



Math Solutions[®]

FOUNDED BY MARILYN BURNS

RADICALLY REAL: MANIPULATIVES AS A VEHICLE FOR DEVELOPING NUMBER SENSE

KATIE ISAAC

NATIONAL COUNCIL OF TEACHERS OF MATHEMATICS

CONFERENCE

APRIL 11, 2014

Using Mathematical Tools

“Tools can be thought of as ways to amplify students’ mathematical activities.”

—James Hiebert et al., *Making Sense: Teaching and Learning Mathematics with Understanding*

Mathematical tools can:

- Provide a convenient and permanent record of mathematical activity
- Provide a way of communicating with others
- Facilitate thinking.

Standards for Mathematical Practice

“Mathematically proficient students consider the available tools when solving a mathematical problem.”

- Common Core - Standards for Mathematical Practice #5

Tools for Mathematical Thinking

- **Dot Images**
- **Ten-frames**
- **Bead Boards (rekenrek)**
- **Number lines**

How can each of these tools be used in the classroom to build number sense?

“Through partitioning (decomposing), students come to understand the idea that numbers can be broken down into other numbers. They also begin to recognize the relationship of parts to the whole. When students interpret numbers in terms of part-whole relationships, they think about numbers as made up of other numbers, and this way of thinking is the major conceptual achievement of the early school years.”

—David Sousa in *How the Brain Learns Mathematics*

Quick Images

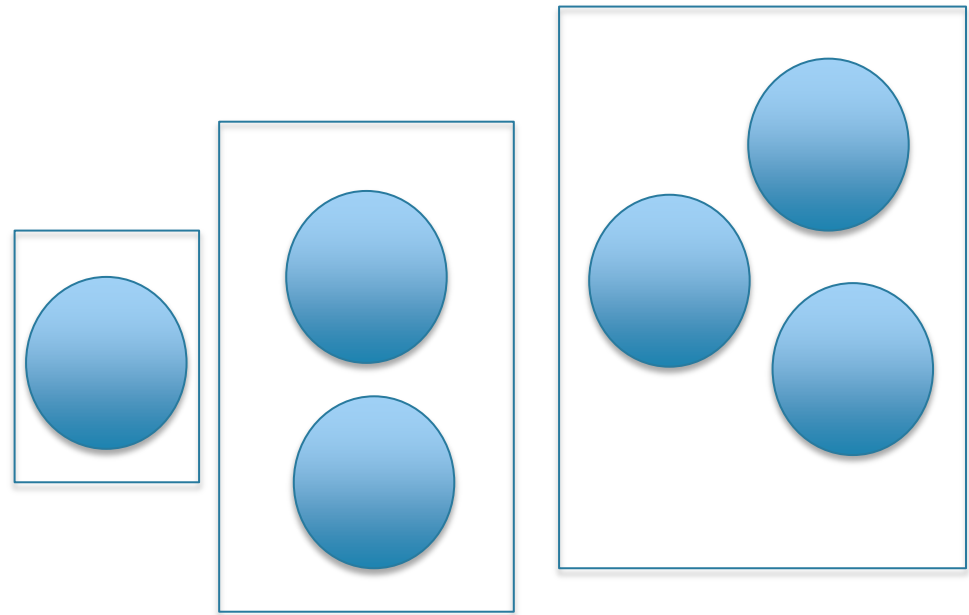
(Recommendations from Doug Clements)

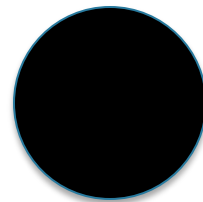
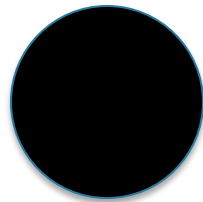
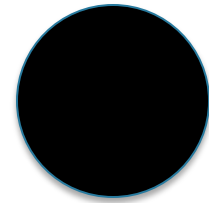
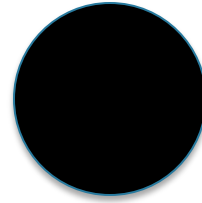
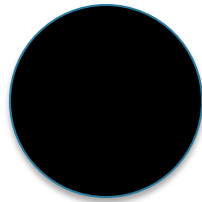
- Use dot patterns not manipulatives initially - (Children have a tendency to rely on counting manipulatives by ones rather than creating a mental image.)
- Include regular arrangements and symmetrical arrangements
- Dot should have strong contrast from the background

