

# Telling Stories, Teaching Math

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*“I want a better narrative. I want something that goes emeffing POW at the end. I want something that makes it about story arc instead of: ‘Ok, well you guys did a great job investigating torque, let’s do momentum now.’*

*They acquiesce easily, but is that what I want?”*

*–Shawn Cornally, ThinkThankThunk*

# Why Tell Stories?

- History
- Science
- Memory & Processing

# History

- People Think in Stories
- “The human brain is hard-wired for stories. We know our ancestors told each other stories 32,000 years ago by the cave paintings they used to illustrate them. Long before humans developed writing they passed down their history, culture, and traditions orally through stories that eventually got written down...”

<http://futuremediachange.com/2010/04/storytelling-your-skeleton-key-to-the-brain/>

**“Personal stories and gossip make up 65% of our conversations.”**

*Jeremy Hsu, Scientific American*

**...A story, if broken down into the simplest form is a connection of cause and effect.**

We think in narratives all day long, no matter if it is about buying groceries, whether we think about work or our spouse at home. We make up (short) stories in our heads for every action and conversation.

[Leo Widrich](#)

<http://blog.bufferapp.com/science-of-storytelling-why-telling-a-story-is-the-most-powerful-way-to-activate-our-brains>

# Science

- Our brains respond differently to stories than to lists of facts.
- *“Every engaging story must...ignite the brain’s hardwired desire to learn what happens next. When writers tap into the evolutionary purpose of story and electrify our curiosity, it triggers a delicious dopamine rush that tells us to pay attention. Without it, even the most perfect prose won’t hold anyone’s interest”*

Lisa Cron, [Wired For Story](#)

When we listen to a standard presentation, our language processing regions in the brain, Broca's area and Wernicke's area are active.

When we are being told a story though, not only are the language processing parts in our brain activated, but other areas in our brain, the ones we would use when experiencing the events of the story are stimulated as well.

[Leo Widrich](#)

<http://blog.bufferapp.com/science-of-storytelling-why-telling-a-story-is-the-most-powerful-way-to-activate-our-brains>

...whenever we hear a story, we want to relate it to one of our existing experiences. That's why metaphors work so well with us. Whilst we are busy searching for a similar experience in our brains, we activate a part called the insula, which helps us relate to that same experience of pain, joy, disgust or anything else.

Leo Widrich





# Memory

- We remember information better when told in narrative form.
- We are able to process information more easily when it is presented to us in a story.

# Stories Help Us Remember

- Because our brains are built for stories, they absorb stories more readily than other kinds of information. Psychological studies suggest that people are more open to ideas when they're listening to stories than when they're listening to factual information.
- Stories enable us to transcend our brains' usual memory limitations, serving, in the words of Mike Speiser, as "one of mankind's most efficient compression algorithms." Thus, he explains, memory champions are able to quickly remember the order of a deck of cards by inventing a story about them as they view them.
- <http://futuremediachange.com/2010/04/storytelling-your-skeleton-key-to-the-brain/>

# Stories Help Us Solve Problems

- The “human mind is a story processor, not a logic processor,” says Jonathan Haidt. Certainly we use logic inside stories better than we do outside. Leda Cosmides and John Tooby have shown that the Wason Selection Test can be solved by fewer than 10% as a logic puzzle, but by 70-90% when presented as a story involving detection of social-rule cheating.

Jag Bhalla, <http://blogs.scientificamerican.com/guest-blog/2013/05/08/it-is-in-our-nature-to-need-stories/>

