



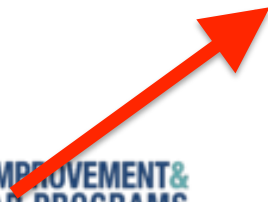
# Mathematics in 2016 and Growth Mindset

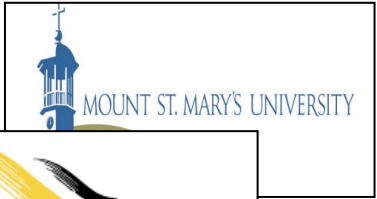
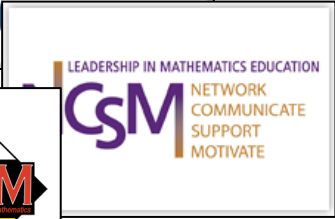


John SanGiovanni

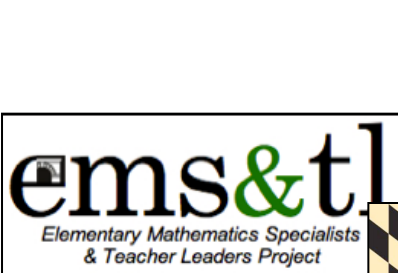
Coordinator, Elementary Mathematics

## What is your favorite number?





5



# Eliminate It!!

Which would you eliminate and why?

meter	quart
liter	milliliter

O'Connell and SanGiovanni (2013)

# Eliminate It!!

Which would you eliminate and why?

21	63
17	84

O'Connell and SanGiovanni (2013)

When you think about your  
experience in math class,  
what **words** come to mind?

Should we put down what we think is right, or what we think you think is right?



2028

65%\*

2080

# So...What's the big deal?

We are currently  
preparing students for  
jobs that  
exist

using technologies  
that haven't  
invented

to solve problems that  
we don't even know  
are problems yet.





# Fortune 500 Most Valued Skills

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## 1970

1. Writing
2. Computational skills
3. Reading skills
4. **Oral communication**
5. **Listening skills**
6. **Personal career development**
7. **Creative thinking**
8. **Leadership**
9. **Goal setting**
10. Teamwork
11. Organizational effectiveness
12. Problem solving
13. Interpersonal skills

## 1999

1. Teamwork
2. Problem solving
3. Interpersonal skills
4. **Oral communication**
5. **Listening skills**
6. **Personal career development**
7. **Creative thinking**
8. **Leadership**
9. **Goal setting**
10. Writing
11. Organizational effectiveness
12. Computational skills
13. Reading skills

In other words...

We must prepare them for **their future** rather than our past.



# The Impact on Teaching and Learning...

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What is the capital of Maryland?

Why was Annapolis a good choice for the capital of Maryland?

If Maryland was to move the capital in 2017 what city or location would be a good choice?

# Leverage Understanding

## Procedural

$$\frac{2}{7} \bigcirc \frac{3}{5}$$

$$\frac{14}{18} \bigcirc \frac{14}{20}$$

$$\frac{13}{14} \bigcirc \frac{15}{16}$$

Find common denominators

Cross multiply  
(bow-tie,  
butterfly, the x)

## Conceptual

$$\frac{2}{7} \bigcirc \frac{3}{5}$$

Compare to  $\frac{1}{2}$

$$\frac{14}{18} \bigcirc \frac{14}{20}$$

Same number of pieces

$$\frac{13}{14} \bigcirc \frac{15}{16}$$

Size of pieces

# Applying Comparing Fractions

The table group with the most marbles at the end of the month earns a prize. Which group won this month?

Table Groups	Amount of Marbles
Group 1	$\frac{5}{12}$
Group 2	$\frac{3}{8}$
Group 3	$\frac{1}{4}$
Group 4	$\frac{2}{5}$
Group 5	$\frac{6}{10}$
Group 6	$\frac{2}{3}$



# Thinking vs Getting Answers

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# What This Means for Math

# Myths

- Knowing facts is the most important idea in K-5.
- Good math students know their facts.
- Boys are better at math.
- I always have to show my work to get it right.
- Faster is better.