Subitizing

- **Perceptual subitizing**- ability to see a group and know how many without counting
- **Conceptual subitizing**- ability to see more than one group and add them together to find the total

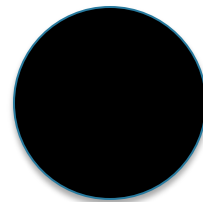
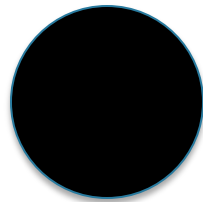
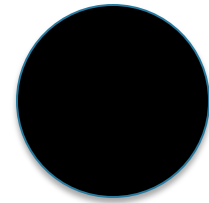
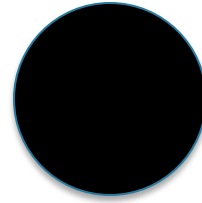
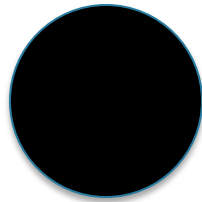
Subitizing Research

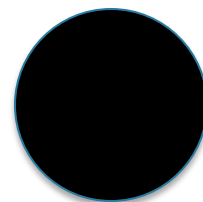
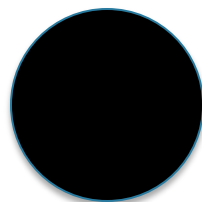
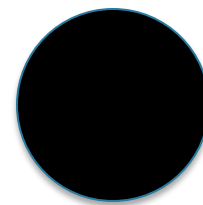
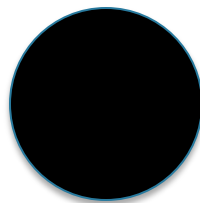
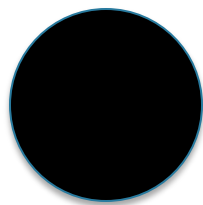




What did you see?

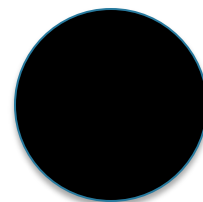
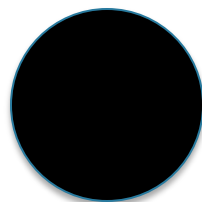
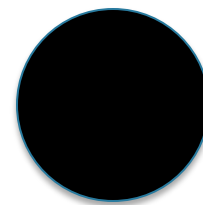
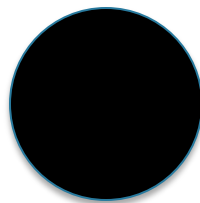
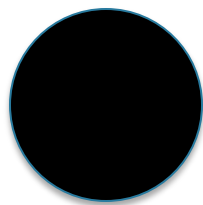
How did you see it?



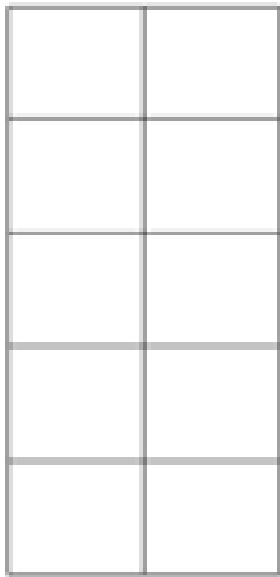
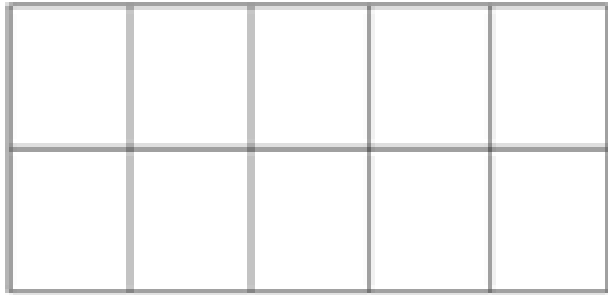


What did you see?