# What Is A Story?

*Stuff Happens*

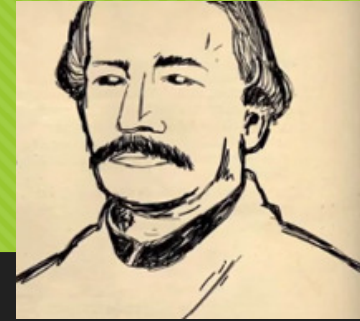


*Characters Change*

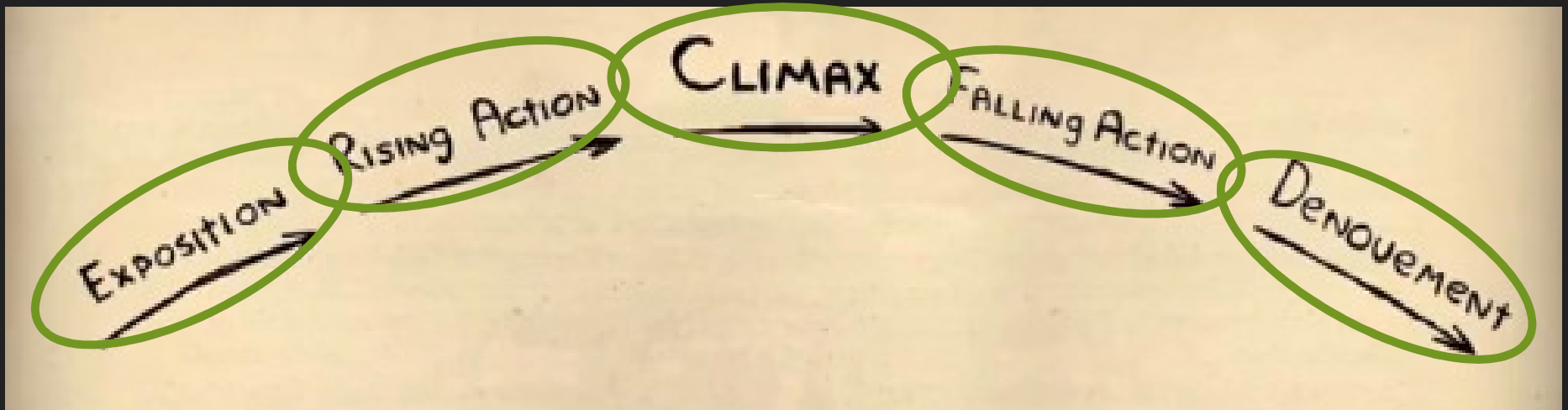
## What a Story Is NOT.

- Story is not a context overlaid onto a problem. A word problem, generally speaking, is not a “story problem.”
- A better term for this is “pseudo-context.” (Boaler)

# The Dramatic Arc



Gustav Freytag



# Story Map

- Characters
- Setting
- Plot
- Climax
- Resolution

## The Story Map



Name: \_\_\_\_\_

Title: \_\_\_\_\_

**Beginning** Who are the main characters?

\_\_\_\_\_  
\_\_\_\_\_

Where does the story take place?

\_\_\_\_\_  
\_\_\_\_\_

When does the story happen?

\_\_\_\_\_  
\_\_\_\_\_

**Middle** What is the problem?

\_\_\_\_\_  
\_\_\_\_\_

How are the characters trying to solve it?

\_\_\_\_\_  
\_\_\_\_\_

**End** How is the problem finally solved?

\_\_\_\_\_  
\_\_\_\_\_

What did the main character find out about herself/himself?

\_\_\_\_\_  
\_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

\_\_\_\_\_  
\_\_\_\_\_

# Story Rope

The school uses story ropes to encourage and gauge reading comprehension. The gingerbread man, she explained, reminds kids to identify the characters in the story. The house is a marker for setting. The cowboy boot signifies the problem that will inevitably kick in. The three stars encourage kids to look for components of the problem and how the plot unfolds in the beginning, middle and end. The sun represents the solution to the problem.











Andrea Pitzer,  
<http://www.niemanstoryboard.org/2011/11/04/your-brain-on-narrative-evolution-and-the-story-rope/>



