Welcome to …

(CO)^{2}MP Elementary

Common Core for Mathematical Proficiency in Elementary Schools

Agenda

- Wollygoggles
- Connecting Arithmetic to Algebra
- Multiplication as Dot Arrays
- Lunch
- Area Models for Multiplication
- Connecting Area to Algebra
- Reflection

Morning Warm-Up

Connecting Arithmetic to Algebra

"During the first part of the school year, it is critical to establish a classroom community in which students' mathematical thinking is valued, students are willing to publically try out incomplete ideas, and students listen to and build on each other's thinking."

-- Russell, Shifter, Bastable (2011)

Connecting Arithmetic to Algebra

Read page 9 to page 15.

As you are reading: Highlight, underline, or make note of things you find significant or meaningful.

When your group is finished, take some time to discuss these things you highlighted, underlined, or made a note of.

Connecting Arithmetic to Algebra

Focus Question #1 (pg. 23)

In the first section of Chapter 2, we visit four teachers' classrooms (Ms. Olana, Ms. Kaye, Ms. Diaz, and Ms. Rogers).

- Locate a particular passage for each teacher in which you notice the teacher working to help her students learn how to have mathematics discussions.
- Take notes on the specific actions or words of the teacher including the impact on students, if any.
- What are the implications of these teacher moves for your own classroom?

Algebra – Visualize Multiplication

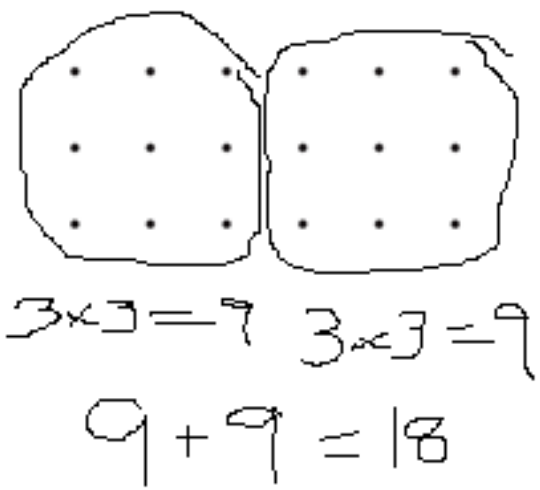
As we have been discussing, the CCSSM intends for students to reason and make sense of mathematics, not just memorize facts and procedures they have not made sense of.

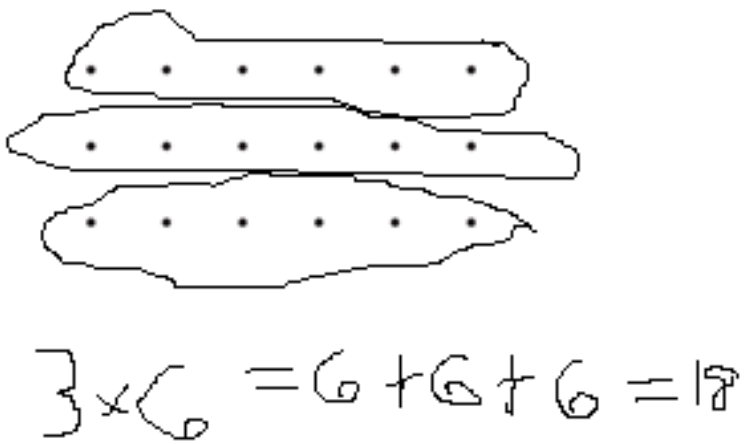
Dot Arrays are one way teachers are allowing students to voice mathematical ideas and explore multiplication prior to memorizing facts.

Algebra – Visualize Multiplication

These student samples came from a teacher who allowed students to first explore dot arrays and challenged them to *find the number of dots without counting them one by one.*

Later on, she encouraged them to use their own ideas about multiplication to represent the results.

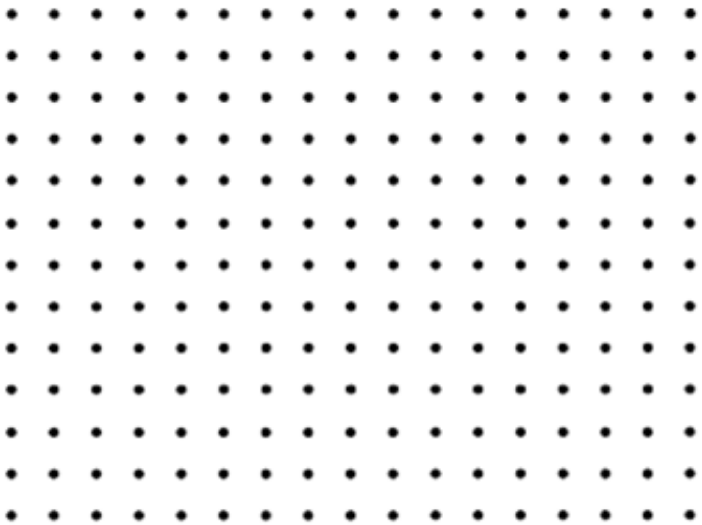




Algebra – Visualize Multiplication

Give opportunities for students to find more efficient ways and they will.

Using the 13x17 dot array, find an efficient way to know the number of dots. Write your solution using a(some) number sentence(s).

