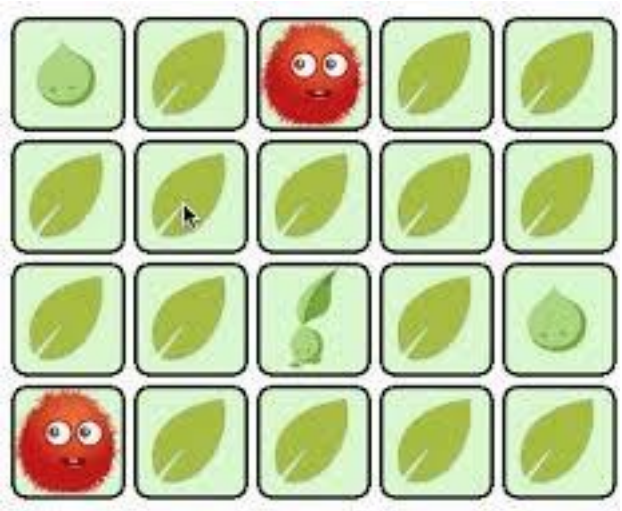
Memory - Long Term: Observable Behaviors

- **Paired Associate Memory**
  - Can't remember math facts 3x4=12
  - Lacks automaticity with math facts

- **Pattern Recognition/Method Transfer**
  - Struggles to remember previously learned patterns and procedures (e.g., mastered one day, brand new the next)
  - Difficulty remembering in the spring what they learned in the fall



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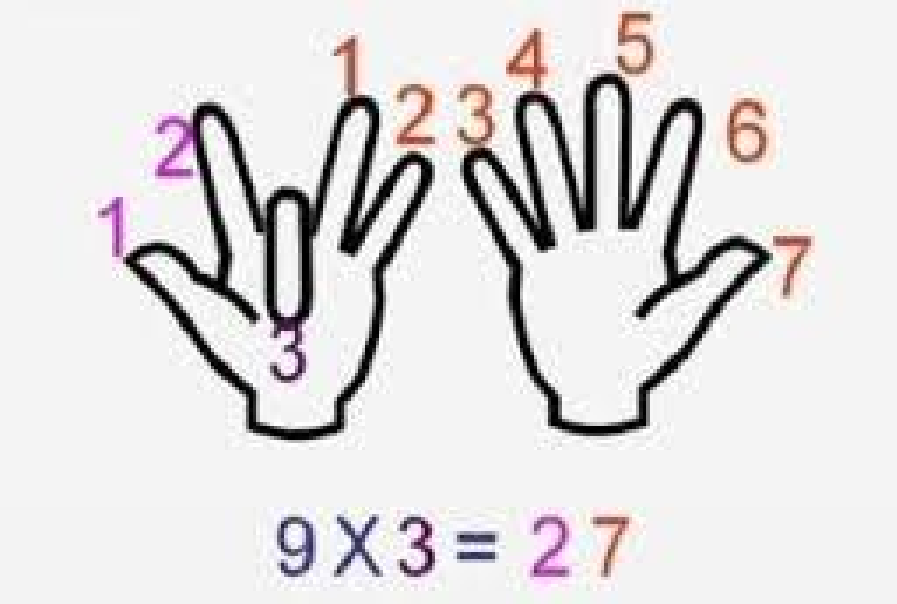
Memory - Long-Term: Interventions

- Flash Cards
- Math Fact Tricks, e.g, finger trick for 9's, 7x8=56 because 5, 6, 7, 8



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Memory - Long-Term: Strategies

- **Repetition and practice**
- **Apps/Web based programs**: http://www.edutopia.org/blog/10-apps-for-math-fluency-monica-burns, Reflex Math, Quick Math, Flashmaster
- **Math resource binder with examples of completed problems**
- **Calculator**

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Memory - Observable Behaviors

- **Active Working Memory:**
  - Knows math facts in isolation but can not apply them when problem solving
  - Loses her/his place in a long math problem
  - Can not follow multi-step directions (remembers the first step but not the steps that follow)
  - Struggles with mental math

