

# Eliciting Mathematical Reasoning with Digital Tools: Engaging Students (and Teachers)

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\*Note: If you have an iPhone or Android phone with data access, please install the free Socrative Student app. My room # is 51016

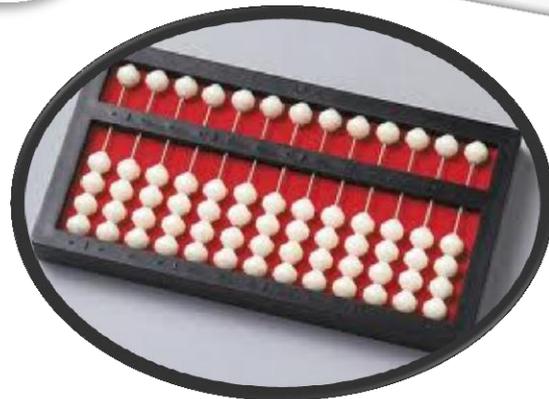


# Today's Plan

- Quick History
- Technology and Common Core
- Tools for Engaging Students in Mathematical Discussion
- Tools for Making Sense of Mathematics
- Tools for Communication about Mathematics



# Early Educational Technology

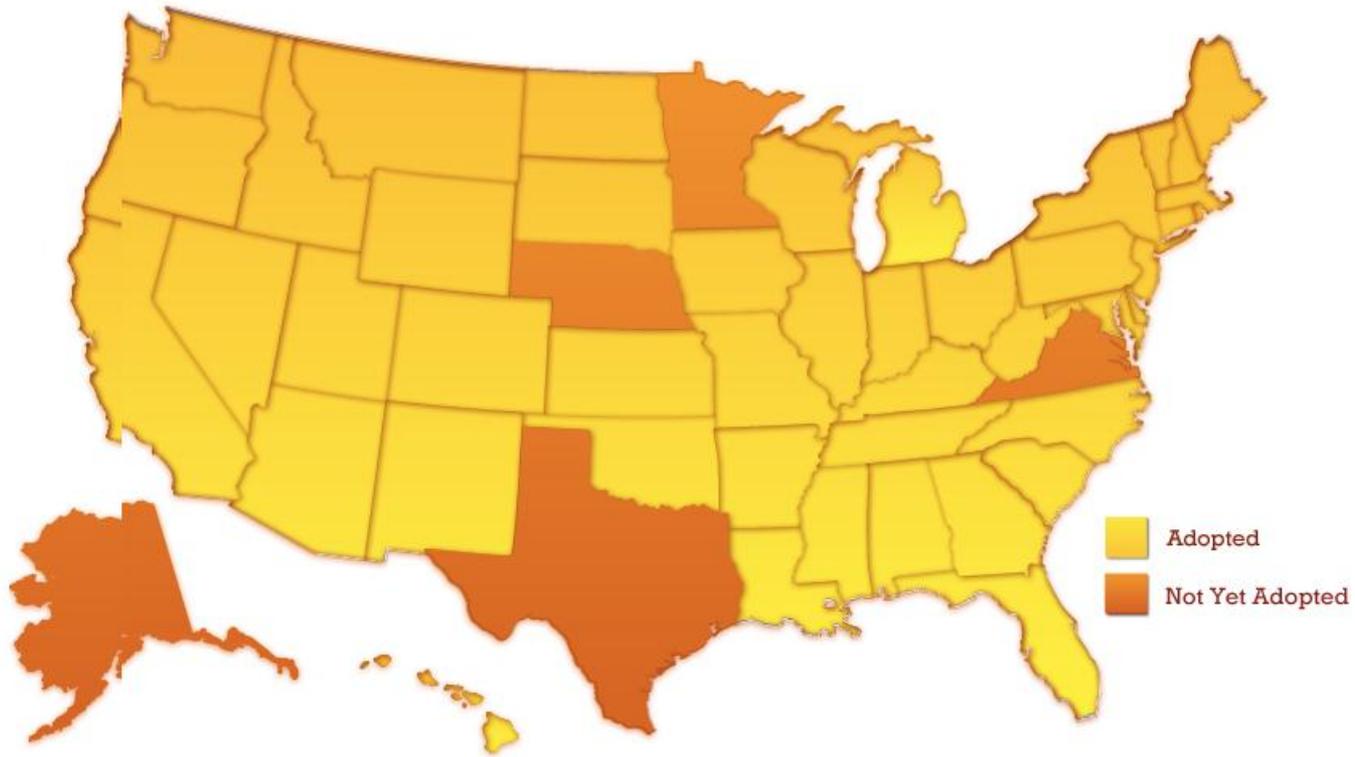


# Early Educational Technology

<http://archive.org/details/HowtoUse1963>



# Common Core Standards by State



District of Columbia



Puerto Rico



Guam



American Samoa Islands



U.S. Virgin Islands



Northern Mariana Islands

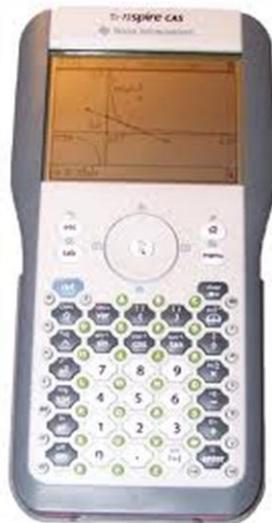
# Standards for Mathematical Practice

*Mathematically proficient students routinely...*

1. *make sense* of problems and *persevere* in solving them;
2. *reason* abstractly and quantitatively;
3. *construct* viable arguments and *critique* the reasoning of others;
4. *model* with mathematics;
5. *use* appropriate tools strategically;
6. *attend to* precision;
7. *look for* and make use of structure;
8. Look for and *express* regularity in repeated reasoning.



# Current Educational Technology



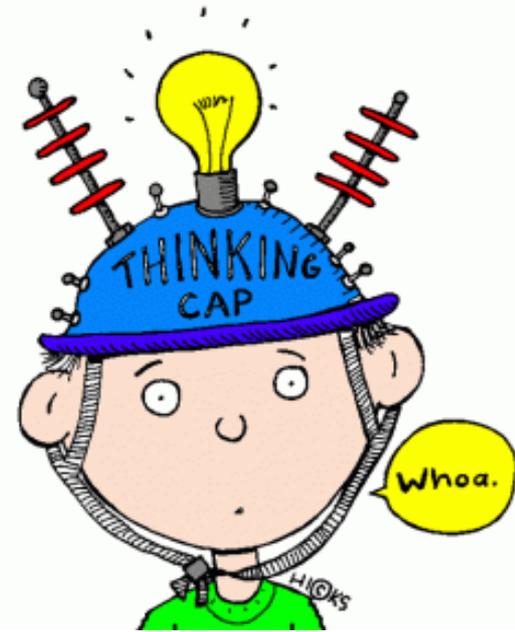
# Current Technology in Education

<http://www.youtube.com/watch?v=OBVGQt1Eeug>



