What's This All Mean – To Me? Curriculum Focal Points, National Math Panel, and MY Classroom

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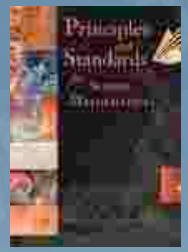

Content and Process Standards

- Number & Operations
- Algebra
- Geometry
- Measurement
- Data Analysis & Probability

- Problem Solving
- Reasoning & Proof
- Communication
- Connections
- Representation

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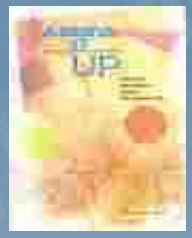

Mathematical Proficiency

- **conceptual understanding** - comprehension of mathematical concepts, operations, and relations.
- **procedural fluency** - skill in carrying out procedures flexibly, accurately, efficiently, and appropriately.
- **strategic competence** - ability to formulate, represent, and solve problems.
- **adaptive reasoning** - capacity for logical thought, reflection, explanation, and justification.
- **productive disposition*** - inclination to see mathematics as sensible, useful, and worthwhile, coupled with a belief in diligence and one's own efficacy.

The Happiness Factor!?

Adding it Up, 2001

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Oh my…

- “My wife who is completing her MS degree in Mathematics (a former HS Math teacher in the public schools), and I both agree, you are either born with a math gene or you're not (like many other god given abilities like performing arts, athletics, etc) and no amount of "confidence" or "fun" will convert most students into mathematicians, scientists, or engineers.

- The sooner we only focus on say the top 16-25% of students in math, the less frustrating math teachers will become.”

Why Identify Focal Points?

- Address long lists of state learning expectations
- Address “mile wide, inch deep” math curriculum
- Identify the mathematics that should be the focus of instruction and student learning, preK-8
- Begin the discussion of appropriate curricular expectations
- Identify key mathematical ideas all others build on

Number of 4th-Grade Learning Expectations per State by Content Strand

	Number & Operation	Geometry	Measurement	Algebra	Data Analysis, Probability & Statistics	Total Number of Learning Expectations
California	16	11	4	7	5	**43**
Texas	15	7	3	4	3	**32**
New York	27	8	10	5	6	**56**
Florida	31	11	17	10	20	**89**
Ohio	15	8	6	6	13	**48**
Michigan	37	5	11	0	3	**56**
New Jersey	21	10	8	6	11	**56**
North Carolina	14	3	2	3	4	**26**
Georgia	23	10	5	3	4	**45**
Virginia	17	8	11	2	3	**41**

Reys, et al., 2006

What Are Curriculum Focal Points?

- The most important mathematical topics for each grade level, preK-8
- Cohesive clusters of related ideas, concepts, skills, and procedures that form the foundation for higher-level mathematics
- More than a single objective, standard, expectation, or indicator
- Not discrete topics for teachers to present and check off as mastered by students

NCTM has met with or will meet with over 25 states as they consider using the Curriculum Focal Points in revising their state standards.

CFPs and the Process Standards

Introductory statement for each level, PreK-8:

"It is essential that these focal points be addressed in contexts that promote problem solving, reasoning, communication, making connections, and designing and analyzing representations."

Focal Points - Number & Algebra

- **Grade 3**
  - Developing understanding of multiplication and division and strategies for basic multiplication facts and related division facts
  - Developing an understanding of fractions and fraction equivalence
- **Grade 4**
  - Developing quick recall of multiplication facts and related division facts and fluency with whole number multiplication.
  - Developing an understanding of decimals, including the connections between fractions and decimals.
- **Grade 5**
  - Developing and understanding of and fluency with division of whole numbers.
  - Developing an understanding of and fluency with addition and subtraction of fractions and decimals

Math Wall Activities

24

73

49

Today's Date

What's Next? Why?

- 5, 15, 20, 30, 35, 45,...
- 1, 1, 2, 4, 3, 9,...
- Friday, Thursday, Thursday, Friday, ...
- _____, 25, _____

My number of the day*

- The number before my number is _____
- The number after my number is _____
- _____ is 10 more than my number.
- _____ is 50 more than my number.
- _____ is 100 more than my number.
- _____ is ½ of my number.*
- You can find my number by counting by _____'s.