- **Long-Term Procedural Memory:**
  - Struggles to remember mathematical procedures even with repetition

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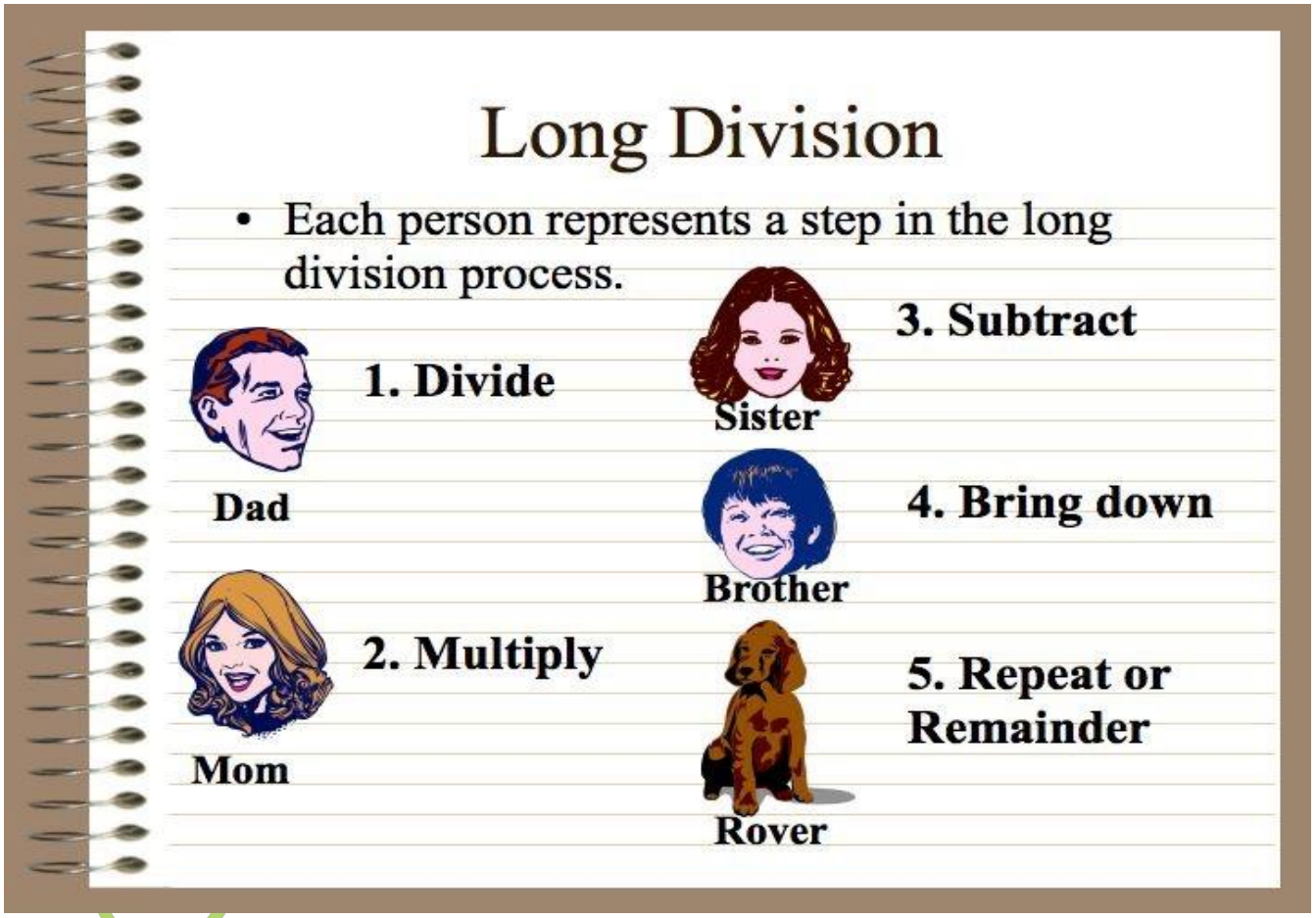
Memory - Active Working and Procedural: Strategies

- **Mnemonics e.g., Division Family, PEMDAS, FOIL**



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Memory - Active Working and Procedural: Strategies

- **Procedure Posters**
- **Procedure Checklists**
- **Procedure Resource Binder**
- **Break into one step at a time:**
  1. What the question is asking them to find
  2. Which information is necessary to answer the question
  3. Which operations should be used in solving the problem.
- **Provide fill-in-the-blank math procedures**
- **Songs, Chants, Raps**

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Simulation from Misunderstood Minds

Consider the two figures shown below.