# Role of Technology

Support and advance mathematical sense-making, reasoning, problem solving, and communication



<http://www.skill-guru.com/gmat/wp-content/uploads/2011/02/thinking-cap.gif>

(NCTM Position Statement, 2011)

<http://www.nctm.org/about/content.aspx?id=31734>

# Use of Technology

...simply having access to technology is not sufficient. The role of the teacher and/or curriculum in mediating the use of technological tools is critical.

(NCTM Position Statement, 2011)



# Non-Negotiables

- Students have the ability to reason and make sense of mathematics.
- Teachers have the (response)ability support all students in mathematical reasoning and sense making.



# Use Technology Strategically to...

- **engage** students in mathematical reasoning;
- help students to **make sense** of mathematical concepts or relationships; and
- provide a means for students to **communicate/collaborate** with and about mathematics.



# Two Categories of Tools

## Content Exploration



National Library of Virtual Manipulatives

[Click here to visit the new NLVM website!](#)



**Culturally Situated Design Tools:**  
TEACHING MATH AND COMPUTING THROUGH CULTURE

## Communication & Collaboration



Docs



# YouTube: Using Video to Engage Students in Mathematical Discussion

<http://www.youtube.com/watch?v=BbX44YSsQ2I>



Write down as many fraction problems as you can from this *American Chopper* episode.