# What Kinds of Stories Are There?

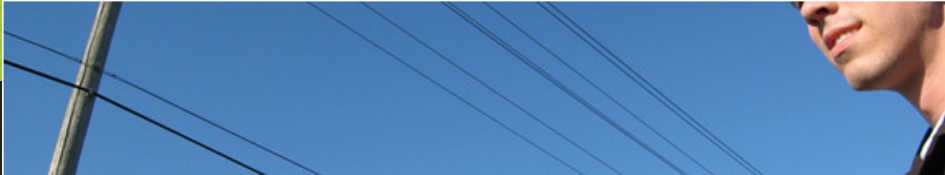
Kurt Vonnegut

Shapes of Stories

<p><b>Man in Hole</b></p>  <p>The main character gets into trouble then gets out of it again and ends up better off for the experience.</p> <ul style="list-style-type: none"> <li>Arctic and Old Lace</li> <li>Harold &amp; Kumar Go To White Castle</li> </ul>	<p><b>Boy Meets Girl</b></p>  <p>The main character comes across something wonderful, gets it, loses it, then gets it back forever.</p> <ul style="list-style-type: none"> <li>Jane Eyre</li> <li>Eternal Sunshine of the Spotless Mind</li> </ul>	<p><b>From Bad to Worse</b></p>  <p>The main character starts off poorly then gets continually worse with no hope for improvement.</p> <ul style="list-style-type: none"> <li>The Metamorphosis</li> <li>The Twilight Zone</li> </ul>	<p><b>Which Way Is Up?</b></p>  <p>The story has a lifelike ambiguity that keeps us from knowing if new developments are good or bad.</p> <ul style="list-style-type: none"> <li>Hamlet</li> <li>The Sopranos</li> </ul>
<p><b>Creation Story</b></p>  <p>In many cultures' creation stories, humankind receives incremental gifts from a deity. First major staples like the earth and sky, then smaller things like sparrows and cell phones. Not a common shape for Western stories, however.</p>	<p><b>Old Testament</b></p>  <p>Humankind receives incremental gifts from a deity, but is suddenly ousted from good standing in a fall of enormous proportions.</p> <ul style="list-style-type: none"> <li>Great Expectations</li> </ul>	<p><b>New Testament</b></p>  <p>Humankind receives incremental gifts from a deity, is suddenly ousted from good standing, but then receives off-the-charts bliss.</p> <ul style="list-style-type: none"> <li>Great Expectations with Dickens' alternate ending</li> </ul>	<p><b>Cinderella</b></p>  <p>It was the similarity between the shapes of Cinderella and the New Testament that thrilled Vonnegut for the first time in 1947 and then over the course of his life as he continued to write essays and give lectures on the shapes of stories.</p>

# How Do I Write One?

- What is the major idea?
- What changes occur over the course of the student's experience with the topic?
- What information does the student **NEED** in order to get started?



**Archive for the 'makeovermonday' Category**

**[Makeover] Summary**  
Posted in [makeovermonday](#) on September 23rd, 2013 1 Comment »

Many thanks to [Mr. Weiss](#) for reminding me to compile all of this summer's makeovers. Here's every revision principle we applied this summer, ranked from most frequently occurring to least.

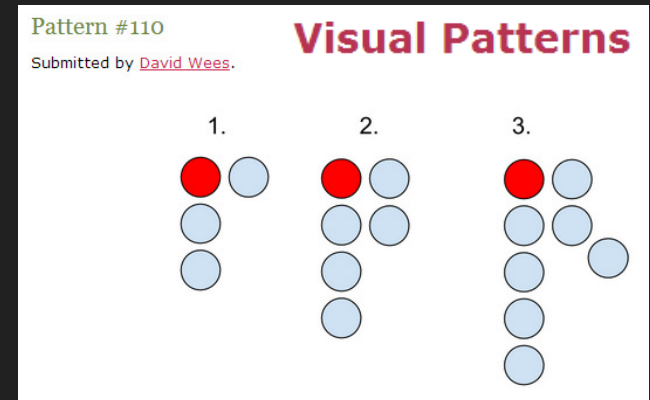
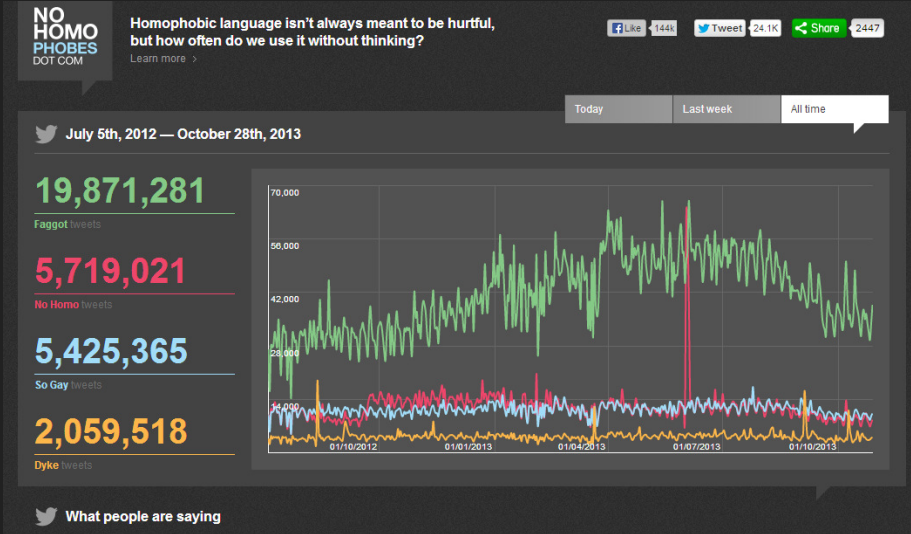
- 9) Add intellectual need.
- 6) Raise the ceiling on the task.
- 5) Add intuition.
- 5) Lower the floor on the task.
- 4) Reduce the literacy demand.
- 4) Show the answer.
- 2) Put students in the shoes of the person who might actually experience this problem.
- 2) Start the problem with a concise, concrete question.
- 2) Ask a better question.
- 2) Delay the abstraction.
- 1) Offer an incentive for more practice.
- 1) Enable pattern-matching.
- 1) Get a better image.
- 1) Add modeling.
- 1) Change the context.
- 1) Open the problem up to more than one possible generalization.
- 1) Justify the constraints.