How did you see it?



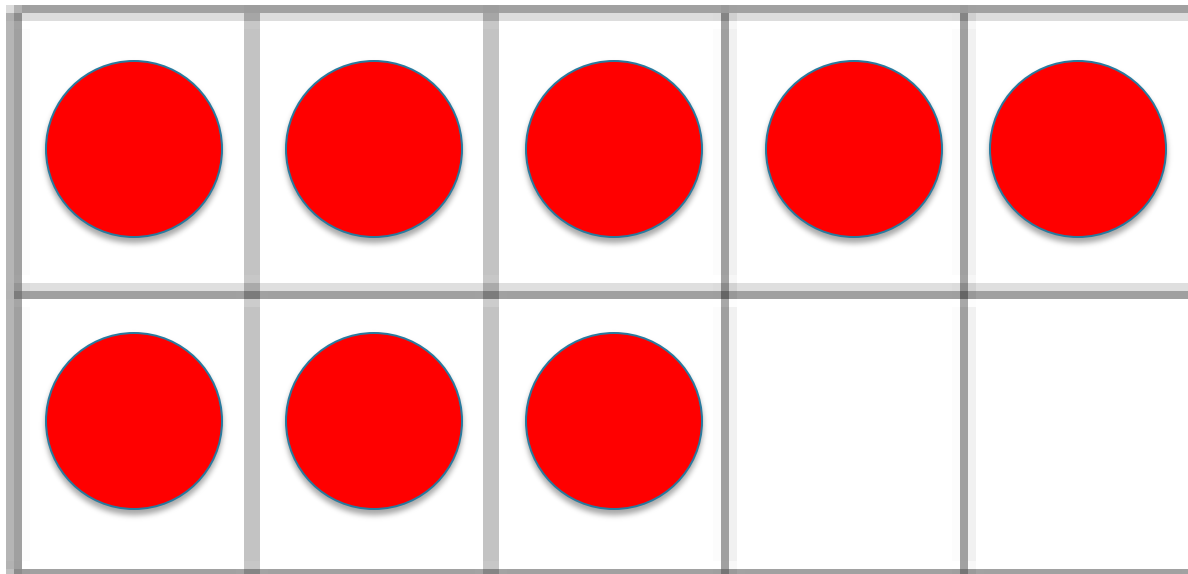
Ten-Frames



- Deepen the understanding of landmark numbers; 5 and 10.
- Develop the ability to use landmark numbers.
- Develop computational fluency.

How Many Dots? Part 1

How many dots are in the ten-frame?
How did you figure it out?



Ten-Frame and Dot Card Images

View video clip:

<https://mathsolutions.wistia.com/projects/mmtpdw6udz>

Mathematically proficient students look closely to discern a pattern or structure.

—Common Core Standards for Mathematical Practice.

Building Quantities on a Ten-Frame

View video clip:

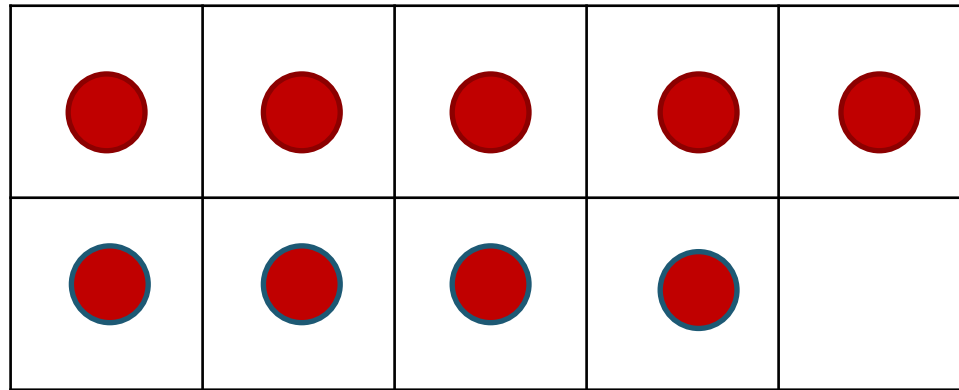
<https://mathsolutions.wistia.com/projects/mmtpdw6udz>

—Clip H: Building Quantities on a Ten-Frame

Grow and Shrink

- Materials
 - Grow and Shrink board
 - Counters
 - Die
- Directions
 - Roll a die. Place that many counters on the board. Roll the die again. Show the new number on the board.