<http://www.youtube.com/watch?v=Omh8lto-05M>



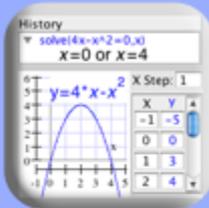


# NCTM's Core Math Tools

- [www.nctm.org/coremathtools](http://www.nctm.org/coremathtools)

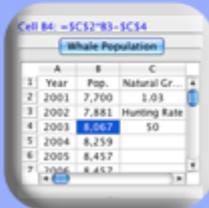
## Algebra & Functions

### CAS



Produce tables and graphs of functions, manipulate symbolic expressions, and solve equations and inequalities

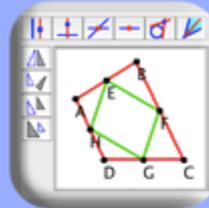
### Spreadsheet



Use familiar spreadsheet functions, insert class data or data from other sources, and employ data transformations.

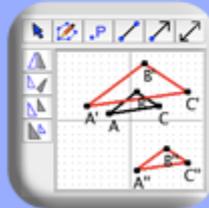
## Geometry & Trigonometry

### Synthetic



Construct, measure, manipulate, transform, and animate geometric figures

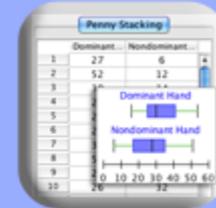
### Coordinate



Construct, measure, manipulate, transform, and animate geometric figures in a coordinate plane

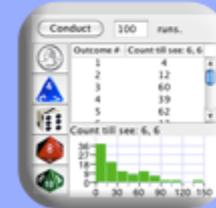
## Statistics & Probability

### Data Analysis



Graphically display and analyze univariate and bivariate data

### Simulation



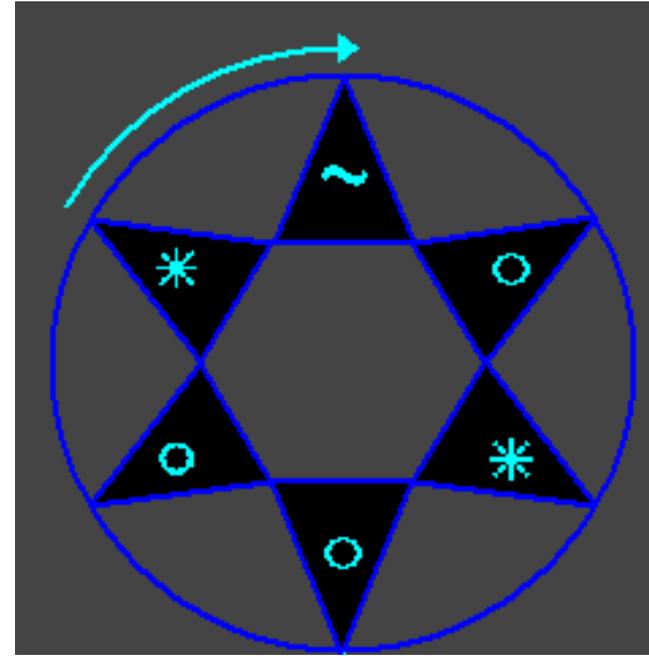
Create and run simulations of probabilistic situations

*Note: You need Java 6 (update your browser)*

# Rhythm Wheel: Exploring Multiplicative Reasoning

***After 4 loops of this wheel:***

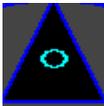
1. How many individual sounds will be played? How do you know this?
2. How many times will the “open” hand drum sound  be played? How do you know?
3. How many times more will the “open” hand drum sound be played than the “slap” drum sound ? How do you know?