If you're looking for a dy/dan house style, for better or worse, that's it right there.

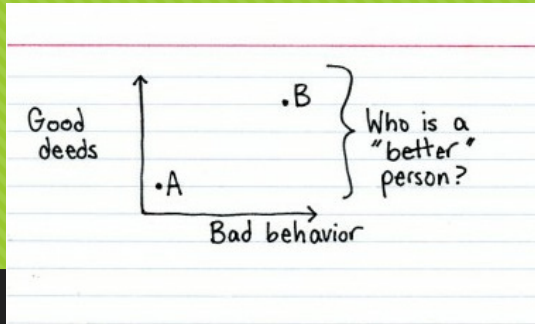
# The Key Element

- Conflict
  - Confusion
  - Perplexity
  - Productive Struggle

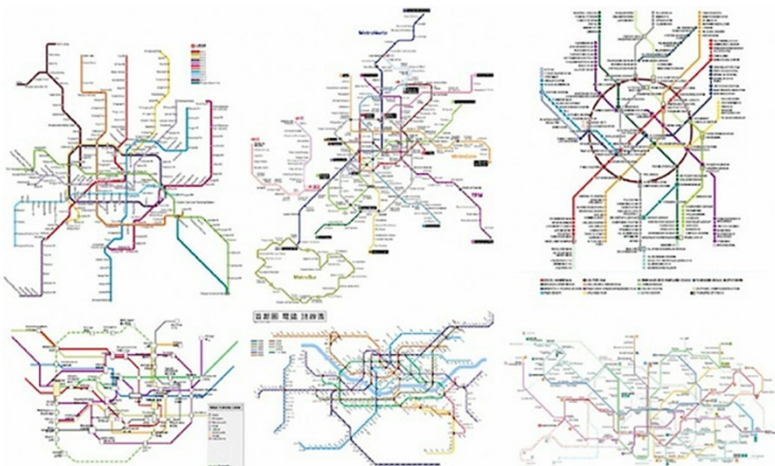
# How Does This Work For Math?



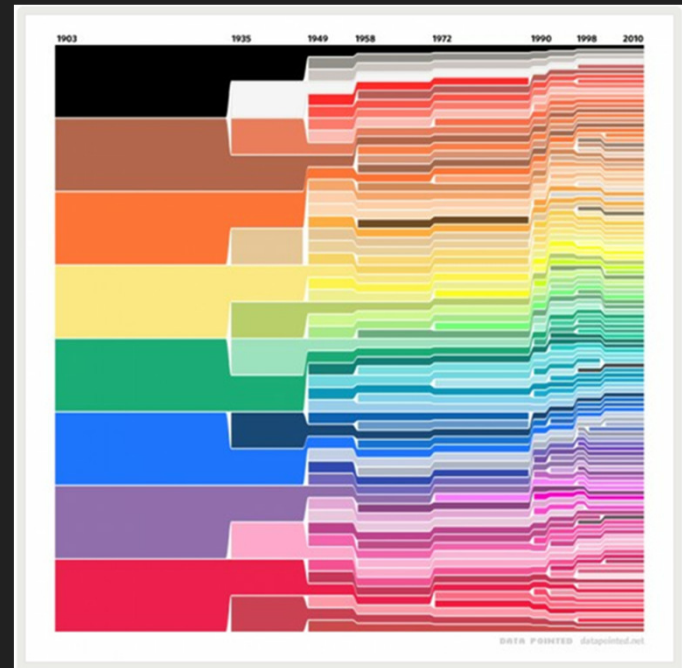
**Graphing Stories**  
Fifteen seconds at a time