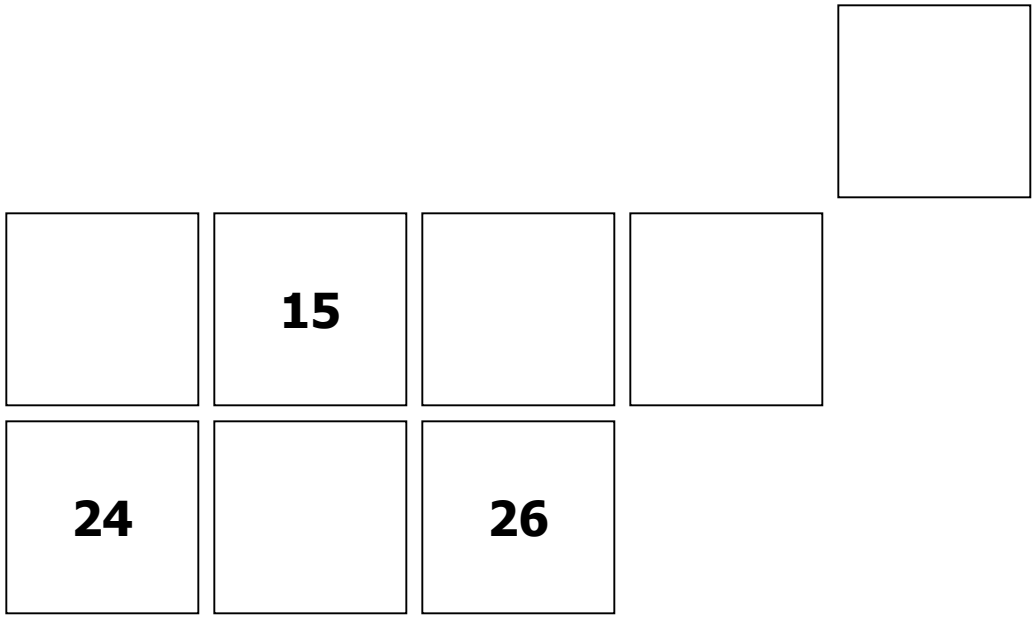
***children select a special number each day**

Important Benchmarks

- Early
  - Ten
  - Hundred
- Later On
  - Thousand
  - Million

0	1	2	3	4	5	6	7	8	9
10	11	12	13	14	15	16	17	18	19
20	21	22	23	24	25	26	27	28	29
30	31	32	33	34	35	36	37	38	39
40	41	42	43	44	45	46	47	48	49
50	51	52	53	54	55	56	57	58	59
60	61	62	63	64	65	66	67	68	69
70	71	72	73	74	75	76	77	78	79
80	81	82	83	84	85	86	87	88	89
90	91	92	93	94	95	96	97	98	99

100 Chart Puzzles



- Finding and using patterns and other thinking strategies greatly simplifies the task of learning multiplication tables.

Thornton, 1978

- Children need to identify individual products rapidly. **Little is known about how children acquire this fluency or what experiences might be of most help.**

Adding it Up (NRC, 2001)