Grow and Shrink



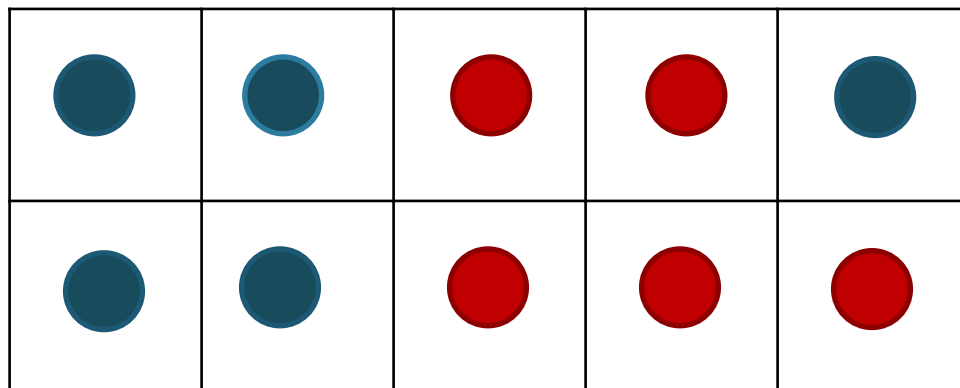
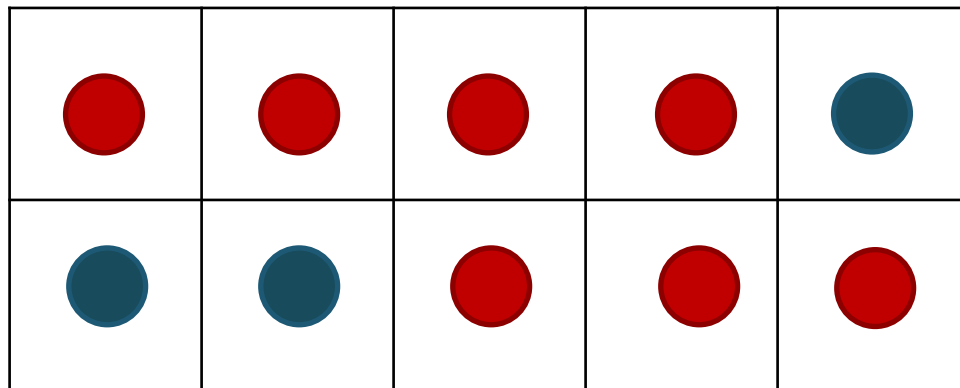
Processing

- How might children place counters on the board? What could you tell from their method?
- How could children transition from one roll to the next?
- What can the teacher learn from the way each child engages in Grow and Shrink? What does counter placement and removal reveal about student understandings?

Race to 20

- Materials
 - Race to 20 board
 - Counters
 - Dice
- Directions
 - Roll the dice. Place that many counters on the board. Roll the dice again. Place that many counters in the other color on the board. The first player to reach or go over 20 wins.