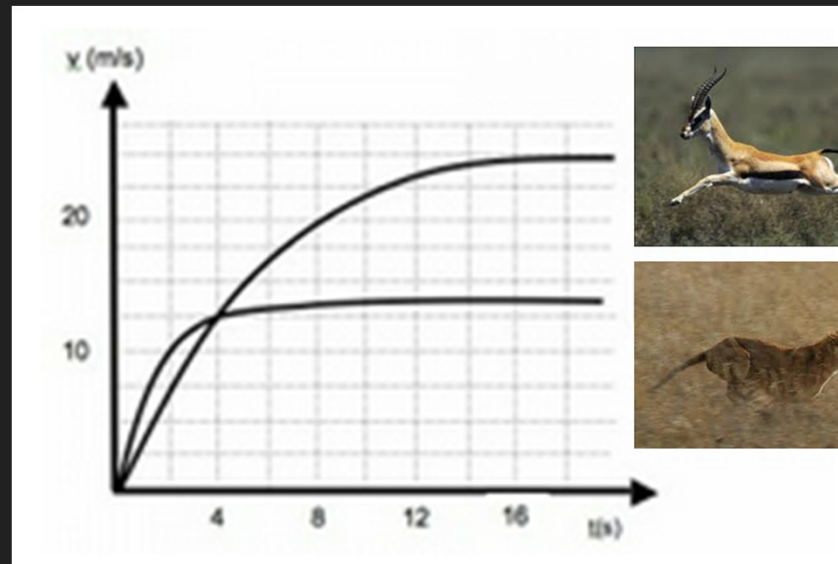


World's Subways Converging on Ideal Form | Wired Science | Wired.com



Sample of subway network structures from (clockwise, top left) Shanghai, Madrid, Moscow, Tokyo, Seoul and Barcelona. Image: Roth et al./JRSI



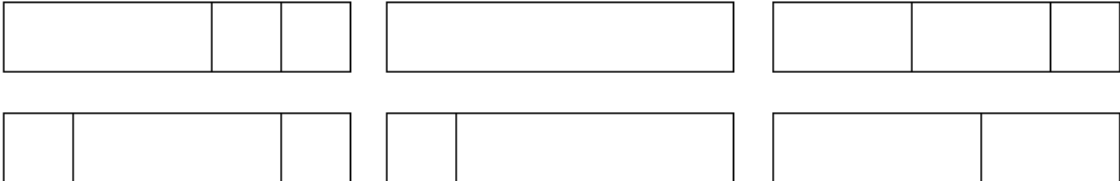


# Planning a Lesson (Short Story)

- Example: Trains
  - What is the epiphany?

**TRAINS**

Pictured below are some "trains" of length five, made up of different size cars.



The image shows six different configurations of trains, each consisting of three cars of varying lengths that sum to a total length of five units. The configurations are as follows:

- Train 1: One large car (length 3) followed by two small cars (length 1 each).
- Train 2: One large car (length 4) followed by one small car (length 1).
- Train 3: One large car (length 2), one medium car (length 2), and one small car (length 1).
- Train 4: One small car (length 1), one large car (length 3), and one small car (length 1).
- Train 5: One small car (length 1), one medium car (length 2), and one large car (length 2).
- Train 6: One large car (length 2) followed by two medium cars (length 2 each).

# Planning a Unit (Novel)

- Example: Bay Quadratics Unit
  - What are the events that move the story along?  
What is the plot?
  - What is the climax?



# Planning a Course (Series)

Wednesday, July 13, 2011

## Algebra 2: "How do we predict the future?"

I took [Kate's Algebra 2 standards](#) and I reorganized the first semester as an answer to the question, "How can we predict the future?"

Here's the results. Nothing earth-shattering, but feedback would be appreciated.

# Time to Play!

- Find a partner, small group, or work solo.
- Choose a topic.
- Find the epiphany/climax.
- Plot out the beginning, middle and end.
- Make room for productive struggle!