What shape will result when the plane intersects the three dimensional object? **Select shape A or B.**

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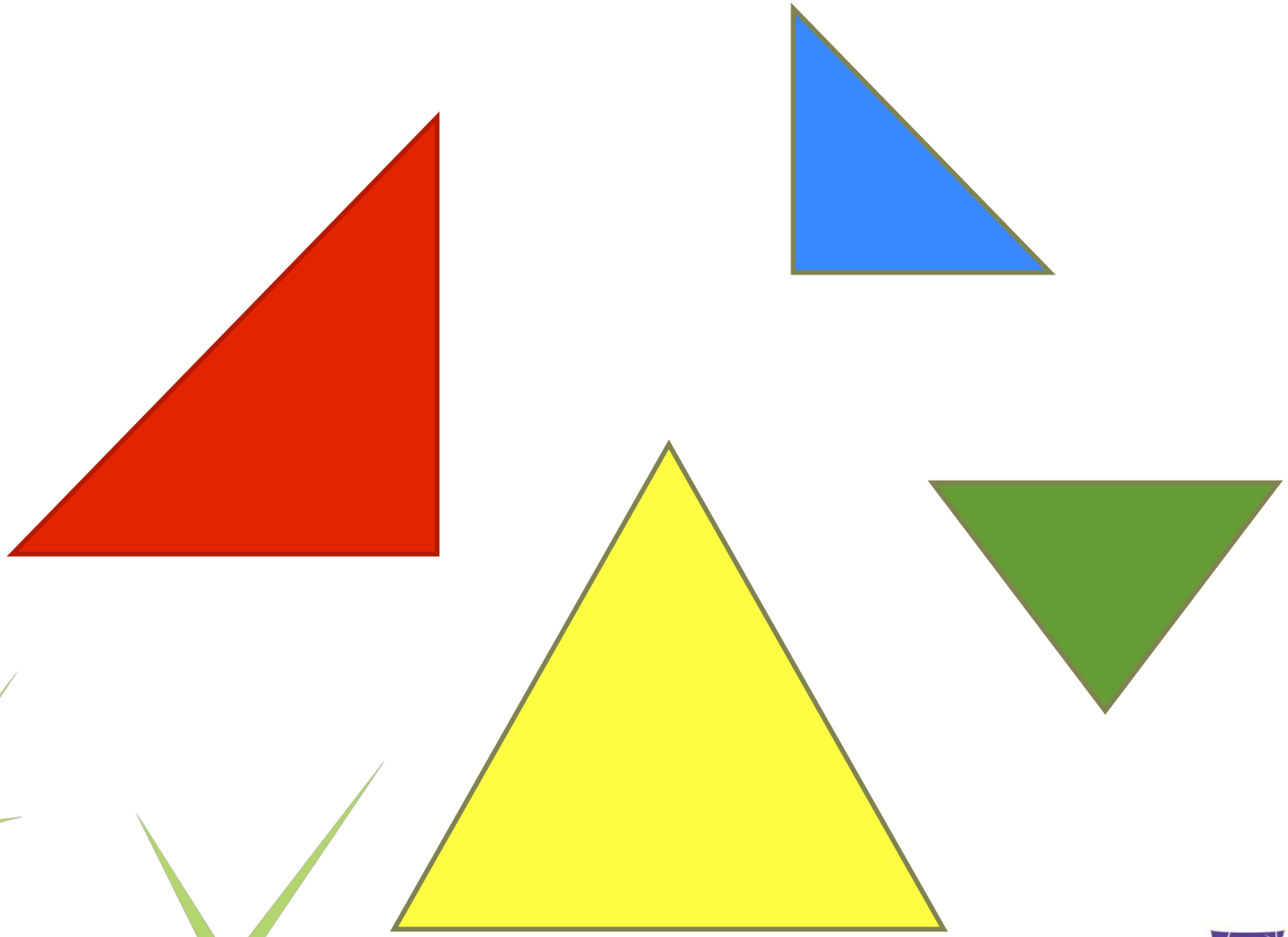
Spatial Ordering: Visual Perception/Object ID



