Why do we teach/learn math?

"to get to seven-eleven and back successfully"

- + - x ÷
- decimals
- money

Why do we teach/learn math?

"so we can figure out our budget, like car payments, mortgages, take-home pay"

- decimals, percent
- interest
- maybe formula substitution

"hey Mr F.....they do that for you!"

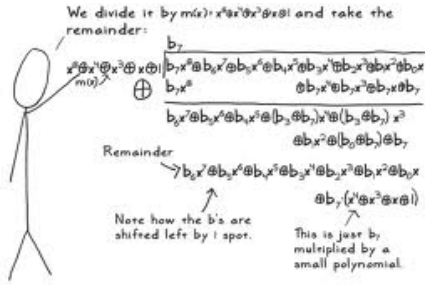
Why do we teach/learn math?

"ok.....what about the f word?"

f ..... (a c t) (o r) (i n g)

"Keep it real man"

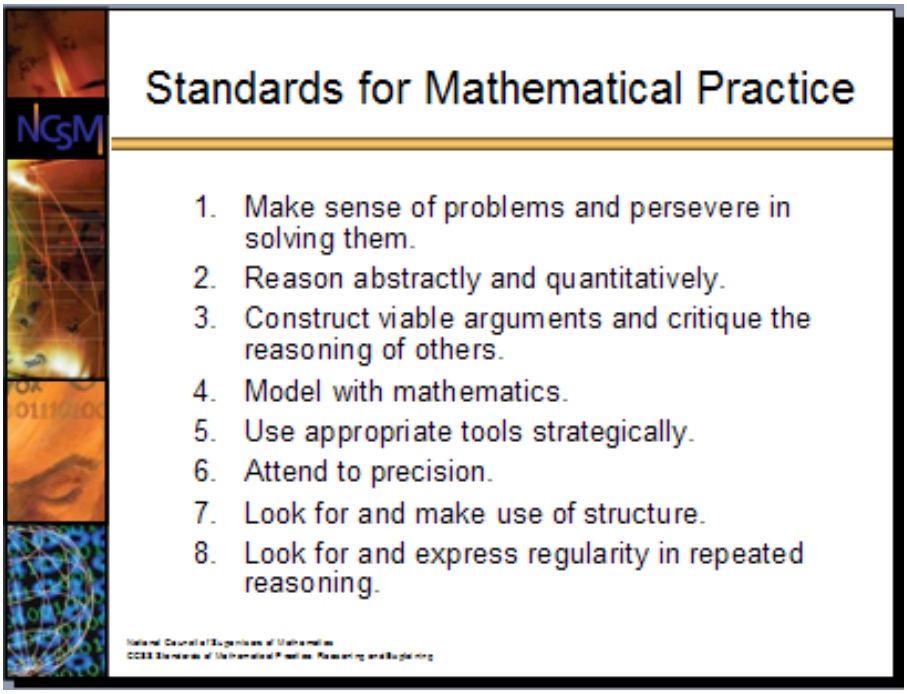
Why do we teach/learn math?



"truth is.....calculus is the place where math and the real world merge"

- related rates
- min/max
- applications of derivatives and integrals
- the sciences and engineering

SO..... Why do we teach/learn math?



What if every student K-12 becomes proficient at this set?

the eight practice standards for mathematics taken from CCSS

We teach/learn math to Practice the Practices (SMP CCSS)

The Standards for Mathematical Practice describe varieties of expertise that mathematics educators at all levels should seek to develop in our students.....

CCSS p6

So factoring was "real life" !

$2x^2-12x+16$

(a short example)

- what do I do first?
- If I do this...I could be wrong
- but I've been practicing .....
- I know the procedures
- if I'm wrong I'll know because....
- I've checked it and it's good

they're in there.....

6/22/11 NYSUT's Teacher Practice Rubrics

Element I.2: Teachers demonstrate current, research-based knowledge of learning and language acquisition theories and processes.
NYSED Indicators: *Design lesson plans and adjust instruction to include a variety of strategies that support the learning needs of each student. Design lesson plans and adjust instruction to include a variety of strategies that support the language acquisition needs of each student. Teachers explain their instructional decisions citing current research.*

	Indicators	Ineffective	Developing	Effective	Highly Effective
A	*Uses strategies to support*	Teacher designs lessons	Teacher designs lessons to	Teacher designs lessons to	Teacher designs lessons

Marzano's Rubric

8. Previewing New Content

The teacher engages students in activities that help them link what they already know to the new content about to be addressed and facilitates these linkages.