# Makeover Mondays

<http://blog.mrmeyer.com/?p=17162>

## 2.3 Dividing Mixed Numbers (pp. 70–75)

Find  $3\frac{3}{4} \div 1\frac{1}{2}$ .

$$3\frac{3}{4} \div 1\frac{1}{2} = \frac{15}{4} \div \frac{2}{2}$$

$$= \frac{15}{4} \times \frac{2}{3}$$

$$= \frac{5 \cdot 15 \times 2^1}{2 \cdot 4 \times 3 \cdot 1}$$

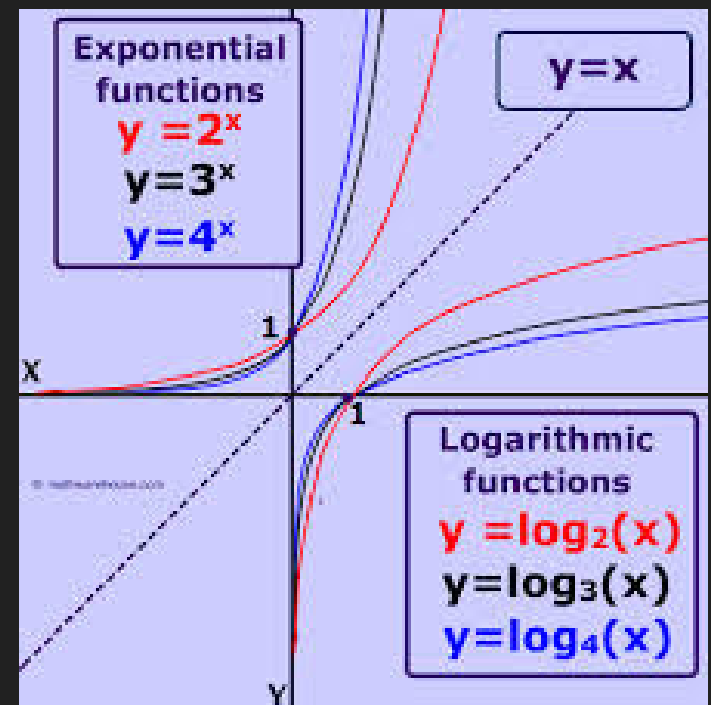
$$= \frac{5}{2}, \text{ or } 2\frac{1}{2}$$

Write each mixed number as an improper fraction.

Multiply by the reciprocal of  $\frac{3}{2}$ , which is  $\frac{2}{3}$ .

Multiply fractions. Divide out common factors.

Simplify.



Or, choose your own problem to make-over.

# Dan Meyer's Three Acts Collection

<https://docs.google.com/spreadsheets/ccc?key=0AjIqyKM9d7ZYdEhtR3BJMmdBwnM2YWxWYVM1UWowTEE#gid=0>

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Date Added	Last Updated	Task Title	Lesson Plan	Act 1	Act 2	Act 3	Sequel	Standard 1	Standard 2	Standard 3	Standard 4	Suggested Question
46	11/3/2011	2/25/2012	<a href="#">Domino Skyscraper</a>	x	x	x	x	x	F-LE.2				How many dominoes would it take to knock over a skyscraper-sized?
47	10/30/2011	2/22/2012	<a href="#">Hot Coffee</a>	x	x	x	x	x	G-MG.1	G-MG.2	G-GMD.3	6.RP.3	How many gallons fit into that coffee cup?
48	10/30/2011	10/30/2011	<a href="#">Incredible Shrinking Dollar</a>	x	x	x	x	x	F-LE.2				What will the dollar bill look like after getting reduced that many times?
49	10/30/2011	10/30/2011	<a href="#">Super Bear</a>	x	x	x	x	x	6.RP.3				How many regular bears equals the super bear?
50	9/28/2011	1/16/2012	<a href="#">Shower v Bath</a>	x	x	x		x	6.RP.3				Which is cheaper: a shower or a bath?
51	9/25/2011	9/25/2011	<a href="#">Partial Product</a>		x				6.RP.2				What's the total grocery bill?
52	9/13/2011	9/13/2011	<a href="#">Will It Hit The Hoop?</a>		x	x	x	x	F-BF.3				Will the ball go in the hoop?
53	8/27/2011	8/27/2011	<a href="#">Obscure Geometry</a>		x			x	G-GPE.7				What fraction is each small piece of the whole?
54	8/13/2011	8/13/2011	<a href="#">Speed of Light</a>	x	x	x	x	x	6.RP.3				What does the speed of light look like?
55	8/8/2011	2/22/2012	<a href="#">Pyramid of Pennies</a>	x	x	x	x	x	3.MD.7	F-BF.1			How many pennies is that?
56	7/31/2011	7/31/2011	<a href="#">Ticket to Ride</a>		x	x	x	x	7.G.6	6.RP.3			How many tickets are on the roll?
57	7/29/2011	7/29/2011	<a href="#">Print Job</a>	x	x	x	x	x	6.RP.3				How long will it take to print all those pages?
58	7/24/2011	7/24/2011	<a href="#">World Record Airbag</a>		x			x	A-CED.1	F-BF.1	F-LE.3		How fast was he flying when he hit the bag?
59	7/23/2011	2/22/2012	<a href="#">Holes</a>	x	x	x		x	7.G.3	7.G.4	7.G.6	7.RP.1	How much extra dirt will Stanley have to dig after a year?
60	7/23/2011	7/23/2011	<a href="#">Amazon Percent Discount</a>		x			x	6.RP.3				How much does it cost?
61	7/22/2011	4/4/2012	<a href="#">Bucky the Badger</a>	x	x	x	x	x	3.OA.9	MP.3			How many push-ups did Bucky have to do?
62	7/22/2011	7/22/2011	<a href="#">Brita</a>		x	x	x	x	7.G.4				How many times would all the water bottles used in the US in a year?
63	7/11/2011	7/11/2011	<a href="#">Falling Glowsticks</a>	x	x			x	A-CED.1	F-BF.1	F-LE.3		How deep is the cave?
64	7/11/2011	7/11/2011	<a href="#">Falling Rocks</a>	x	x	x		x	A-CED.1	F-BF.1	F-LE.3		How deep is the cave?
65	7/11/2011	1/17/2012	<a href="#">Apple Mothership</a>		x	x		x	G-MG.2	MP.4			How many people per square foot is that?
66	7/11/2011	7/11/2011	<a href="#">Bone Collector</a>		x	x	x	x	6.RP.3				How big is the killer's shoe size?
67	7/10/2011	12/29/2011	<a href="#">Sugar Packets</a>	x	x	x	x	x	6.RP.3				How many sugar packets are in a bottle of soda?
68	7/8/2011	7/8/2011	<a href="#">Water Tank</a>	x	x	x	x	x	G-GMD.3	G-GMD.4			How long will it take to fill up the water tank?