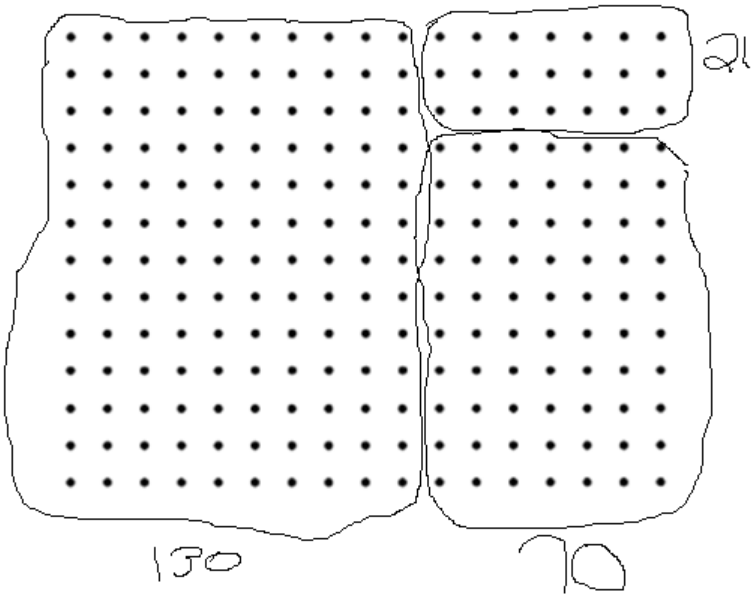


Algebra – Visualize Multiplication

As students were working on different two digit times two digit dot arrays the teacher asked them to be thinking of a way to find the answer just using the meaning of the digits and then represent it using the dot array.

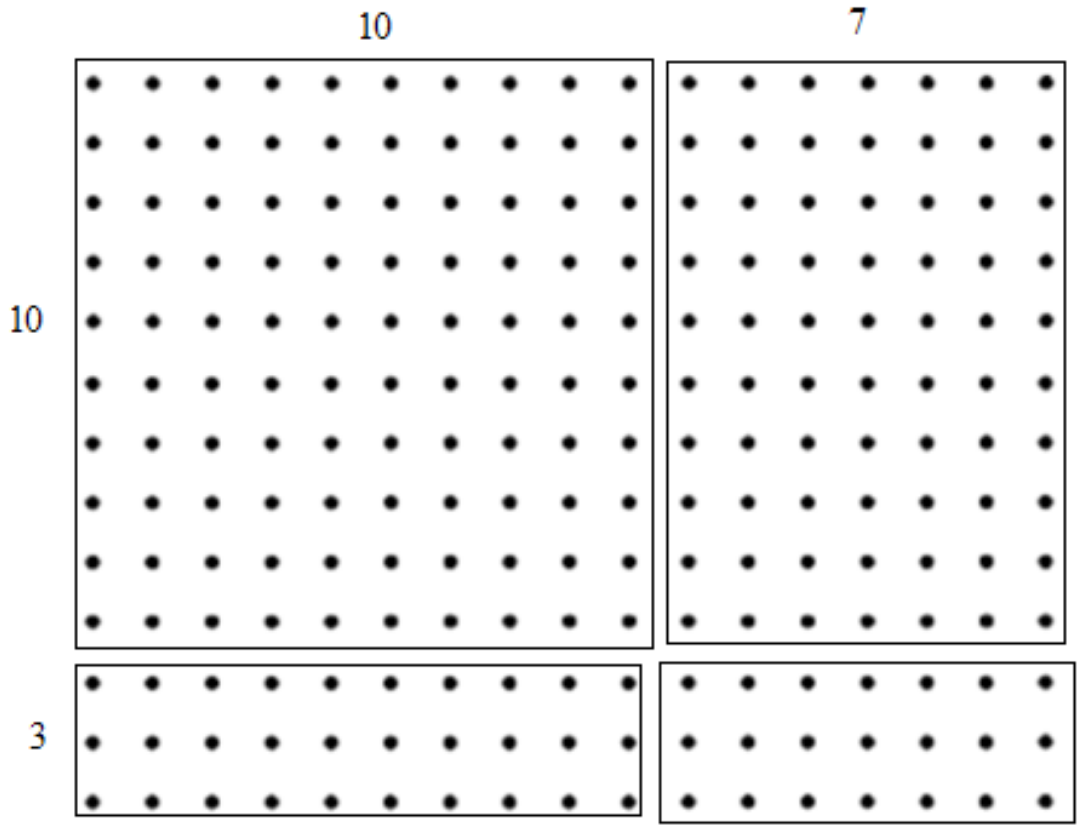
Use Jorge's dot array to explain how he multiplied the digits.

$$\begin{array}{r} 17 \\ \times\ 13 \\ \hline \end{array}$$



Algebra – Visualize Multiplication

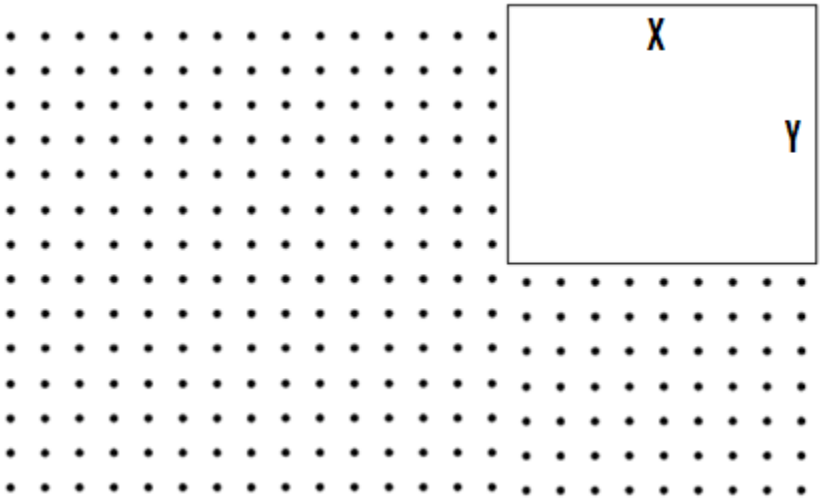
Students were later asked to explore whether or not they could break up both numbers and multiply across?