# Facts

- Understanding isn't forgotten.
- Experience and exposure develops fluency.
- Advanced students may not know be quick.
- Fact recall is a leading cause of math anxiety.
- Understanding numbers enables the student to focus on new ideas.



# Other Myths that Cause Problems: “Tricks” and “Always Rules”

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- Use keywords to solve word problems.
- You cannot take a bigger number from a smaller number.
- Addition and multiplication make numbers bigger.
- Subtraction and division make numbers smaller.
- We must reduce the fraction.
- The longer the number, the larger the number.
- And hundreds more... math ISN'T magic.

# Use keywords to solve word problems.

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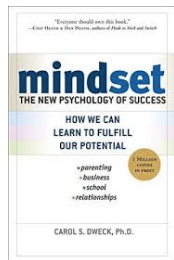
The clown gave my little brother 7 red balloons and some green balloons. **Altogether** my brother got 13 balloons. How many green balloons did he get?

# Facts about Learning Mathematics: Mindset

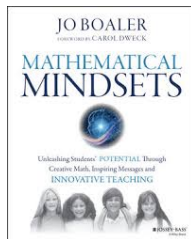
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## Fixed Mindset

- Understanding, proficiency, ability are “set”
- You are good at something or you aren’t



Dweck, 2008



## Growth Mindset

- Understanding, proficiency, ability are developed regardless of your genes
- You become better at something as you work with it – as you struggle with it

# Fact: Anyone Can Learn at High Levels

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- There is no such thing as the math gene.
- Brains can grow and change.