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Spatial Ordering: Visual Perception/Object ID: Strategies

Triangle Checklist

- Closed Shape
- 3 Sides
- 3 Corners/angles

Songs, Chants, Raps

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Regular polygons

From: A Maths Dictionary for Kids by Jenny Eather at www.amathsdictionaryforkids.com

Regular polygons	No. of sides and vertices	No. of angles	Size of interior angles	No. of lines of symmetry	Order of rotational symmetry	No. of diagonals
equilateral triangle	3	3	60°	3	3	0
square	4	4	90°	4	4	2
pentagon	5	5	108°	5	5	5
hexagon	6	6	120°	6	6	9
heptagon	7	7	128.6°	7	7	14
octagon	8	8	135°	8	8	20
nonagon	9	9	140°	9	9	27
decagon	10	10	144°	10	10	35

dodecagon - 12 sides pentadecagon - 15 sides
icosagon - 20 sides hectogon - 100 sides
A hectogon looks like a circle except at very high magnification.

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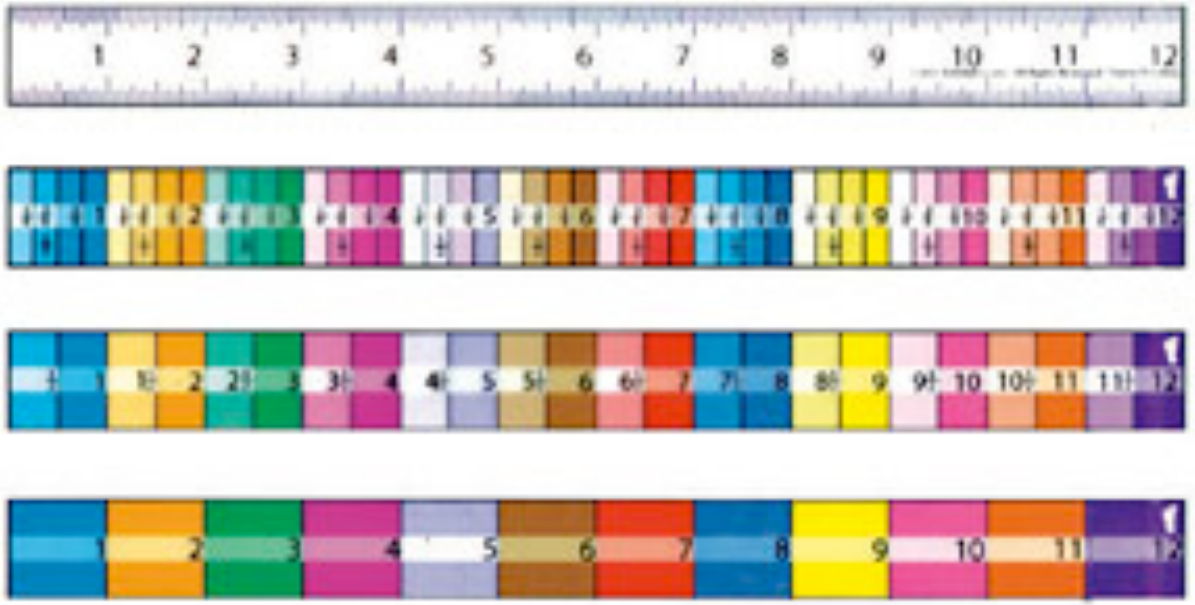