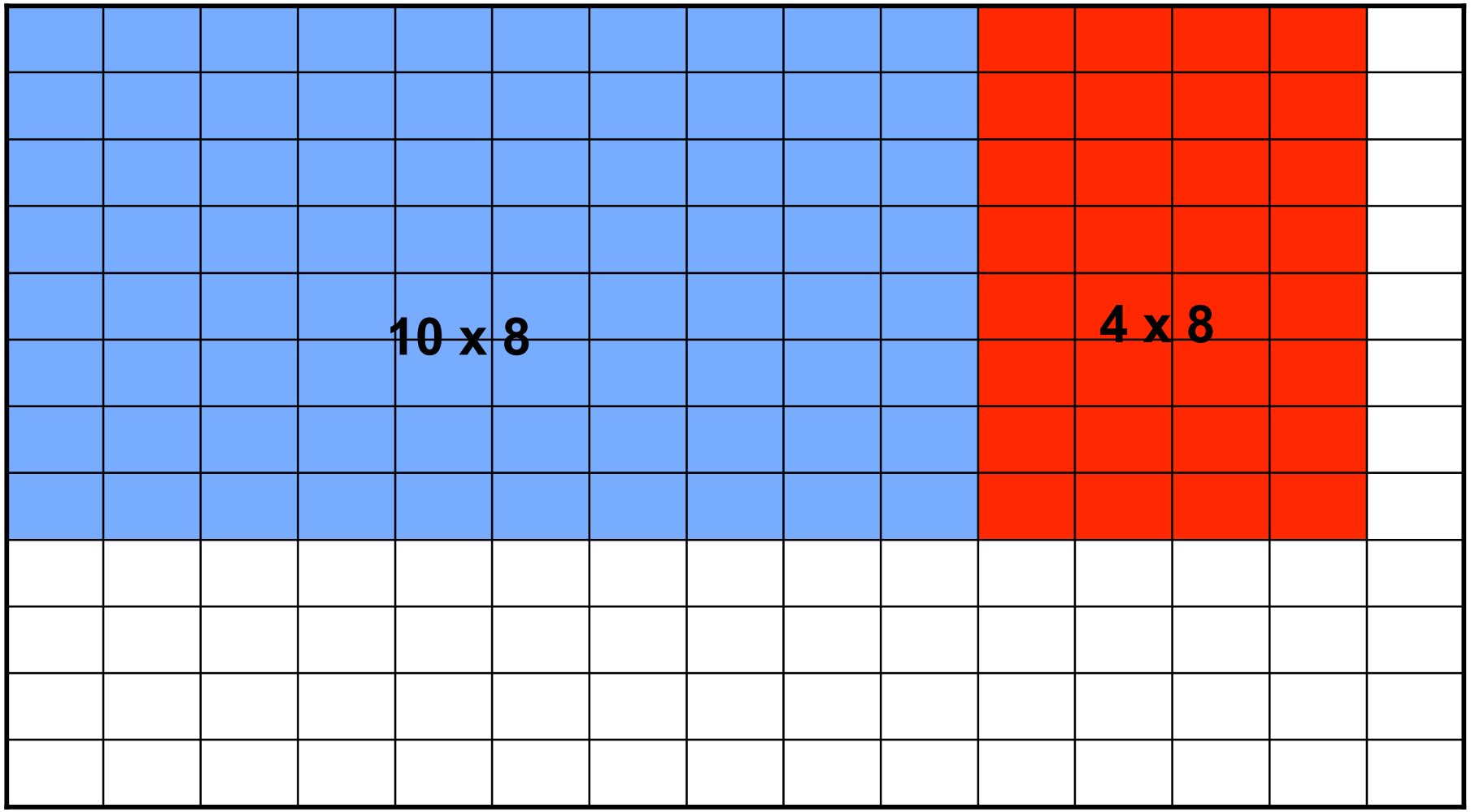
Consider…

- Teachers - In many cases, students should know their facts before they come to you. **OK, they don't - get over it!!**

- But, facts are important linchpins for upper level computation work.
- **How many times in your instructional life do you think you have dealt with this issue?**

Mystery Facts

- The sum of the digits in this 2-digit number is 9. The difference between the digits is 3. A number that fits this description is _____. Multiplication fact(s):
- The tens digit in this 2-digit number is one-fourth of the ones digit The sum of the digits is an even number. A number that fits this description is _____. Multiplication fact(s):
- One of the digits in this 2-digit number is 5, but the number is not divisible by 5. Nor is it divisible by 9. A number that fits this description is _____. Multiplication fact(s):



14 x 8 = (10 x 8) + (4 x 8)