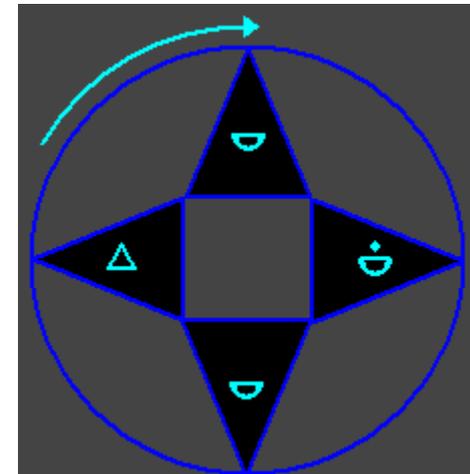
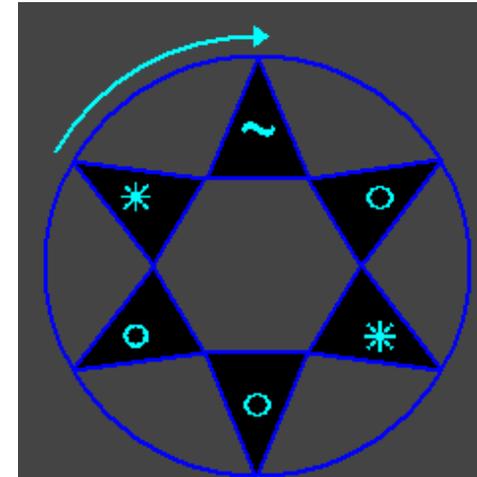


# Rhythm Wheel (part 2)

1. How many loops would the 1<sup>st</sup> and 2<sup>nd</sup> wheels each need to make so they stop playing at the same time? Why?

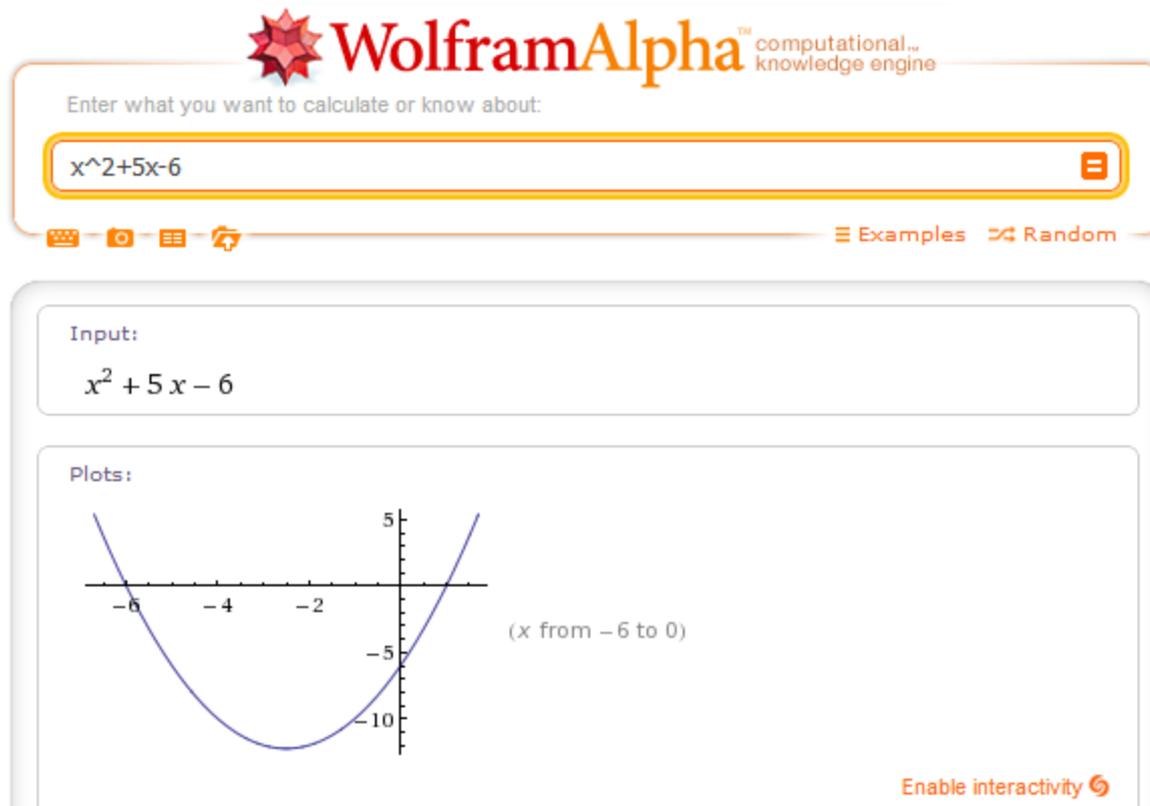
2. If the 2<sup>nd</sup> wheel does 18 loops, how many loops will the 1<sup>st</sup> wheel need to make so it stops at the same time?