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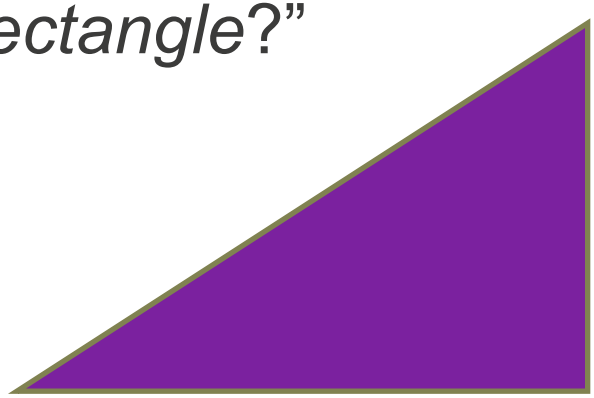
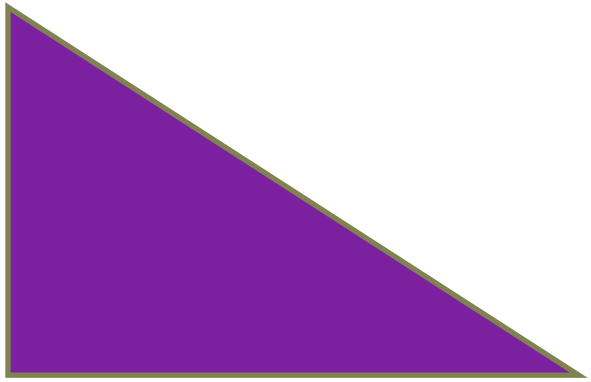
Spatial Ordering: Mental Rotation

- CCSS.Math.Content.K.G.B.6 Compose simple shapes to form larger shapes. *For example, "Can you join these two triangles with full sides touching to make a rectangle?"*





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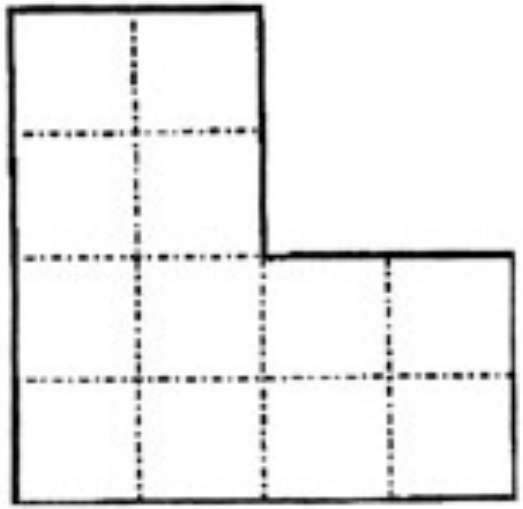
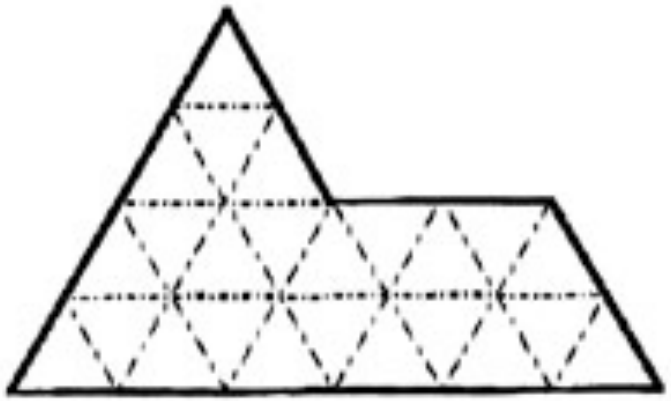
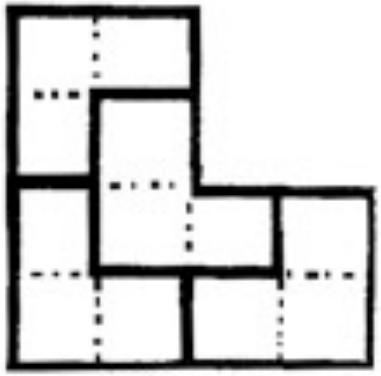
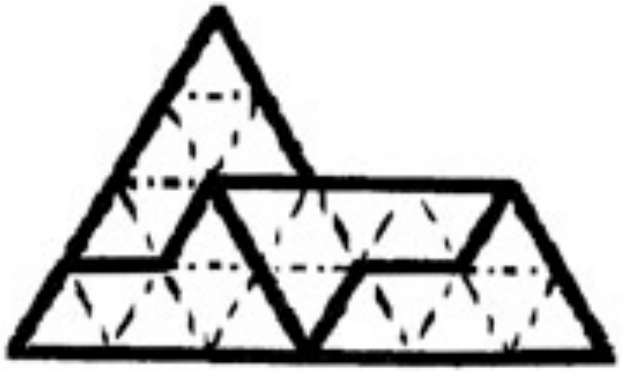




