

Parkland School District  
February 2015

# ELEMENTARY MATHEMATICS

# Why is learning math different now than when I was in school?

- Knowledge gained from research
- Professional leadership of the National Council of Teaching Mathematics (NCTM)
- Public or political pressure for change in mathematics education due largely to poor U.S. student performance
- Implementation of the PA Core Standards

# Trends in International Mathematics and Science Study (TIMSS)

- TIMSS is the largest study of math and science education ever conducted.
- A major finding called the US mathematics curriculum a mile wide and an inch deep.
- US curriculum was found to be unfocused, pursuing many more topics than other countries while repeating many concepts.
- Although the world has changed greatly over the past 100 years, it was found teaching mathematics during the same time frame was essentially unchanged!

# US Lesson findings....

- In more than 99.5% of the US lessons the teacher reverts to showing students how to solve the problem.
- Out of 81 videotaped US lessons ZERO lessons had any high level mathematics content observed; in contrast 30-40% of lessons in Germany and Japan contained high level content
- 89% of the US lessons consisted of low level content.

# The Common Core Standards

- National Common Core Standards
- State Core Standards: PA Core Standards
- Why Core Standards?
  - Prepares students for college and/or career
  - Provides clear, focused standards
  - Sets consistent expectations
  - Includes both knowledge and application of subject area
  - Based on real world application

# Comparing Standards

## PA CORE STANDARD:

CC.2.1.2.B.3 Use place value understanding and properties of operations to add and subtract within 1000.

## PA 2010 STANDARD:

2.2.2.B Add and subtract single and double-digit numbers with and without regrouping, to include problems with money.

# "Old Way"

- $73 - 46 =$ 
  - Line up tens and ones
  - Must start in the ones place
  - Can't take 6 away from 3, so borrow from the 7; 7 becomes a 6, 3 becomes a 13
  - Subtract the columns:  $13 - 6 = 7$ ;  $6 - 4 = 2$
  - Answer is 27

$$\begin{array}{r} 6 \ 13 \\ \cancel{7}3 \\ -46 \\ \hline 27 \end{array}$$

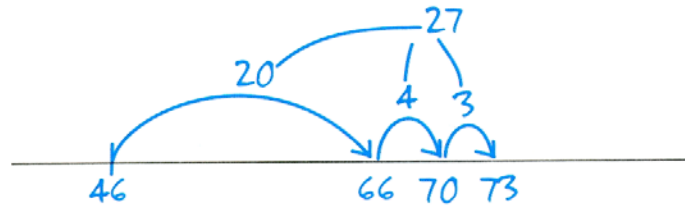
# Three different invented strategies for Subtraction by counting up

## Add Tens to Get Close, Then Ones

$$73 - 46$$

46 and 20 is 66. (30 more is too much.)  
Then 4 more is 70 and 3 is 73. That's 20  
and 7 or 27.

$$\begin{aligned} 46 + 20 &= 66 \\ 66 + 4 &= 70 \\ 70 + 3 &= 73 \\ 20 + 4 + 3 &= 27 \end{aligned}$$

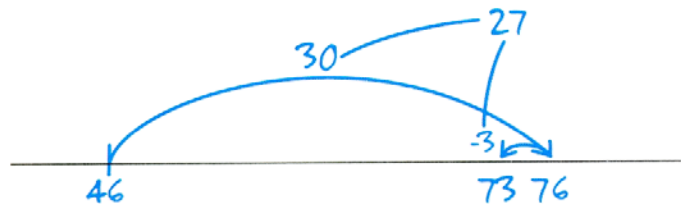


## Add Tens to Overshoot, Then Come Back

$$73 - 46$$

46 and 30 is 76. That's 3 too  
much, so it's 27.

$$\begin{aligned} 46 + 30 &\rightarrow 76 - 3 \rightarrow 73 \\ 30 - 3 &= 27 \end{aligned}$$