3. If the neck cowbell  sound gets played 30 times, how many times will the open hand drum sound  be played? Prove it! (Assume the wheels stop at the same time.)



What if the neck is played  $x$  times?

# Wolfram Alpha: Exploring Equivalent Expressions



Input:  $x^2 + 5x - 6$

Alternate forms:

$$(x - 1)(x + 6)$$

$$\left(x + \frac{5}{2}\right)^2 - \frac{49}{4}$$

1. Prove that the “alternate forms” are equivalent expressions.
2. What does each form tell you about the parabola?

# The Socially Networked World of Our Students (and Teachers)

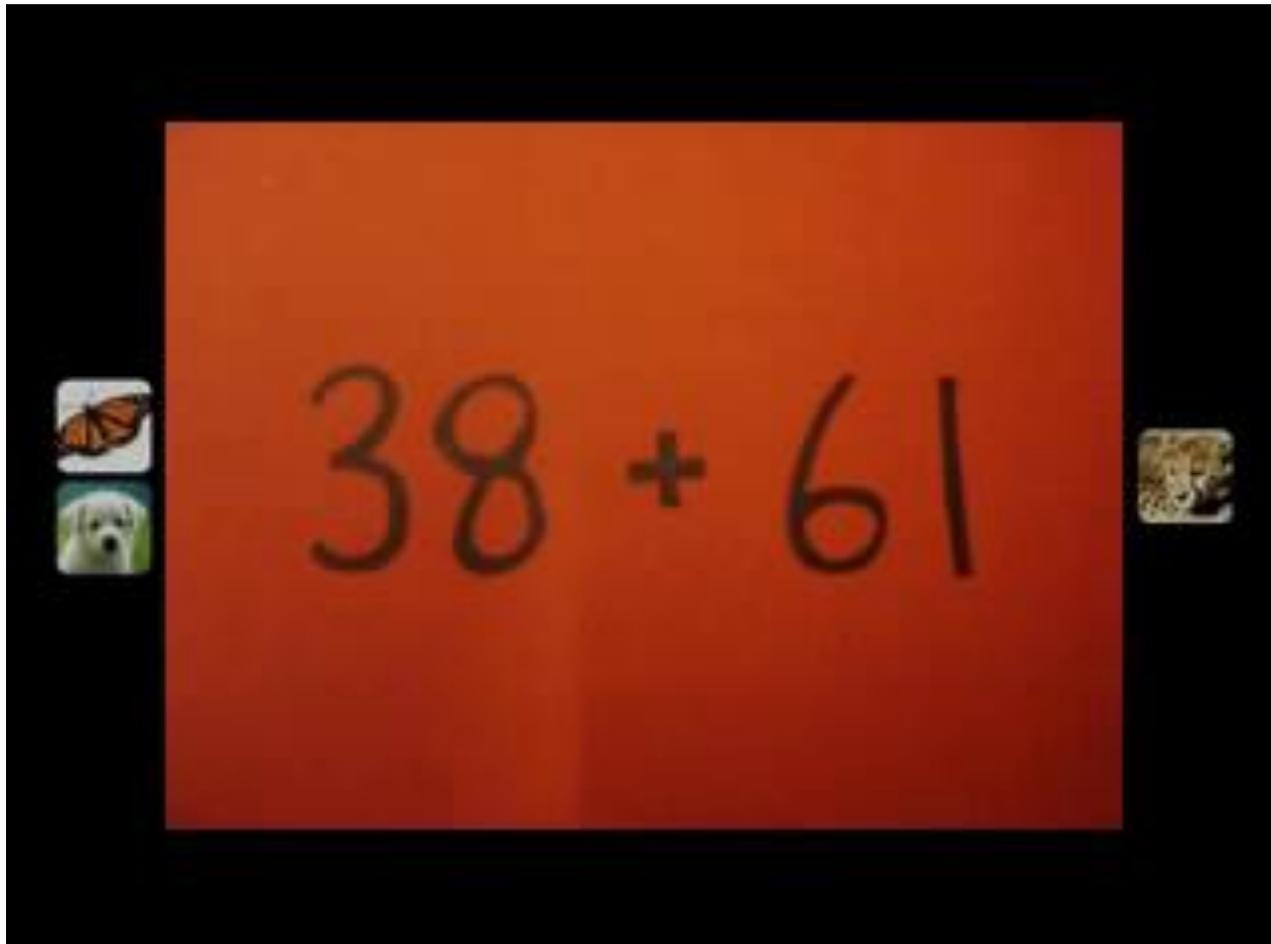


# Voicethread: Students Commenting

<http://voicethread.com/?#q+calculus.b265940.i1392796>



# Voicethread: Encouraging Students' Varied Reasoning



# Voicethread: Teacher Created Podcast

<http://voicethread.com/share/1630437/>



# Visual Modeling

<http://www.youtube.com/watch?v=KcNZUoOT5oo>

$$\begin{aligned} 5 \div \frac{2}{3} \\ = \frac{15}{3} \div \frac{2}{3} \\ = ? \end{aligned}$$

**How does this help give meaning to the “left over” piece? Is it  $\frac{1}{3}$  or  $\frac{1}{2}$  ? Why?**

# Your Turn

Solve this in a way that *makes sense*.

$$1\frac{1}{2} \div \frac{1}{3}$$

- Share your reasoning with your neighbor(s). What justifies your method?

Use your camera phone to share written work:

Send pix to: [teci@cellblock.com](mailto:teci@cellblock.com)



# Learn & Reflect Strand

CC Room 204 B, 3:30-4:30

- What role does technology play in providing multiple representations and opportunities for communication to help students develop mathematical understanding?