Solutions:





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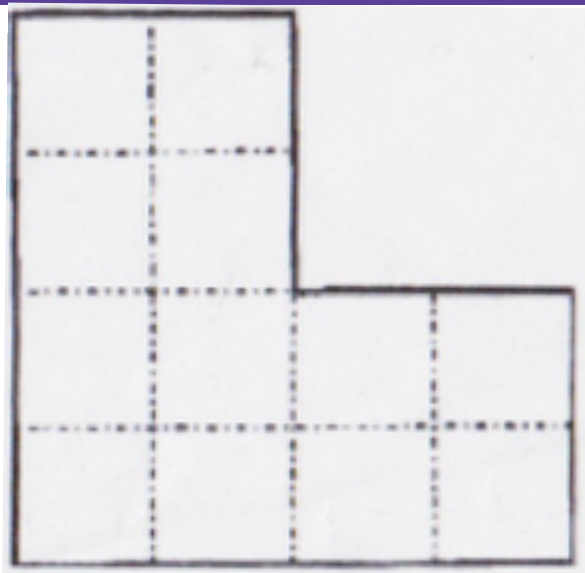

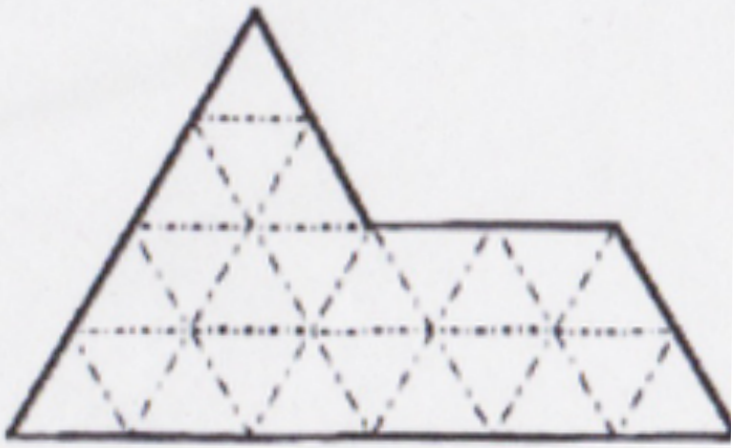

Solutions:

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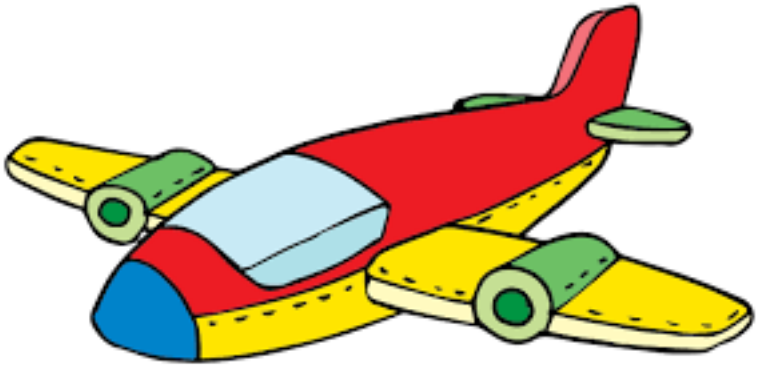
Solve the following problem:

Frank wants to become an actor in Hollywood, but he needs money to travel from Green Bay, WI. He can fly for $225 or he could drive his car. His car contains a 17gallon gas tank. His car gets 30 miles per gallon. It is 2,000 miles from Green Bay to Hollywood. The price of gas is $3.00 a gallon. Would it be cheaper for him to fly or drive?