Boxes to multiply…

- Draw a rectangle to show 46 x 7 = 322

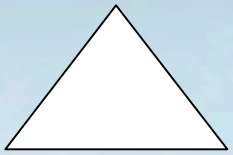
46 x 7 = (40 x 7) + (6 x 7) =

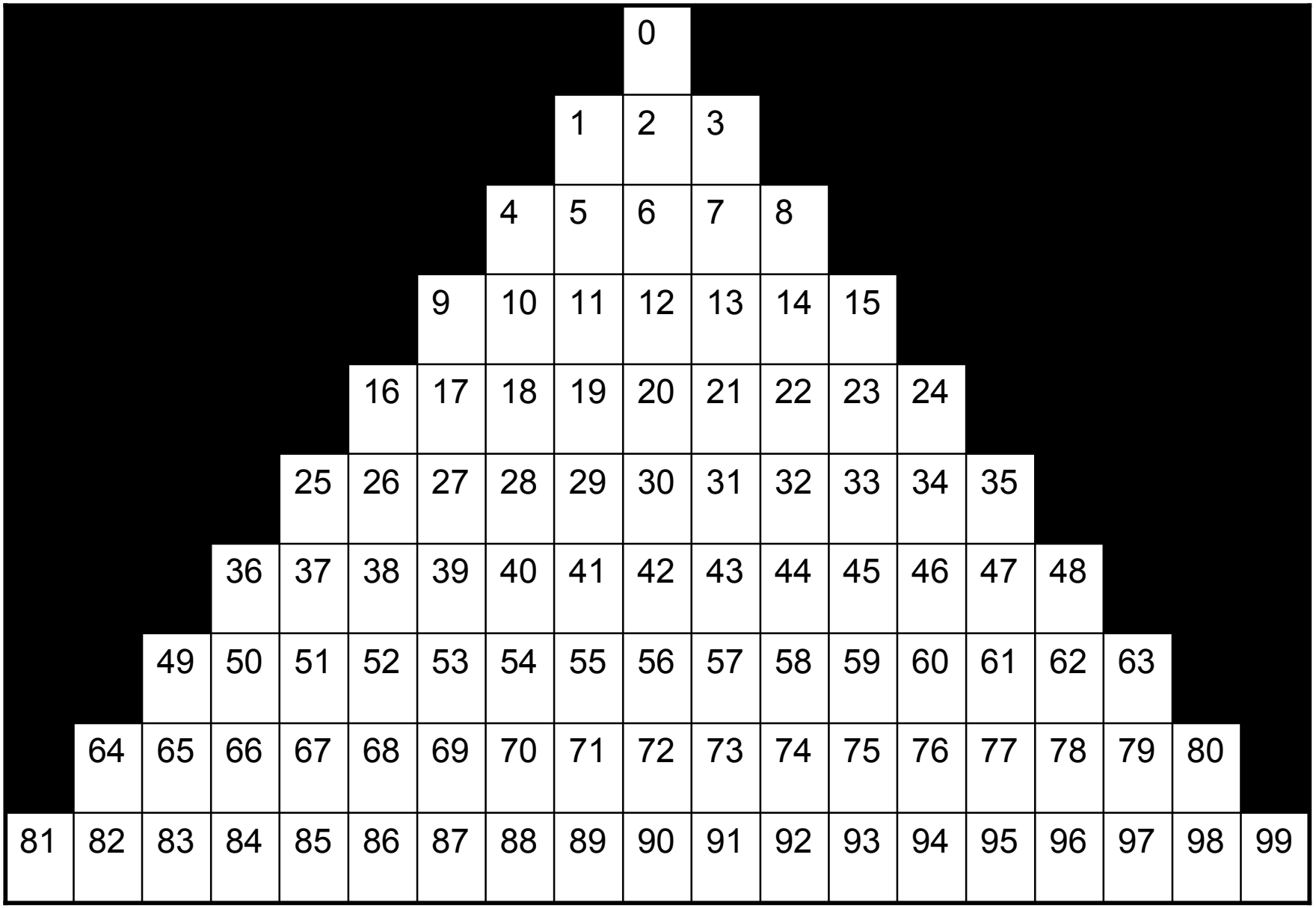
280 + 42 = 322

100 Chart Equations

- Circle 38. Add 10. Add 1. Subtract 9. Add 5. New number is _____.
- Circle 6. Add 30. Subtract 8. New number is _____.

- 45 – 10 + 7 =
- Write your own:




0
1 2 3
4 5 6 7 8
9 10 11 12 13 14 15
16 17 18 19 20 21 22 23 24
25 26 27 28 29 30 31 32 33 34 35
36 37 38 39 40 41 42 43 44 45 46 47 48
49 50 51 52 53 54 55 56 57 58 59 60 61 62 63
64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80
81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99

My number of the day*

- Multiply your number by 4: _____
- Subtract 1: _____
- What is the new number? _____

- How is the new number different from your number of the day?
- $4x - 1 = n$

Today's Secret Number (Mr. x)

- It is less than 3 x 8
- It is an even number
- It is more than 2 weeks
- It is not a multiple of 8
- It is divisible by 10
- What is today's number? _____

What's my number?

- Start with n. Double it. Now it's?
- What is n x 4?
- What is n x 10?
- What is n x 100?
- What is ½ n? What is 50% of n?
- What is ¼ n? What is 25% of n?
- Name two numbers n falls between.