- How does technology influence your instructional decisions? And, how do your instructional decisions influence your use of technology?
- How can technology increase access to significant mathematics to **all** students? How do you promote social justice for access to and facility with technology in learning mathematics?
- How are you thinking differently about your use of technology as a result of participating in the Learn-Reflect strand? What are some of the steps you plan to take to promote growth in your own use of technology?



# Resources

## General

- Any Video Converter [http://www.any-video-converter.com/products/for\\_video\\_free/](http://www.any-video-converter.com/products/for_video_free/)
- Dan Meyer's Work (see him Friday 2 PM, CC Terrace Ballroom 4)
  - Collection of Video-Motivated Math Tasks  
<https://docs.google.com/spreadsheet/ccc?key=0AjlqyKM9d7ZYdEhtR3BJMmdBWnM2YWxWYVM1UWowTEE#gid=0>
  - Design Principles for Engaging Tasks <http://blog.mrmeyer.com/?p=12141>

## Communication Tools

- [www.voicethread.com](http://www.voicethread.com)
- <https://sites.google.com/a/norman.k12.ok.us/web20/home/voicethread> [Ideas for using Voicethread in the classroom]
- [www.screenr.com](http://www.screenr.com)
- [www.cellblock.com](http://www.cellblock.com)
- [www.socrative.com](http://www.socrative.com)

## Math Sense Making Tools

- <http://www.nctm.org/coremathtools> [Free suite of tools for math exploration]
- <http://csdt.rpi.edu/> [Culturally Situated Design Tools – includes Rhythm Wheel]
- <http://www.geogebra.org> [Geogebra]
- <http://www.shodor.org/interactivate> [Math Applets]
- <http://www.nlvm.org> [Nat'l Library of Virtual Manipulatives]



*Thank You!!*

Questions?