# Fact: Mistakes Grow Your Brain

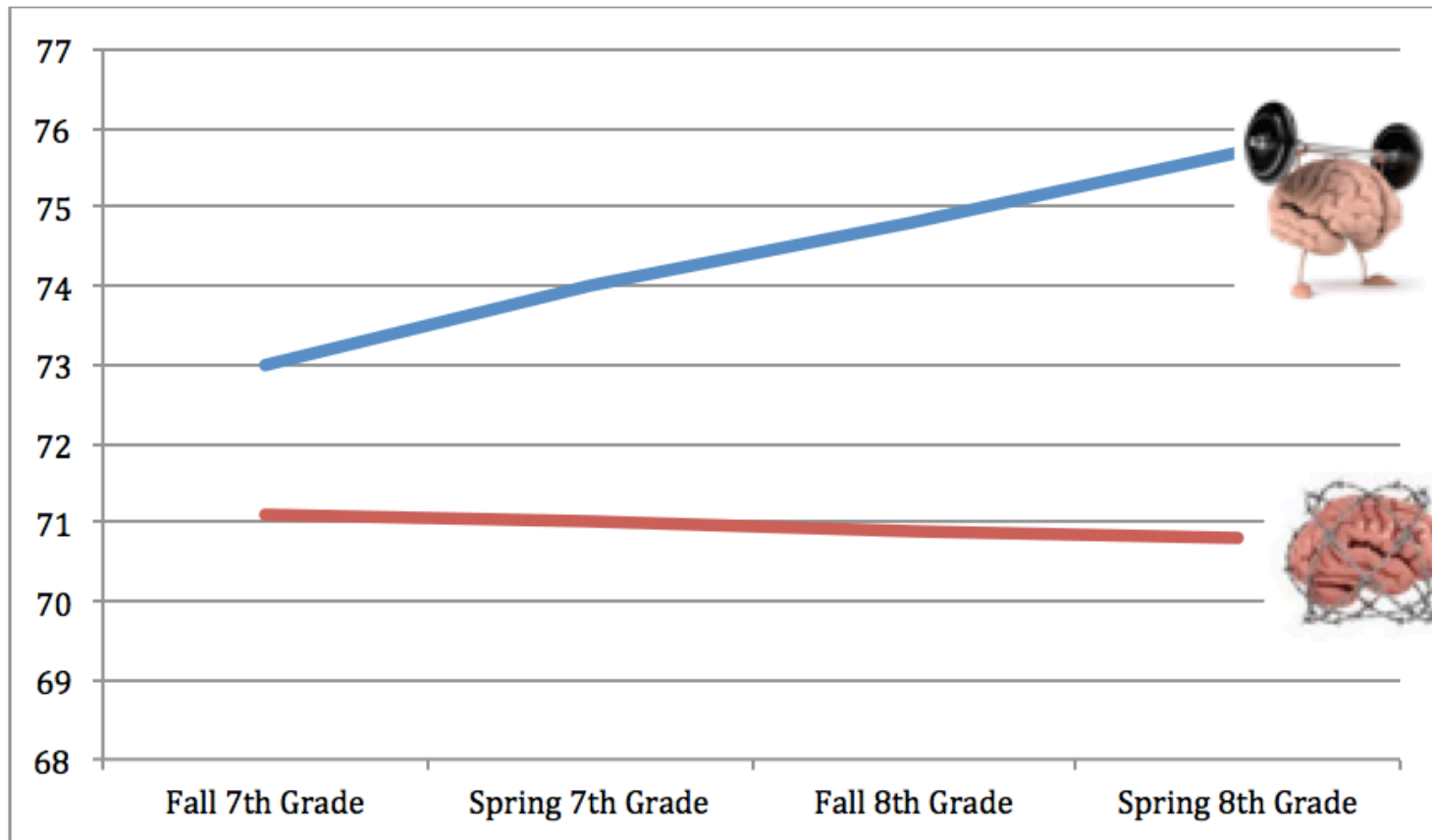


# Fact: When You Believe in Yourself Your Brain Operates Differently

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- Students with a fixed mindset are more likely to give up easily, whereas students with a growth mindset are persistent and keep going even when work is hard.

# Fact: When You Believe in Yourself Your Brain Operates Differently



Blackwell et al., 2007

Boaler, 2016

 **youcubed**  
at Stanford University

# Fact: Speed and Time Pressures Block Memory

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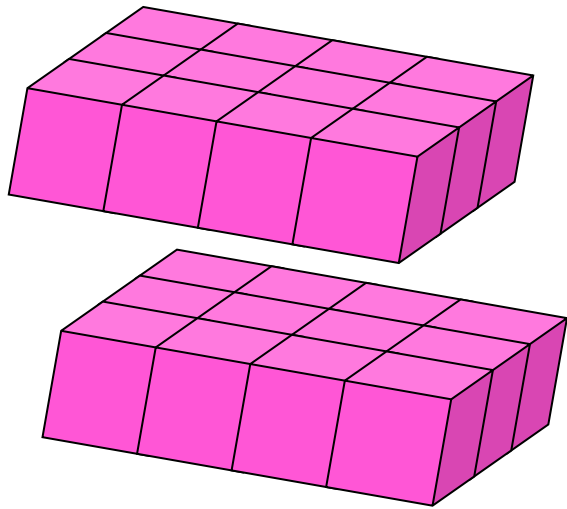
- Math isn't always fast.
- Timed-tests create anxiety.
- Long term impacts.