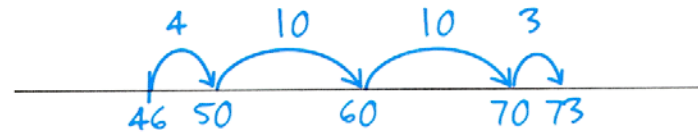


## Add Ones to Make a Ten, Then Tens and Ones

$$73 - 46$$

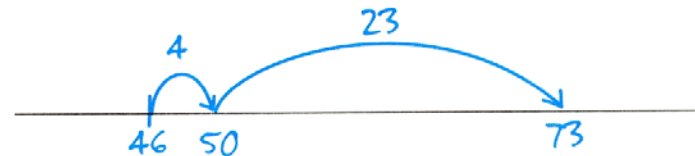
46 and 4 is 50. 50 and 20 is 70 and 3  
more is 73. The 4 and 3 is 7 and 20 is 27.

$$\begin{aligned} 46 + 4 &\rightarrow 50 \\ 50 + 20 &\rightarrow 70 \\ 70 + 3 &\rightarrow 73 \\ 4 + 20 + 3 &= 27 \end{aligned}$$



Similarly, 46 and 4 is 50.  
50 and 23 is 73.  
23 and 4 is 27.

$$\begin{aligned} 46 + 4 &\rightarrow 50 \\ 50 + 23 &\rightarrow 73 \\ 23 + 4 &= 27 \end{aligned}$$





# Four different invented strategies for take away subtraction

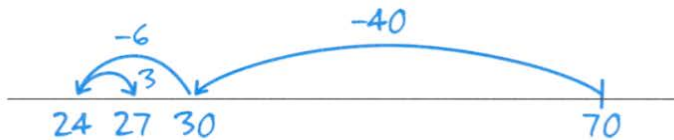
## Take Tens from the Tens, Then Subtract Ones

$$73 - 46$$

70 minus 40 is 30.  
Take away 6 more  
is 24.  
Now add in the  
3 ones  $\rightarrow$  27.

$$70 - 40 \rightarrow 30 - 6$$

$$24 + 3 \rightarrow 27$$



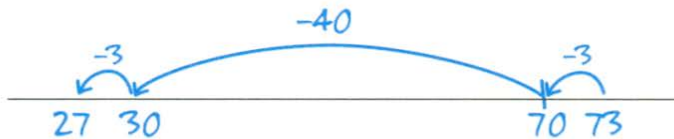
Or

70 minus 40 is 30. I can  
take those 3 away, but I  
need to take away 3 more  
from the 30 to make 27.

$$70 - 40 = 30$$

$$(73 - 3 = 70)$$

$$30 - 3 = 27$$



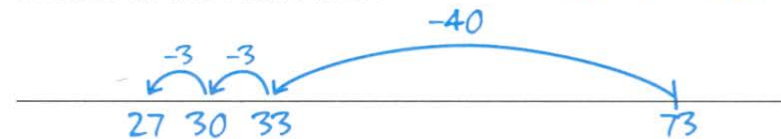
## Take Away Tens, Then Ones

$$73 - 46$$

73 minus 40 is 33. Then take away 6:  
3 makes 30 and 3 more is 27.

$$73 - 40 \rightarrow 33 - 3$$

$$30 - 3 \rightarrow 27$$



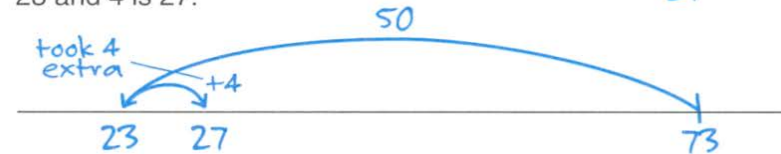
## Take Extra Tens, Then Add Back

$$73 - 46$$

73 take away 50 is 23. That's 4 too many.  
23 and 4 is 27.

$$73 - 50 \rightarrow 23 + 4$$

$$27$$



## Add to the Whole If Necessary

$$73 - 46$$

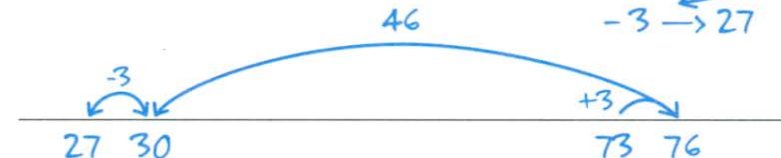
Give 3 to 73 to make 76. 76 take away  
46 is 30. Now give 3 back  $\rightarrow$  27.

$$+3$$

$$73 - 46 \rightarrow$$

$$76 - 46 \rightarrow 30$$

$$-3 \rightarrow 27$$



# Subtraction Algorithm

- Begin with Models Only:

Not enough ones to take off 7.  
Trade a ten for 10 ones.