Race to 20



$$4 + 3 + 3 + 2 + 2 + 3 + 3 = 20$$

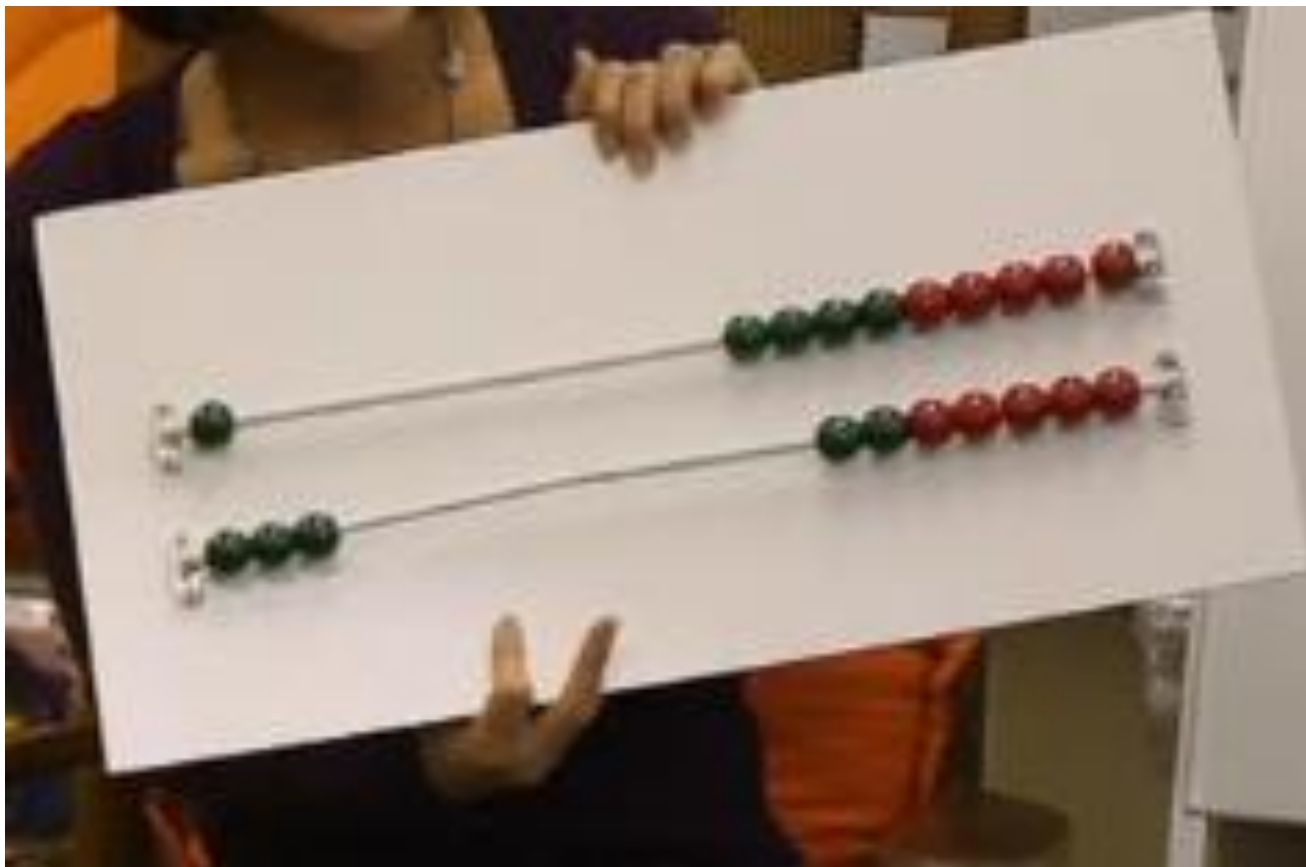
Processing

- What role does the double ten-frame play for students?
- What role do the counters play for students?
- What other tools would be useful for students?

Bead Boards



Rekenrek



Bead Board Video

View video clip:

<https://mathsolutions.wistia.com/projects/mmtpdw6udz>

Insert video clip 7.1 Counting on the bead board

Bead Boards

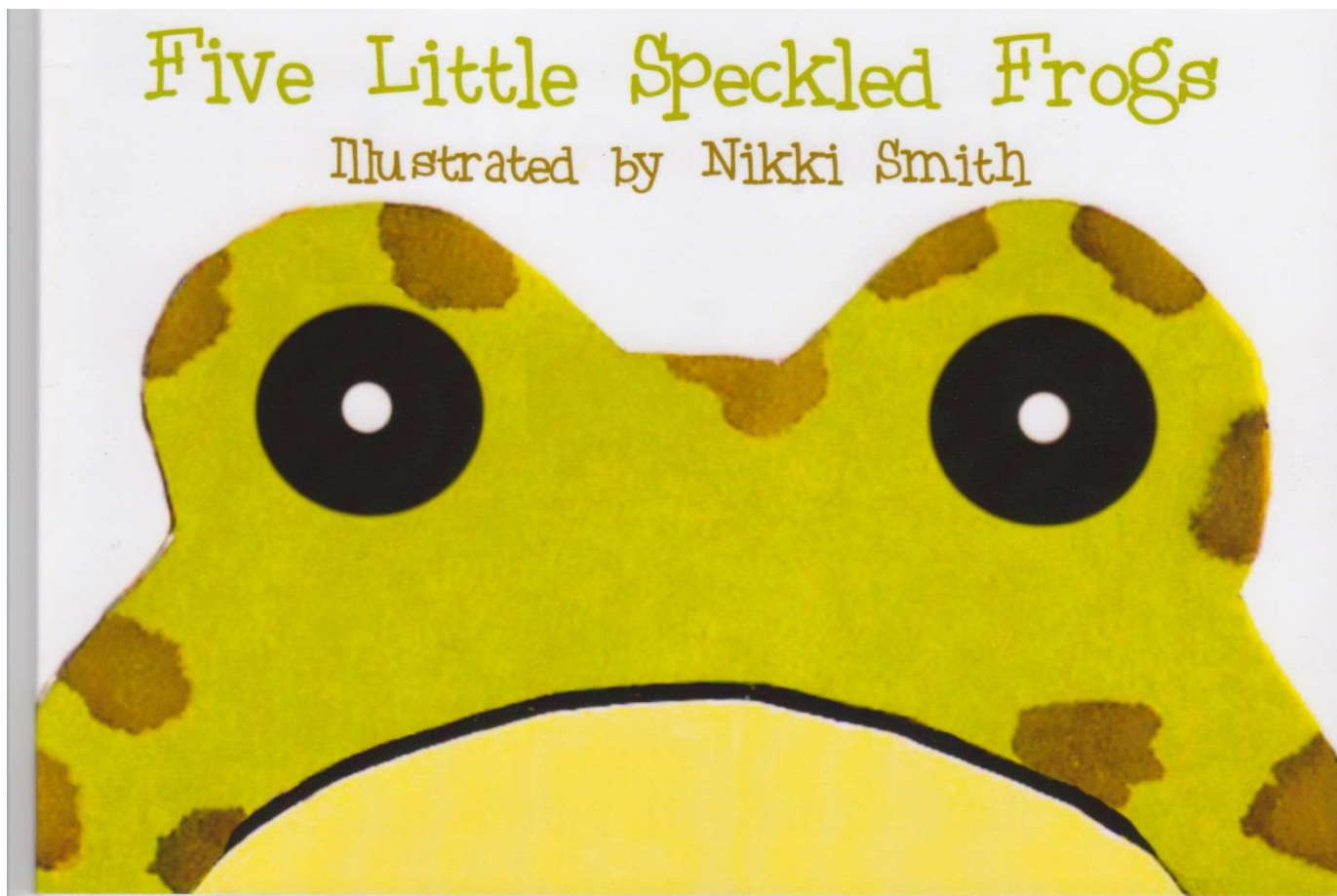
- My kids love to eat cookies. Micah's plate has 7 cookies on it and Joella's plate has 5 cookies on it. How many cookies do they have altogether?
- I looked out the window and saw some birds on two branches. 9 birds were on the upper branch and 7 birds were on the lower branch. How many birds were there on both branches?

Tools for Mathematical Thinking

- **Dot Images**
- **Ten-frames**
- **Bead Boards**
- **Number lines**

How can each of these tools be used in the classroom to build number sense?