# Andrew Stadel's Three Acts Collection

<https://docs.google.com/spreadsheet/ccc?key=0AkLk45wwjYBudG9LeXRad0IHM0E0VFRyOEtRckVvM1E#gid=0>

Task Name	Intended Question	Geometry, Algebra	Concept/Skill	Act 1	Act 2	Act 3	Sequel
Snail's Pace	How long will it take for the snail to get across the sidewalk?	A	Rate	x	x		
Woody's Raise	What amount (of money) per week did Woody settle for?	A	Inequalities	x	x	x	
Shiny Lincoln	What's the price of the large penny?	G	Circles, proportions	x			
Wartime	How long will it take for the dye to flow to the bottom?	A	Rate	x			
Printer Paper	How much paper is stacked on the shipping crate?	G	Volume (prism)	x		x	
Deodorant	How long will all that deodorant last?	A	Rate, time	x	x		
Thick As A Brick	How long is that song?	G & A	Time, ratio, prop	x	x	x	A rule for any point in the
Trashketball	How many trashketballs will fit in the can?	G	Spheres, Cylinders	x	X	x	Change can ht. to fit 1k b
Boat on the River	Will the boat safely pass under the bridge?	G	Trig Ratios	x	x	x	Maximum angle
Stacking Cups	How many cups does it take for the stacks to be equal in height?	A	Linear Eq's/Sys	x	X	x	What's the height
Black Box?	What [fraction] will come out of the black box?	K-5, A	Add Fractions	x	X	x	
Best Halves [Square]	Who drew the best half?	G	Area, Ratio, %	x			
Styrofoam Cups	How many cups will stack to the top of the door frame?	A	Linear f(x), slope	x	X	x	Styro = blue cup stack
Stealing Second	How long will it for the ball to get to second base and beat the runner?	G & A	Pythag Th., Rate	x			
Bottomless Mug	How much money could you actually save?	A	Rate, time, calendar	x	X	x	See Act 2
Quesadilla	How should I cut the quesadilla?	NS	Fractions, dec, %'s	x			

# Should All Lessons, Units, Courses Involve Stories?

Maybe...

But probably not.

- Time Factors
- Effort Expended
- Creative Well

# Telling Stories, Teaching Math

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Breedeem Murray

Teaches at: The Bay School of San Francisco

Blogs at: The Space Between The Numbers

Tweets at: @btwnthenumbers