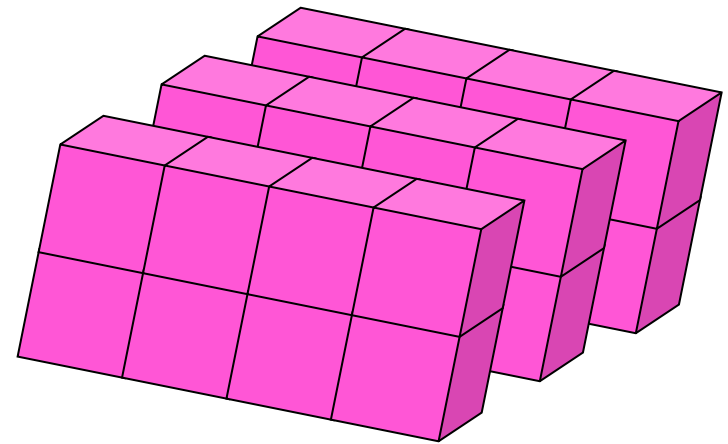


# Fact: Visual Math Improves Math Performance

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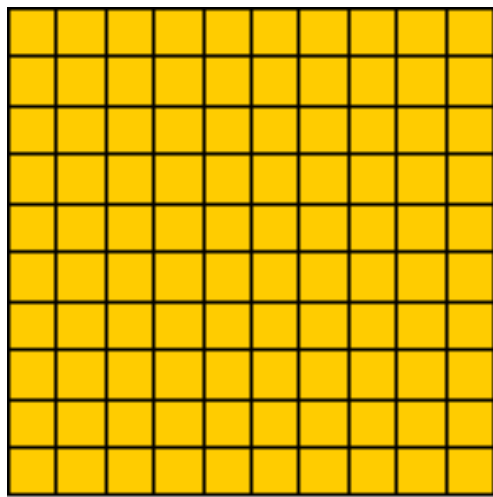
$$(3 \times 4) \times 2$$



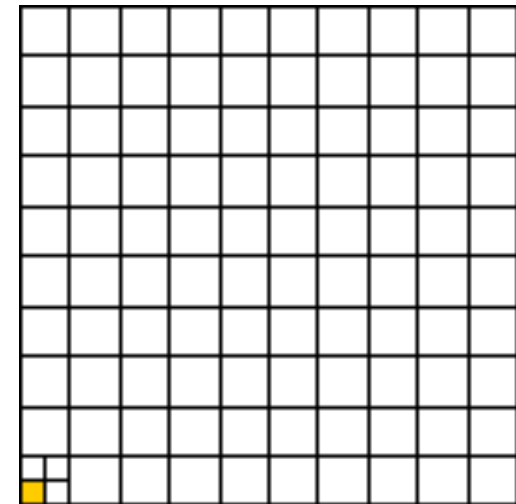
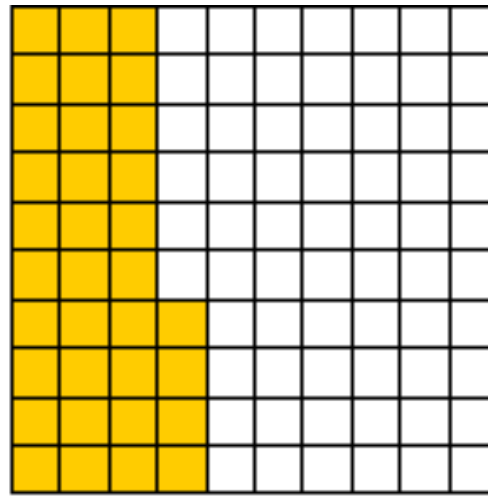
$$3 \times (4 \times 2)$$

# Fact: Visual Math Improves Math Performance

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134%



$\frac{1}{4}$  % or 0.25%

$$46 \times 25$$
$$(40 + 6) \times (20 + 5)$$

	<b>40</b>	<b>+</b>	<b>6</b>
<b>20</b>	<b>800</b>		<b>120</b>
<b>+</b>			
<b>5</b>	<b>200</b>		<b>30</b>

# Fact: When We Believe In Our Students They Do Better

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When teachers were told that students had higher intellectual ability their students scored at significantly higher levels than students whose teachers were not told anything.

(Rosenthal and Jacobs, 1968)

# Fact: Parent's Beliefs About Mathematics Change Their Children's Achievement

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Parents' math knowledge did not turn out to have any impact [on student's performance], only their level of math anxiety.



How can I support my  
student at home?