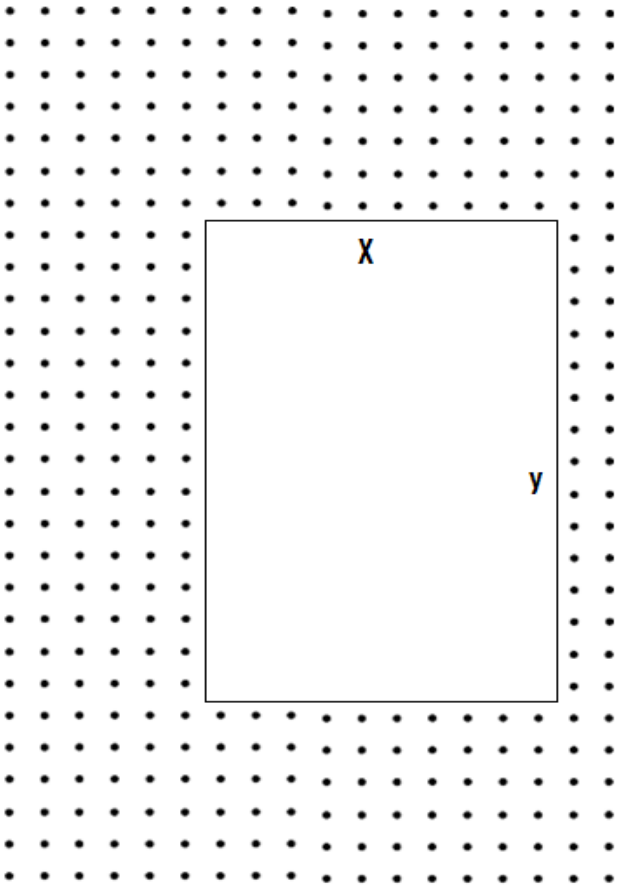


$$\begin{array}{r} 17 \\ \times\ 13 \\ \hline 100 \\ 70 \\ 30 \\ +\ 21 \\ \hline 221 \end{array}$$

Algebra – Visualize Multiplication

Transitioning students to thinking of X*Y as a group





Lunch

Some History

- 1980 – NCTM *An Agenda for Action*
- 1989 – NCTM *Curriculum Standards*
- 1991 – Ohio Model (8 Strands)
- 2000 – NCTM *Principles and Standards*
- 2002 – Ohio Academic Content Standards
- 2010 – Common Core State Standards for Mathematics
- 2011 – Ohio Model Curriculum
- 2014 – *Principles to Actions*

Using an Area Model for Multiplication

On centimeter grid paper, draw a 12 cm by 7 cm rectangle.

- How does this rectangle relate to the multiplication problem 12 × 7? Be as specific as you can about the relationship between the rectangle, the factors, and the product.

- Use your rectangle and base-ten blocks to find the product of 12 × 7 in at least two different ways.

- Does one of your ways make use of the structure of our base-ten number system? If so, explain how. If not, find a way that does make use of the structure of our base-ten number system and explain how.

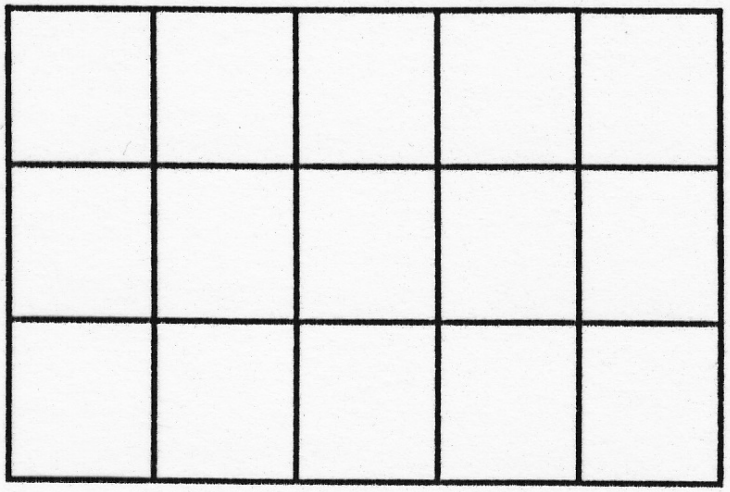
Using an Area Model for Multiplication

On centimeter grid paper, draw a 23 cm by 16 cm rectangle.