Teacher Evidence
- ❒ Teacher uses preview question before reading
- ❒ Teacher uses K-W-L strategy or variation of it
- ❒ Teacher asks or reminds students what they already know about the topic
- ❒ Teacher provides an advanced organizer
  - Outline
  - Graphic organizer
- ❒ Teacher has students brainstorm
- ❒ Teacher uses anticipation guide
- ❒ Teacher uses motivational hook/launching activity
  - Anecdotes
  - Short selection from video
- ❒ Teacher uses word splash activity to connect vocabulary to upcoming content

Student Evidence
- ❒ When asked, students can explain linkages with prior knowledge
- ❒ When asked, students make predictions about upcoming content
- ❒ When asked, students can provide a purpose for what they are about to learn
- ❒ Students actively engage in previewing activities

Danielson's Rubric

Component	3c: Engaging Students in Learning
	Student engagement in learning is the centerpiece of the framework for teaching; all other components contribute to it. When students are engaged in learning, they are not merely "busy," nor are they only "on task." Rather, they are intellectually active in learning important and challenging content. The critical distinction between a classroom in which students are compliant and busy, and one in which they are engaged, is that in the latter students are developing their understanding through what they do. That is, they are engaged in discussion, debate, answering "what if?" questions, discovering patterns, and the like. They may be selecting their work from a range of (teacher arranged) choices, and making important contributions to the intellectual life of the class. Such activities don't typically consume an entire lesson, but they are essential components of engagement. A lesson in which students are engaged usually has a discernible structure: a beginning, a middle, and an end, with scaffolding provided by the teacher or by the activities themselves. Student tasks are organized to provide cognitive challenge, and then students are encouraged to reflect on what they have done and what they have learned. That is, there is closure to the lesson, in which students derive the important learning from their own actions. A critical question for an observer in determining the degree of student engagement is "What are the students being asked to do?" If the answer to that question is that they are filling in blanks on a worksheet, or performing a rote procedure, they are unlikely to be cognitively engaged.

Implementation of the SMP

- math classes that are not boring
- stop "covering"
- rich problems
- addressing formative assessments
- utilizing data

If I'm doing those things.....bring on APPR

Where are these Rich Problems

from Diane Briars NCSM

McDonald's Claim

A recent Wikipedia article reports that 8% of all Americans eat at McDonald's every day. Current data indicates approximately 310 million Americans and 12,800 McDonald's restaurants in the United States.

Do you believe the Wikipedia report to be true? Create a mathematical argument to justify your position.

from insidemathematics.org

Winning Lines

This problem gives you the chance to:
- work with a 'magic square' type number game

Gina and Sam are playing a card game.
They place number cards on a large game board.
A **target number** is written inside a circle at the top of each board.

14

7	6	1
5	3	9
2	8	4

To win a point they need to make a line of three numbers whose sum is the target number.
The three numbers can be written in a column, a row or a diagonal.

In any game the same number cannot be used more than twice.
No zeros are allowed.

1. Gina and Sam have completed the game shown above. The target number is 14.
   Draw lines through the five winning lines.

2. Here is a game board that has already been started.

   12

4		
3		
5		

   One point has been won because 4 + 3 + 5 = 12.

   Write numbers on the empty cards to win at least three more points.

   Draw lines through your winning lines.

3. Here is a new game board.

   9

   Fill in the numbers to win at least four points

   Draw in the winning lines.

   Explain why the number 8 cannot be used in any winning line.

from engageny.org

Make true equations. Write one number in every space. Draw a picture if it helps.

1) 1 hundred + 4 tens = _____

2) 4 tens + 1 hundred = _____

3) 14 tens = __10__ tens + _____ tens

   = _____ hundred + __4__ tens

   = _____

4) 7 ones + 5 hundreds = _____

5) 8 hundreds = _____

6) 106 = __1__ hundred + _____tens + _____ones

7) 106 = _____tens + _____ones

8) 106 = _____ones

9) 90 + 300 + 4 = _____

Are these comparisons true or false?

10) 2 hundreds + 3 ones > 5 tens + 9 ones _____

11) 9 tens + 2 hundreds + 4 ones < 924 _____

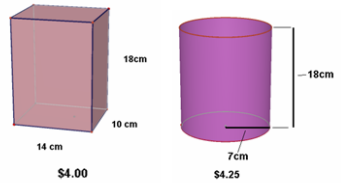
12) 456 < 5 hundreds _____

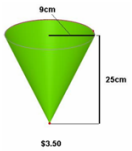
from nys 2005 sample tasks

Sample of Generating and Testing a Hypotheses

G.PS.5 Choose an effective approach to solve a problem from a variety of strategies (numeric, graphic, algebraic)

G.PS.5a
Students in one mathematics class noticed that a local movie theater sold popcorn in different shapes of containers, for different prices. They wondered which of the choices was the best buy. Analyze the three popcorn containers below. Which is the best buy? Explain.





from NCTM

Homework #16- Falling Bridges!

Thorough Ted, a construction engineer, correctly computed that the maximum safe load of a bridge being planned would be $1000(99-70\sqrt{2})$ tons. Speedy Sam, a construction contractor, then approximated $\sqrt{2}$ as 1.4.

The bridge was built and a sign was posted, based on Speedy Sam's calculations, saying how much weight the bridge could safely hold. On the day it opened to traffic, the bridge collapsed under a load less than a tenth of the posted weight.