Spin to win

_____ _____ _____ _____ _____

REJECT

_____ _____

X _____ _____ _____

REJECT

9, 2, 1, 7, 8

Today's Secret Number (Mr. x)

- It is less than 3 x 8
- It is an even number
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- It is not a multiple of 8
- It is divisible by 10
- What is today's number? _____

Number Characteristics

Yes	No
•19; 17 •70; 267	•20; 6 •55; 67

- Numbers that are odd
- Numbers that contain the digit 7

Multiples of five

Prime numbers

Division and Fair Shares

- How would you share 11 subs among 4 people?
- How would you share 11 subs among 5 people?

- How would you share 124 among 5?

Connections – Division & Mental Math

- Quinn found 77 beads in a drawer. He was using them to make bookmarks. If he used 5 beads for each bookmark. How many bookmarks could he make?
- Starter problem 50 ÷ 5

- 275 divided by 5
- Starter problem 250 ÷ 5

Over or Under?

- 200
  - Erasers: 6 per package, 36 packages
  - Pencils: 9 per package, 19 packages
  - Chalk: 12 buckets, 15 per bucket
- 500
  - Pens: 41 boxes, 16 per box
  - Binder Clips: 45 per box, 8 boxes
  - Crayons: 32 per box, 19 boxes

Estimation – Some Thoughts

- Estimating Magnitude – should begin early and occur often.
- Children are initially uncomfortable with computational estimation.
- The language of computational estimation is adult language. Children seem OK with such language as they grow – experientially.

Target Number

- Start number is 6
- Goal number is 420
- Write equations to show how you can get to the goal number.

- Start = 13; Goal = 100
- Start = 1/2 ; Goal = 5

Estimate or Exact?

- Your school bus number.
- When to leave for school in the AM.
- When a flight will leave the airport.
- Total bill at a restaurant.

- When do you estimate?
- When must you have an exact response?

Today's Target is 36

- Try to make today's target by:
  - Adding 2 numbers
  - Finding the difference of 2 numbers
  - Multiplying 2 numbers
  - Adding 3 numbers
  - Multiplying 3 numbers
  - Multiplying and subtracting
  - YOUR own method!

McIntosh, Reys, Reys, and Hope (1997)

Fractions

- A Mess! Children don't do well and never have.
- Links to number theory - GCF and LCM are not consistent across curricula.
- Social contexts for their use are diminishing, as we become a decimal culture.
- Links to decimals, ratio, percent, proportion.
- Elementary schools should begin the process and the **middle school should extend it.**

Representations

Show the following fractions using region, set, and number line models.

- 3/5
- 3/6
- 3/4
- 4/5
- 1/5
- 2/5

Ordering Fractions

Write these fractions in order from least to greatest. Tell how you decided.

- 5/3 5/6 5/5 5/4 5/8
- 7/8 2/8 10/8 3/8 1/8

How Many Marbles?

- Marvin counted the marbles he had collected. He counted more than 40 but less than 70. When he put the marbles in groups of 5, he had 1 left over. When he put them in groups of 4, he had 1 left over. When he put them in groups of 3, he had 1 left over. How many marbles did Marvin collect?

- Show your work. Explain how you got your answer.

Use Percent – Don't Wait!

- Put 2/3; 0.5 and 3/4 in order from smallest to largest.
- It's easy, 0.5 is 50% and 2/3 is 66%, and so it goes first 0.5, then 2/3 and then ¾ because that's 75%.*

*response by Andy in New Approaches to Teaching the Rational Number System by Joan Moss in How Students Learn: Mathematics in the Classroom, NRC, 2005.

Percent Benchmarks

	0%	
100%	50%	< 10%
About 25%	About 75%	About 90%
> 50%	< 50%	

- Lefthanders in the room or class
- Once lived in New Jersey
- Been involved in education > 10 years
- People who were born in Texas

Missing Numbers

- What's my number?
- $2x + 7 = y$
- Rule: Double the number and add 7. What's the number if x =

  10

  100

  0.1

  0.01

Where's the decimal point go?

- 8.432 x 5.75 = 48484
- 3.044 x 16.5 = 50226
- 3.326 x 0.32 x 31.5 = 3352608
- 306.15 ÷ 75.4 = 40603448

Applications

Estimation

- How many 1-digit numbers are there? 2-digit numbers? 3-digit numbers?
- The toll road is 243 miles long. If you traveled at a speed of 61 mph, about how many hours will you be on the toll road?
- The height of full grown human is about 21 times the length of the middle finger.