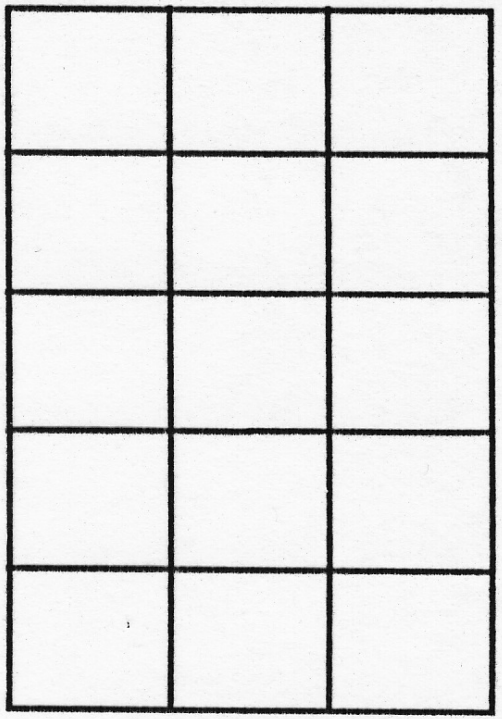
- Use base-ten blocks to find the product of 23 × 16 in a way that makes use of the structure of our base-ten number system.
- How do these area models for multiplication relate to the dot arrays? In what ways are they similar and in what ways are they different?
- How do these area models for multiplication relate to the algorithms that are used for multiplication?

Connecting Number to Algebra

Arrays – Grade 2

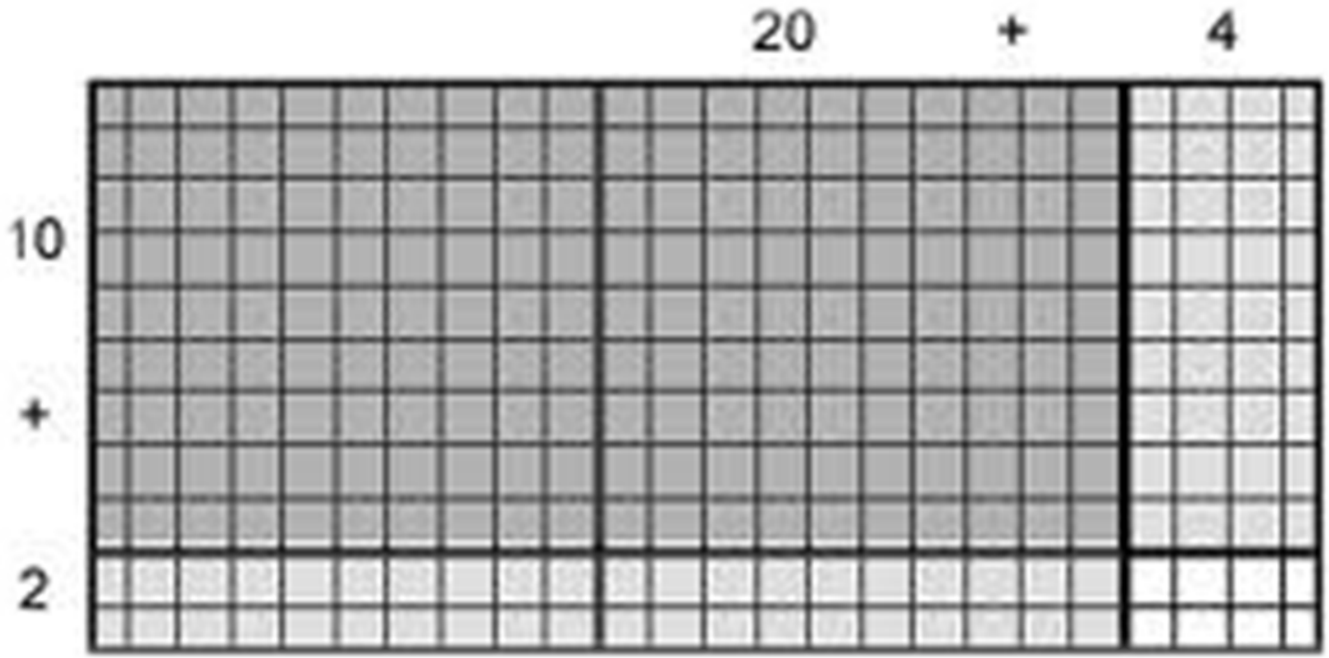


3 x 5



5 x 3

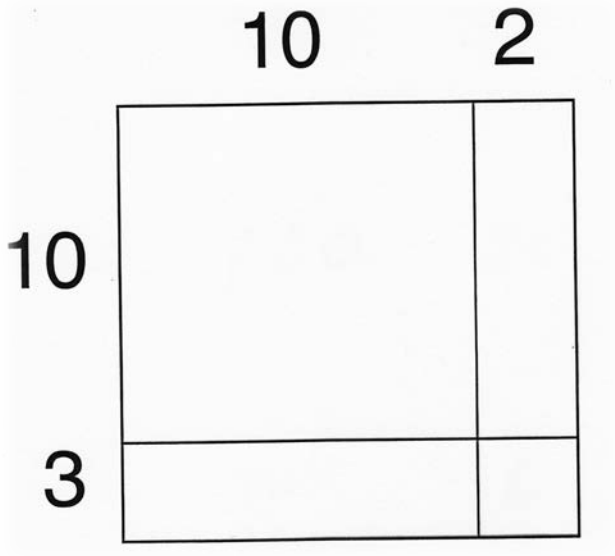
Multi-Digit Multiplication–Grade 4



$$
\begin{array}{rl}
24 & \\
\times\ 12 & \\
\hline
200 & (10 \times 20) \\
40 & (10 \times 4) \\
40 & (2 \times 20) \\
8 & (2 \times 4) \\
\hline
288 &
\end{array}
$$