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What did you need to answer this problem?

1) To be able to read and understand the problem - **Language**
2) To be able to attend to the details of the problem and discard extraneous information - **Attention**
3) To reason through and use problem solving strategies to find the answer - **Higher Order Cognition**
4) To hold onto all the information in your mind as you worked with it - **Active Working Memory**
5) To do the arithmetic - (**ordering systems, processing speed, memory**)

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Language: Observable Behaviors

- Struggles to decode the directions or the word problem
- Struggles to understand instructions or word problems
- Can’t understand what the question is asking
- Does not understand math content vocabulary

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Language: Strategies

Decoding:

- Read problem out loud to the student
- Reading Pen, http://www.wizcomtech.com/
- Have word problems recorded ahead of time for student to listen
- Peer reader

Understanding:

- Teach key words, e.g, altogether means add
- Math Word Wall
- Math Personal Dictionary
- Have students rephrase the directions before starting
- Provide language intervention
- Step by Step Model Drawing

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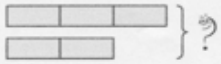
Step-by-Step Model Drawing

1. **Read** the Entire Problem.

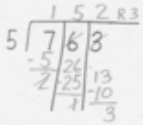
2. **Rewrite** the question in sentence form leaving a blank for your answer.

3. Determine **who** and/or **what** is involved.

4. **Draw** the unit bar(s).



5. **Chunk** the problem, **adjust** the unit bars, and fill in the **Question mark**.



6. Correctly **compute** and solve the problem.

7. **Write** the answer in the sentence, and make sure that the answer makes **sense**.

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Attention: Observable Behaviors

- Makes inconsistent inadvertent errors
- Mixes up operations (adds when should subtract and visa versa)
- Can not pull out the salient information from a word problem to solve it
- Struggles to maintain focus on longer problems

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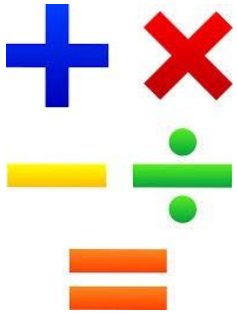
Attention: Strategies

- Highlight calculation signs in different colors
- Teach key words and highlight the key words before starting to solve
- Make an exercise out of just deciding on how to solve the problem vs. actually solving it
- Change pen color when finished to go back as a problem checker, allow the use of a calculator for this task
- Tell student ahead of time when a problem will require a long concentration period - provide motivation for staying focused for the entire procedure (e.g., reward, break, privilege)



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Higher Order Cognition: Observable Behaviors

- Struggles to categorize shapes (e.g., number of similar figures, or equilateral versus isosceles triangles).
- Struggles to understand math concepts (e.g., prime numbers, polygons, supplementary angles, etc.)
- Depends completely on rote memory
- Struggles to identify patterns and relationships
- Has a hard time justifying an answer
- Often faces a problem and does not know what to do
- Struggles to reason through when the answer is not immediate
- Specifically struggles with percentages and fractions due to a lack of proportional thinking
- Specifically struggles with analogical reasoning (e.g., *x* is to *y* as *a* is to …)
- Demonstrates a random, unsystematic approach to problem solving

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Higher Order Cognition: Strategies

- Constructivist activities
- Stepwise approach
- Provide multiple modes of practice
- Opportunities to connect math concepts with familiar situations (height of a classmate, weight of their book, percentages with a shirt on sale.)
- Creating opportunities for discussions of potentially conflicting ideas and have students justify their thinking
- Math Playground, http://www.mathplayground.com/algebraic_reasoning.html
- Explicitly teach problem Solving Strategies, ie., TIPS: **T**hink (read and paraphrase), **I**nformation (what numbers and information do you need in order to solve the problem), **P**roblem (write equation), **S**olve.