Now there are 15 ones.  
I can take 7 off easily.

And now I can take off 2 tens.

That's 18 left.

It does not matter which ones come off. Put the leftovers together.

$$\begin{array}{r} 45 \\ -27 \\ \hline 18 \end{array}$$

# And finally.....

- $73 - 46 =$ 
  - Line up tens and ones
  - Can't take 6 ones away from 3 ones, so borrow 1 ten from the 7; 7 tens (70) becomes 6 tens (60), 3 ones are now 13 ones.
  - Subtract the tens/ones:  $60 - 40 = 20$ ;  $13 - 6 = 7$
  - Answer is 27

## STUDENT NOW HAS:

- Greater depth of understanding of subtraction and number concepts
- Multiple tools in the tool box to solve subtraction problems
- The ability to transfer this knowledge to other upcoming concepts (even if it's not until the next year!)

$$\begin{array}{r} 6 \ 13 \\ \cancel{7}3 \\ -4\cancel{6} \\ \hline 27 \end{array}$$

# Standards for Mathematical Practice

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

# Standards Based Curriculum vs. Traditional Curriculum

- Traditional:
  - Text book with many topics (most one day lessons and no deep understanding).
  - Teacher demonstrates how to do the math and students practice.
  - One way to solve a problem.
- Standards Based:
  - Based on how students learn math and how concepts develop over time.
  - Cover fewer topics, spend more time on each concept, and make connections among concepts.
  - Students learn through inquiry, not only through teacher explanation.
  - Strong emphasis on problem solving and conceptual understanding.
  - Multiple ways to solve a problem.

# Understanding is the Goal!

## Understanding is.....

- being able to think and act flexibly with a topic or concept.
- more than a collection of information, facts, data or procedures.
- the ability to justify why a given mathematical answer is true or why a mathematical rule makes sense.
- essential for students to be able to connect prior knowledge to new knowledge.

# Parent Resources

## National Common Core Standards:

- <http://achievethecore.org/common-core-intro-for-parents>
- <http://www.pta.org/parents/content.cfm?ItemNumber=2583>

## Pa Core Standards:

- <http://www.parklandsd.org/curriculum/pa-core-standards/>
- <http://www.pdesas.org/standard/pacore>

## Go Math:

- <http://www-k6.thinkcentral.com/ePC/start.do>
- [http://www-k6.thinkcentral.com/content/hsp/math/gomath2015/na/grk-6/on\\_the\\_spot\\_videos\\_9780544251519\\_/index.html](http://www-k6.thinkcentral.com/content/hsp/math/gomath2015/na/grk-6/on_the_spot_videos_9780544251519_/index.html)

# Parkway Manor: Feb 3, 2015

- **Kindergarten: Room 143**
  - Kelly Bedics and Karen Brown (Diane Neikam)
- **1<sup>st</sup> Grade: Gym (HERE)**
  - Dan Ryan and Kim vanLierop (Karen Dopera)
- **2<sup>nd</sup> Grade: Cafeteria**
  - Mandy Sommer and Kristin Madeira (Jamie Giaquinto)
- **3<sup>rd</sup> Grade: Room 140**
  - Emily Hamm and Lee Moyer (Scott Bartman)
- **4<sup>th</sup> Grade: Library**
  - Tina Apgar-Doll and Nicole Mandry (Rob Holmes)
- **5<sup>th</sup> Grade: Room 141**
  - Jacque Creamer and Emily Toth (Kelly Rosario)



# Fogelsville: Feb 9, 2015

- **Kindergarten: Gym**
  - Kelly Bedics (Diane Neikam)
- **1<sup>st</sup> Grade: Cafeteria**
  - Dan Ryan and Kim vanLierop (Karen Auliso)
- **2<sup>nd</sup> Grade: Room 309**
  - Mandy Sommer and Kristin Madeira (Kelly Rosario)
- **3<sup>rd</sup> Grade: Art Room**
  - Emily Hamm and Lee Moyer (Michael Gehringer)
- **4<sup>th</sup> Grade: Library**
  - Tina Apgar-Doll and Nicole Mandry (Di Schantz)
- **5<sup>th</sup> Grade: Room 320**
  - Jacque Creamer and Emily Toth (Brenda DeRenzo)