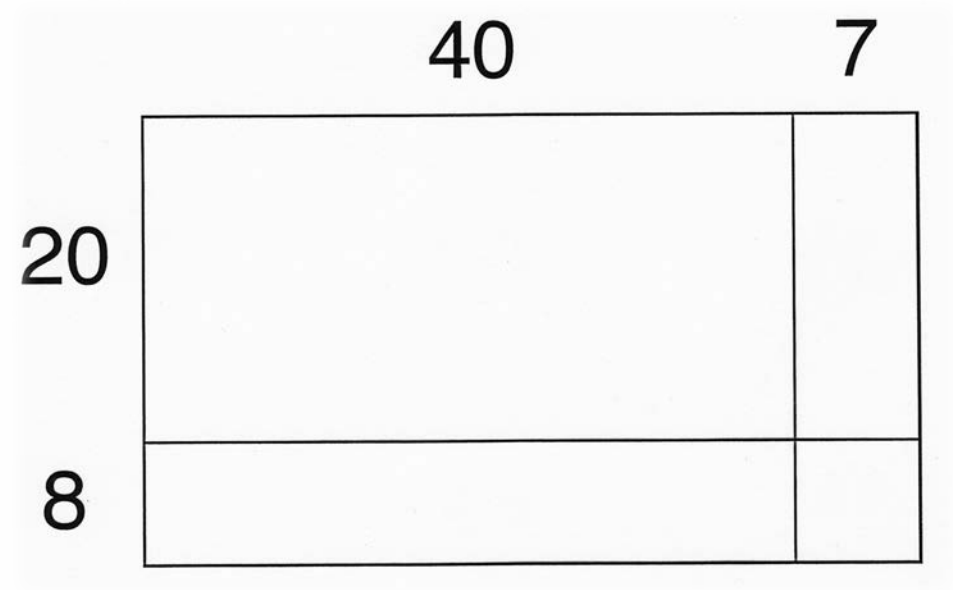
Abstracting Multiplication

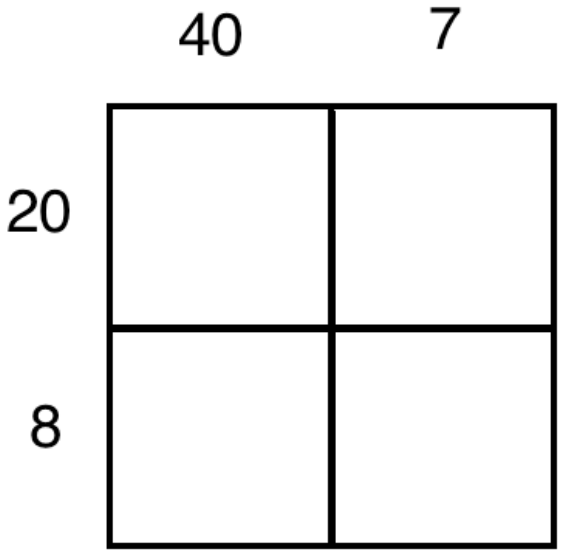
$$12 \times 13$$



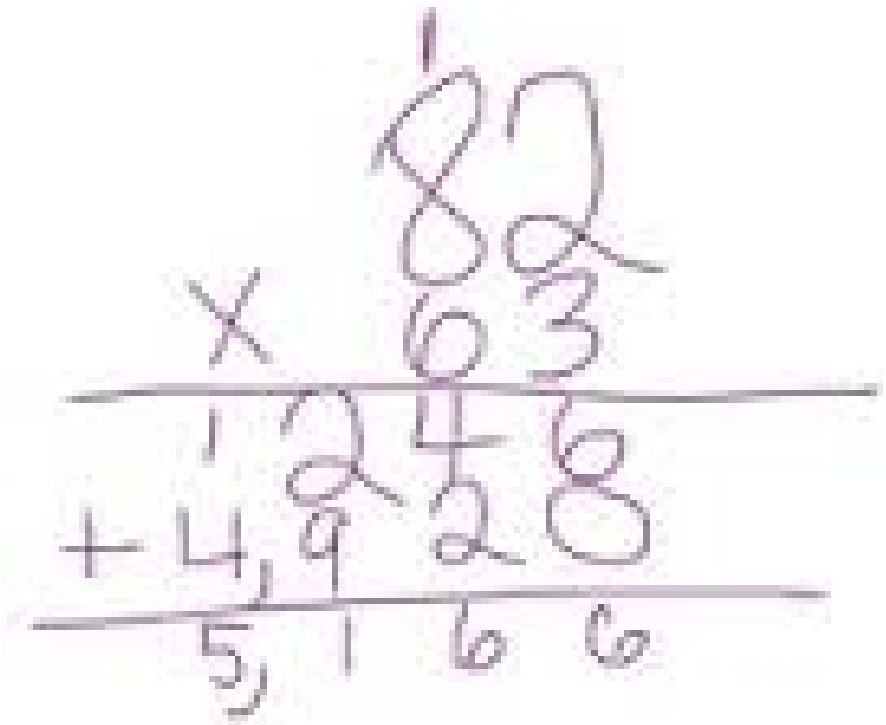
Abstracting Multiplication

$$47 \times 28$$





Traditional Algorithm



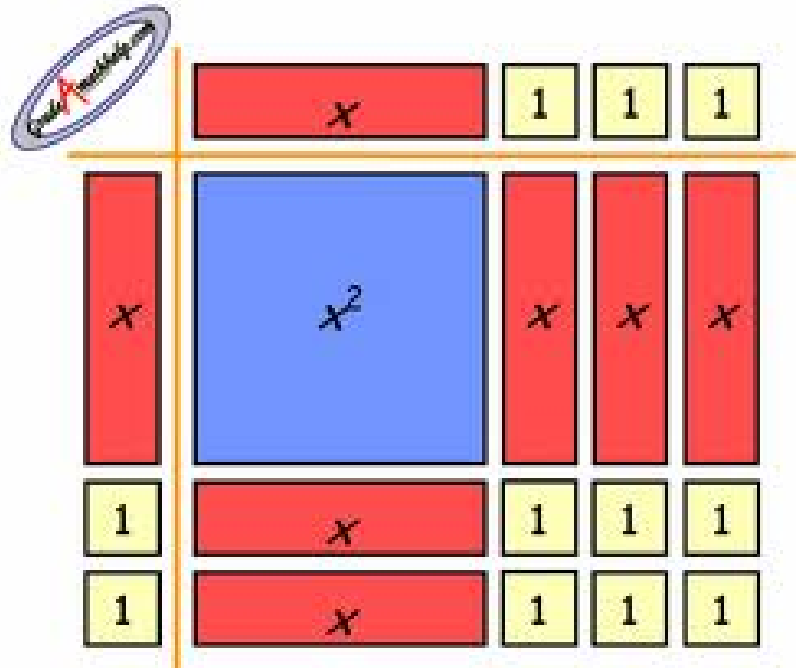