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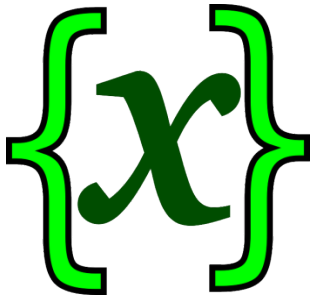
Algebra:

Sara sells necklaces for $50 each. She sells 40 necklaces in a month at this price. If she applied a 10% discount to the price of her necklaces, she would sell an additional 10 necklaces in a month. How much additional money would Sarah make in sales if she sold her necklaces with the 10% discount for a month?

40 (necklaces sold) x $50 (price per necklace) = $2000 earned



- *Language*
- *Processing Speed*
- *Ordering Systems*
- *Memory - Active Working, procedural, sequential, long-term*
- *Higher Order Cognition*
- *Neuromotor*
- *Attention*

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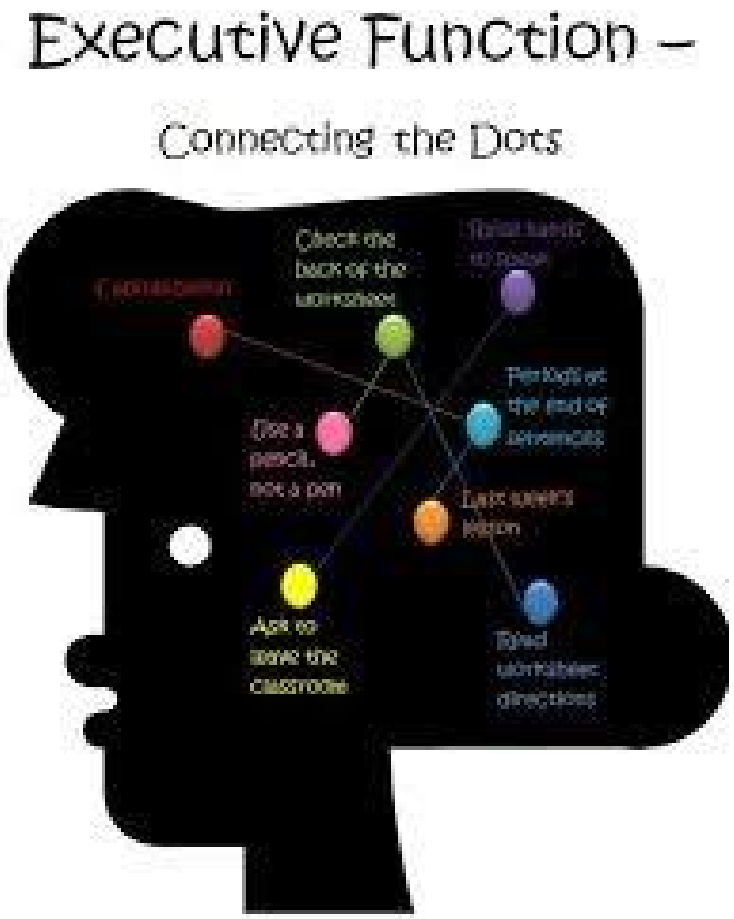
Executive Functions

- Activating to Work
- Focus
- Effort
- Modulating Emotions
- Utilizing Working Memory and Recall
- Monitoring and Self Regulating Action



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In Summary

- We can now identify a student who is prone to dyscalculia early and intervene early.
- A variety of cognitive processes are required to complete mathematical tasks.
- The types of cognitive processes required are based on the type of task.
- Look for patterns of strength and struggle to pinpoint breakdowns and target support.
- Provide intervention to remediate struggles.
- Provide structures and tools to bypass struggles.
- Use and celebrate strengths.

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Upcoming Hidden Sparks Without Walls Sessions

Tues. 2/9/2016	For Parents and Teachers Balancing Love and Limits with Your Teen: Effective Strategies for Parents – Dr. David Pelcovitz
Tues. 2/23/2016	For Teachers *Planning Judaic Studies Lessons for all Learners: How Understanding Neurodevelopment Helps you Reach all Students - Dr. Tamar Bauman*

If you are interested in bringing Hidden Sparks to your school or city, please contact us at: 212-767-7707 or sara@hiddensparks.org

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