Elementary School Mathematics, Addison-Wesley, 1968

Are you sure?

Actual problem presented at a mathematics conference.

A dog traveled 15 meters per second. How far would the dog go in: a minute, a half-hour, an hour, a day?

Speeds of Some Animals

Cheetah	70 mph (65)*
Lion	50 mph
Zebra	40 mph
Rabbit	35 mph
“Super Dog”	33+ mph
Reindeer	32 mph
Elephant	25 mph
Chicken	8 mph

Mathematical Discussions

- Procedural tasks for which students are expected to have well-developed algorithmic approaches are usually **not** good candidates for discussion. Interesting problems that "go somewhere" mathematically can often be catalysts for rich conversation.

PSSM (NCTM, 2000, p. 60)

Imagine you are at your favorite amusement park, ready to ride the roller coaster. The ride lasts 2 minutes 15 seconds. The wait for the coaster each weekend is about 45 minutes, which is double the weekday wait.

- Could you ride the coaster three times in an hour?

Mall Sales

January	6.2%
February	5.8%
March	7.5%
April	7.6%
May	7.9%
June	7.6%
July	6.6%
August	7.7%
September	8.8%
October	6.8%
November	10.1%
December	16.1%

What can you say about this?

Thoughts

- Development of a sense of number is elusive.
- Number sense must be nurtured – every day!
- A sense of number breeds confidence.
- Numb3rs are everywhere!

NMP's – Critical Foundations

- Fluency with Whole Numbers
- Fluency with Fractions
- Geometry

What's Important for Algebra and More!

We share a responsibility

This must be a concerted team effort, it's about every child every day.

They are all yours!

- There are 26 sheep and 10 goats on a ship. How old is the captain?
- What do you think middle grade students did with the problem above?
- More than three out of four students responded with a numeric answer, the most common one being that the captain's age is 36!
- One child explained: "Well, you need to add or subtract or multiply in problems like this, and this one seemed to work best if I add" (Bradford and Stein, 1993).

Finally, with regard to students and learning

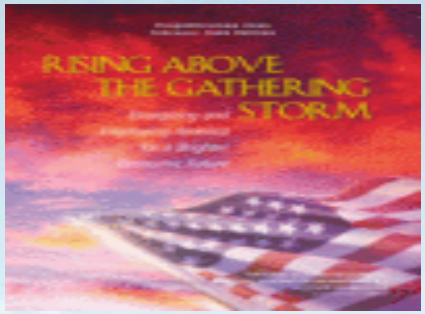
There is nothing more unequal than equal treatment of unequal children.

From the Secretary…

- "We must encourage students to take more advanced math and science classes. Employers today need workers with 'pocket protector' skills – creative problem solvers with strong math and science backgrounds."

Margaret Spellings, June 21, 2007

RAGS Effect



No Child Left Behind Challenges

- Meeting AYP
- Highly Qualified Teachers
- Math for All
  - special Education challenges
  - the continuing use of the word “subgroups”
- Overemphasis on high stakes assessments.

These challenges are diverting teachers from teaching, and driving them from the profession!

And, from my sister…*

Madaline Fennell, the Nebraska teacher of the year: Teachers are asking for,

- fully funding education and assessment programs that are federally mandated;
- language that addresses the special needs of students with disabilities, such as implementing state assessment systems that track the academic growth of individual students;
- replacing penalties against failing schools with methods to enhance achievement;
- multiple methods of assessment that evaluate a student's progress over the entire year, instead of just through standardized tests.

Ms. Fennell said that while there are positive aspects to the law, it is also "fraught with numerous deficiencies." The expertise of teachers who have been chosen as the best of the best in their states, she said, can help lawmakers craft a better version of the No Child Left Behind Act. "Teachers need to be included in this reauthorization," she said. "Please, leave no teacher behind."

* NOT

When did you really become a teacher?

You were not prepared for your first class!

When I got everything done, I just sat down in the middle of my room and cried.

Your Challenge – Daily

- They start their work prior to YOUR directions!
- They finish their homework in school.
- They are not particularly concerned with understanding before taking the “plunge.”
- They have attention spans less than the time needed to attend to seatwork, homework, etc.

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Questions?