Does this make sense to most of our students?

Algebra Tiles

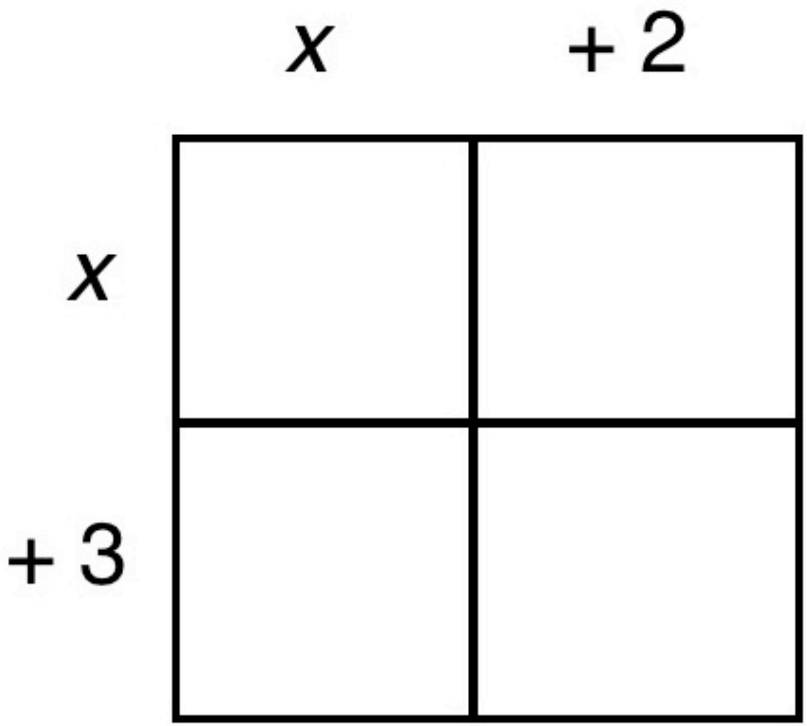
- Area model representations
- Consider: $x^2 + 3x - 4$
- Add: $(x^2 - 2x + 1) + (x^2 + 5x - 4)$
- Multiply: $2(3x + 4)$
- Multiply: $(x + 2)(x + 3)$
- Multiply: $(x - 3)(2x + 1)$