# Let's Begin With Ourselves

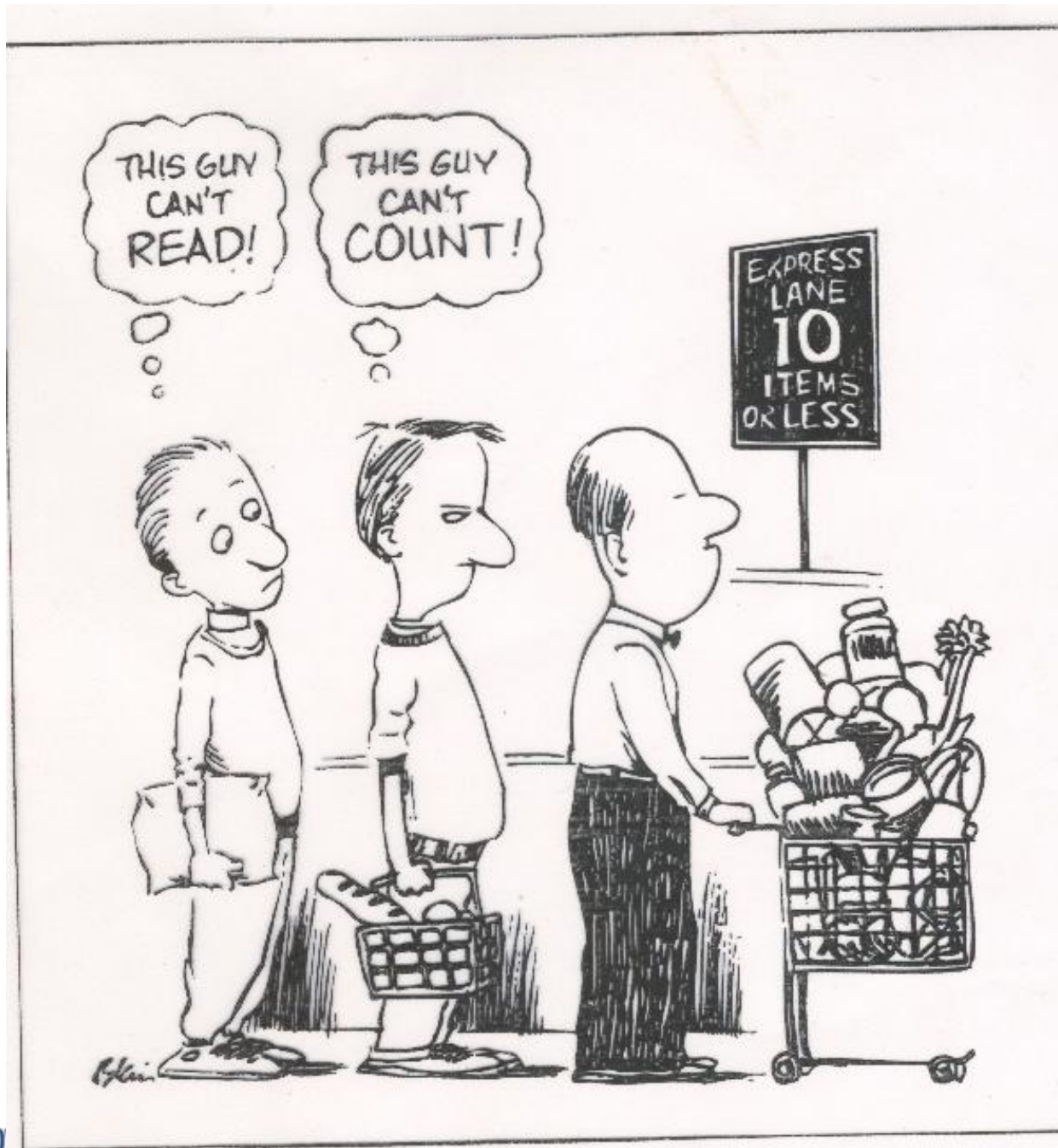
1

10



I am not good at math.

I consider myself to be great at math!





# These MYTHS No Longer Have a Place

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“ I was never that good at math either.”