Using Literature

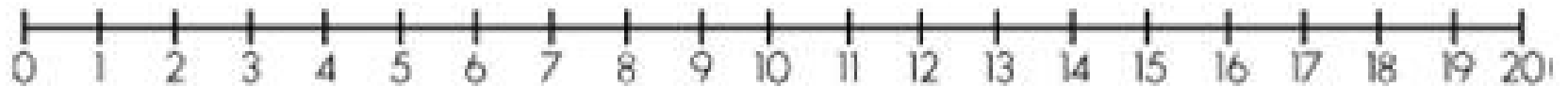


Five Little Speckled Frogs

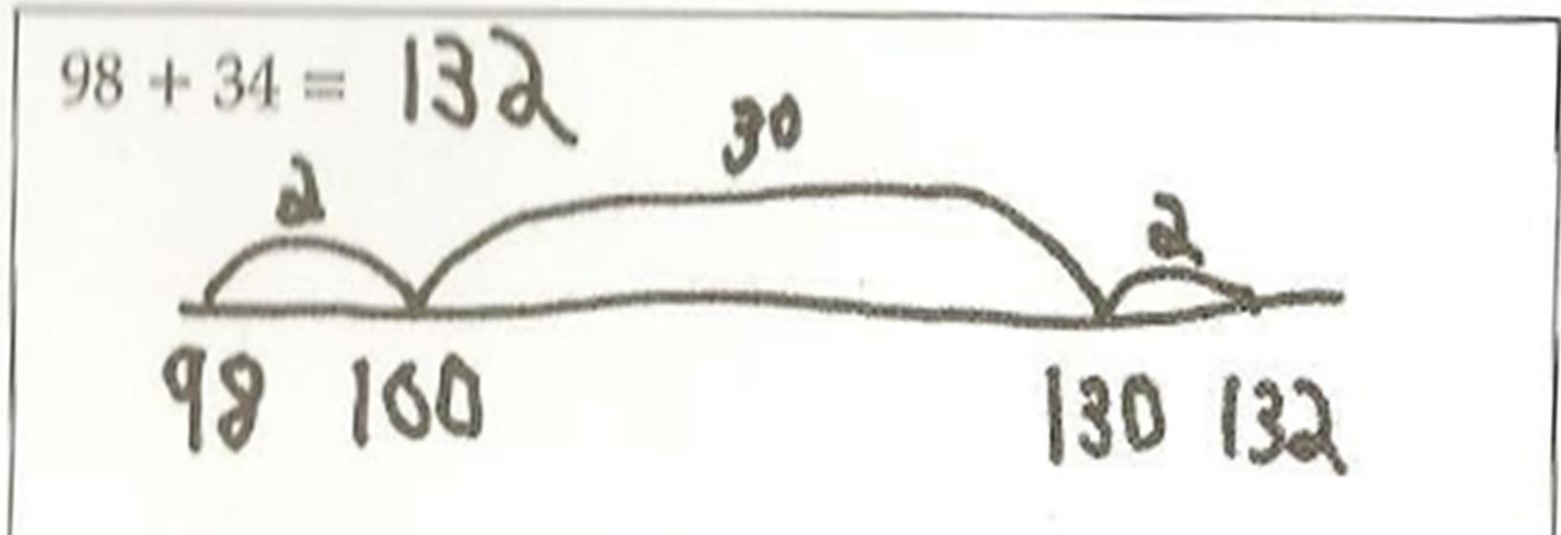
View video clip:

<https://mathsolutions.wistia.com/projects/mmtpdw6udz>

Number Lines



What is $98 + 34$?



Number Lines

- $15 + 7$

- $24 + 12$

Standards from today's session:

- K.CC.C.6
- K.NBT.A.1
- K.OAA.3
- K.OAA.4
- K.OAA.5
- K.OA.6
- 1.OA.6
- 1.OA.8
- 2.OA.B.2
- 2.OA.C.4

Using Mathematical Tools

“What seems to be important is not which tool a teacher chooses to introduce into the classroom, but rather that the teacher thinks carefully about the way in which students’ thinking might be shaped by using particular tools.”

—James Hiebert et al., *Making Sense: Teaching and Learning Mathematics with Understanding*



Math Solutions®

FOUNDED BY MARILYN BURNS

NCTM Booth 1125

mathsolutions.com/presentations

800.868.9092

info@mathsolutions.com