Multiply Binomials - Algebra

$$(x+3)(x+2)$$

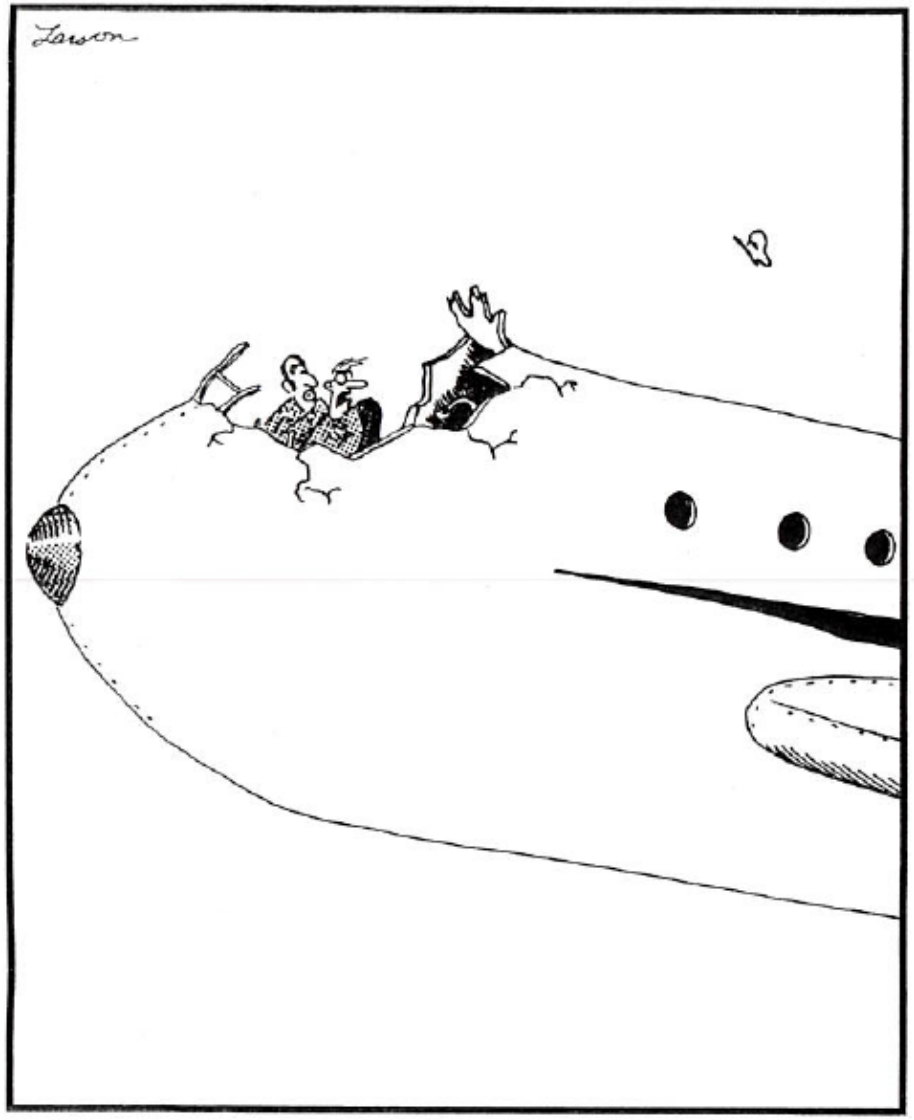


Multiply Binomials - Algebra



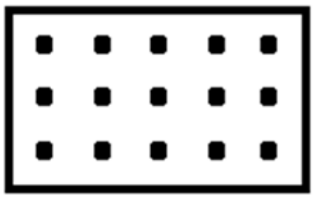
Multiply Binomials - Algebra

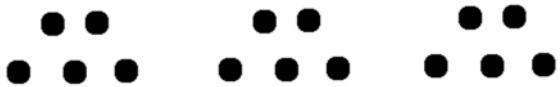
	x	$+2$
x	x^2	$2x$
$+3$	$3x$	6

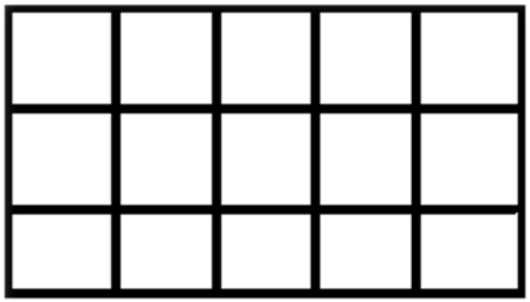


"Oh, great! Now there goes my hat!"

How do you visualize 3 x 5?







Which of these is/are most accurate?

How would you sequence the sharing of these models?

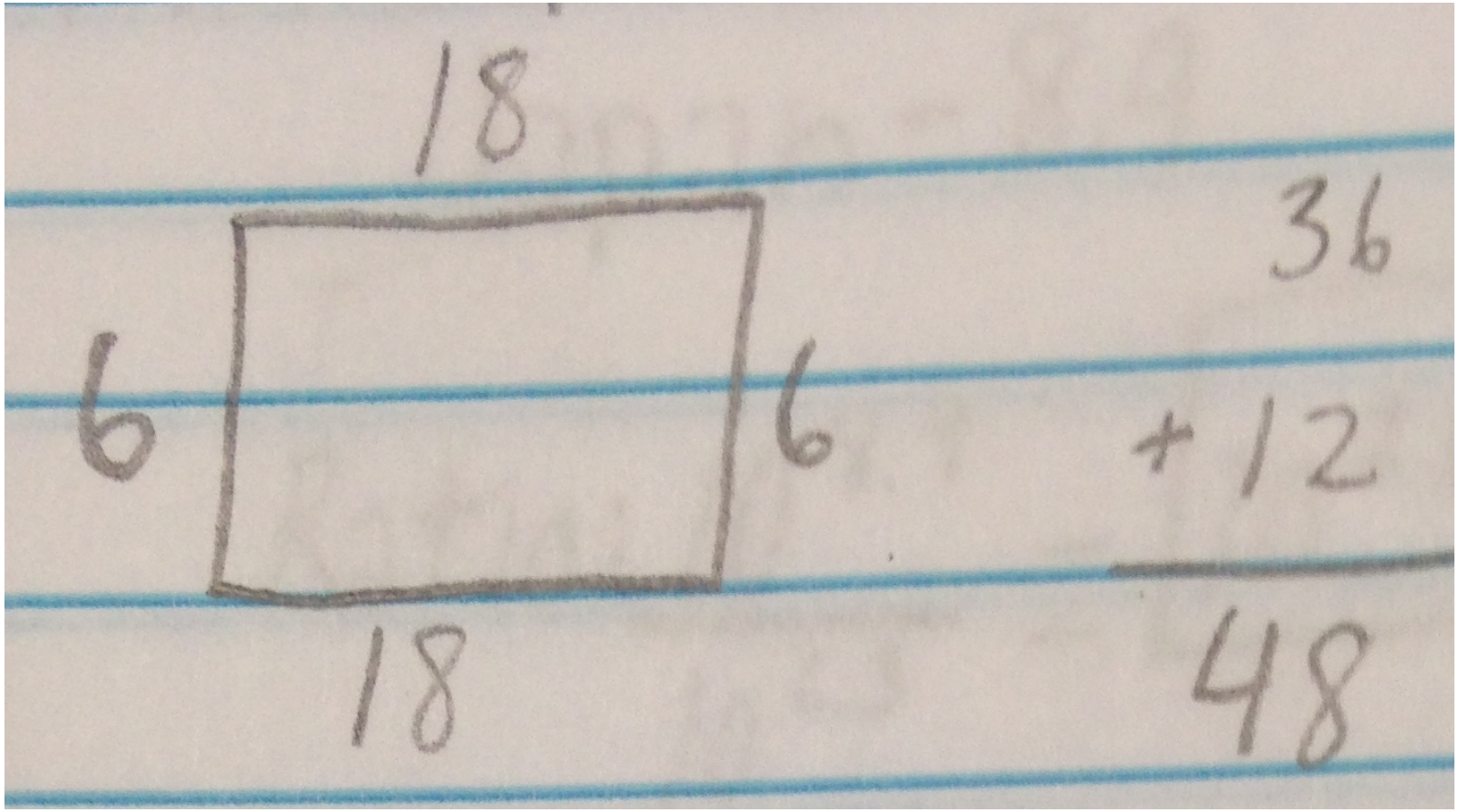
The Five Practices (Peg Smith)