“Our family just doesn’t have the math gene.”

“Not every job needs math.”

“Math is not something I need everyday like reading.”

# Facts: Support at Home

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- Games – more in a moment...
- Encouragement
  - “You’re working really hard.”
  - “You can do it. It takes time.”
  - “It was hard for me too.”
- Occasional practice sheets
- Patience

# Board Games!

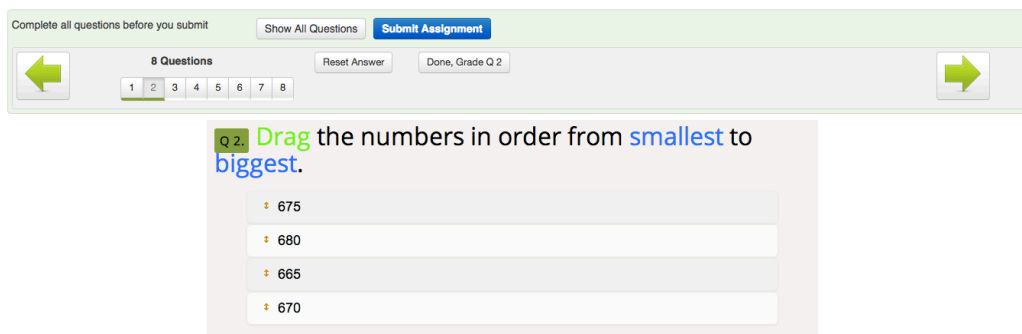
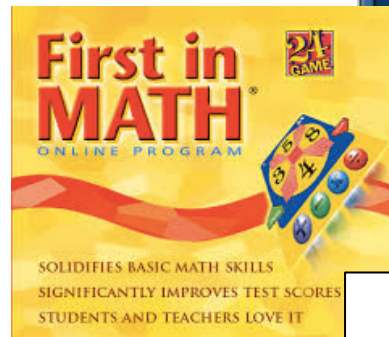
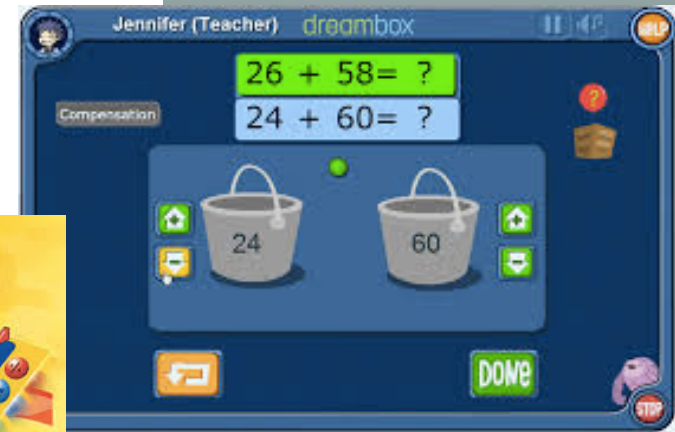
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- Counting games (Parcheesi, Hi-Ho Cherry-O)
- Matching games (Memory)
- Card games (Rummy, 31)
- Problem solving games (Blokus)
- Puzzles



# Useful Sites

- Xtramath
- DreamBox Learning
- First in Math
- Edcite
- Practice Sheets

A number line diagram showing a horizontal line with arrows at both ends. The line is divided into 10 equal segments by vertical tick marks. The first tick mark on the left is labeled '0' and the last tick mark on the right is labeled '1'. A blue dot is placed on the 5th tick mark from the left, labeled 'A' above it.

1) This numberline is divided into how many pieces?

2) What is the location of A (written as a fraction)?

# When Playing Games\*

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- Use a calculator to check answers
- Use a addition chart to support finding answers
- Ask questions
  - “Does this fact/problem remind you of another fact?”
  - “What are you thinking about?”
- Laugh and recognize effort



# Mathematics in 2016 and Growth Mindset



John SanGiovanni  
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