1. **Anticipating** (e.g., Fernandez & Yoshida, 2004; Schoenfeld, 1998)
2. **Monitoring** (e.g., Hodge & Cobb, 2003; Nelson, 2001; Shifter, 2001)
3. **Selecting** (e.g., Lampert, 2001; Stigler & Hiebert, 1999)
4. **Sequencing** (e.g., Schoenfeld, 1998)
5. **Connecting** (e.g., Ball, 2001; Brendehur & Frykholm, 2000)

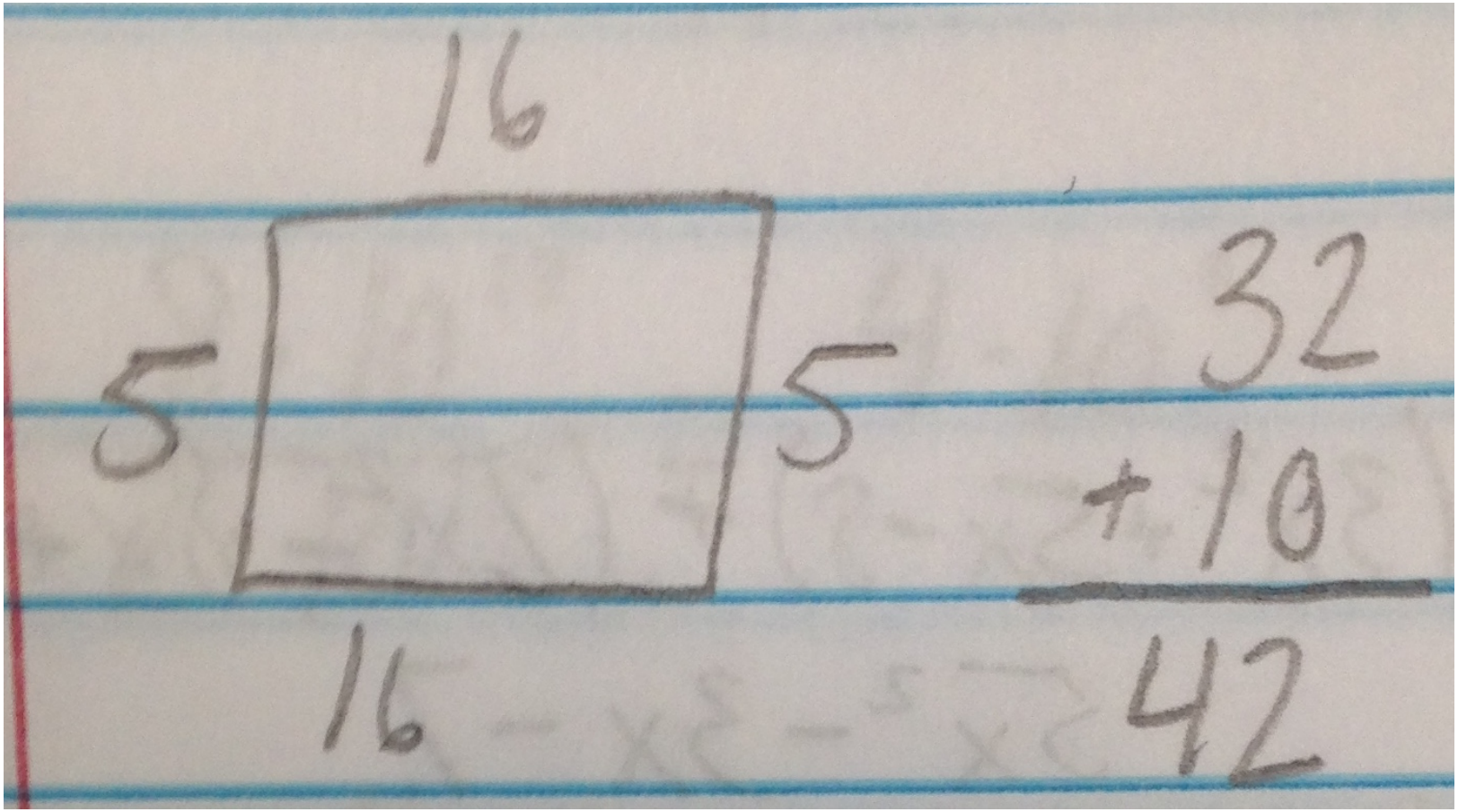
Problem

In a rectangle, the length is 6 more than twice the width. If the perimeter is 44 inches, find the area of the rectangle.

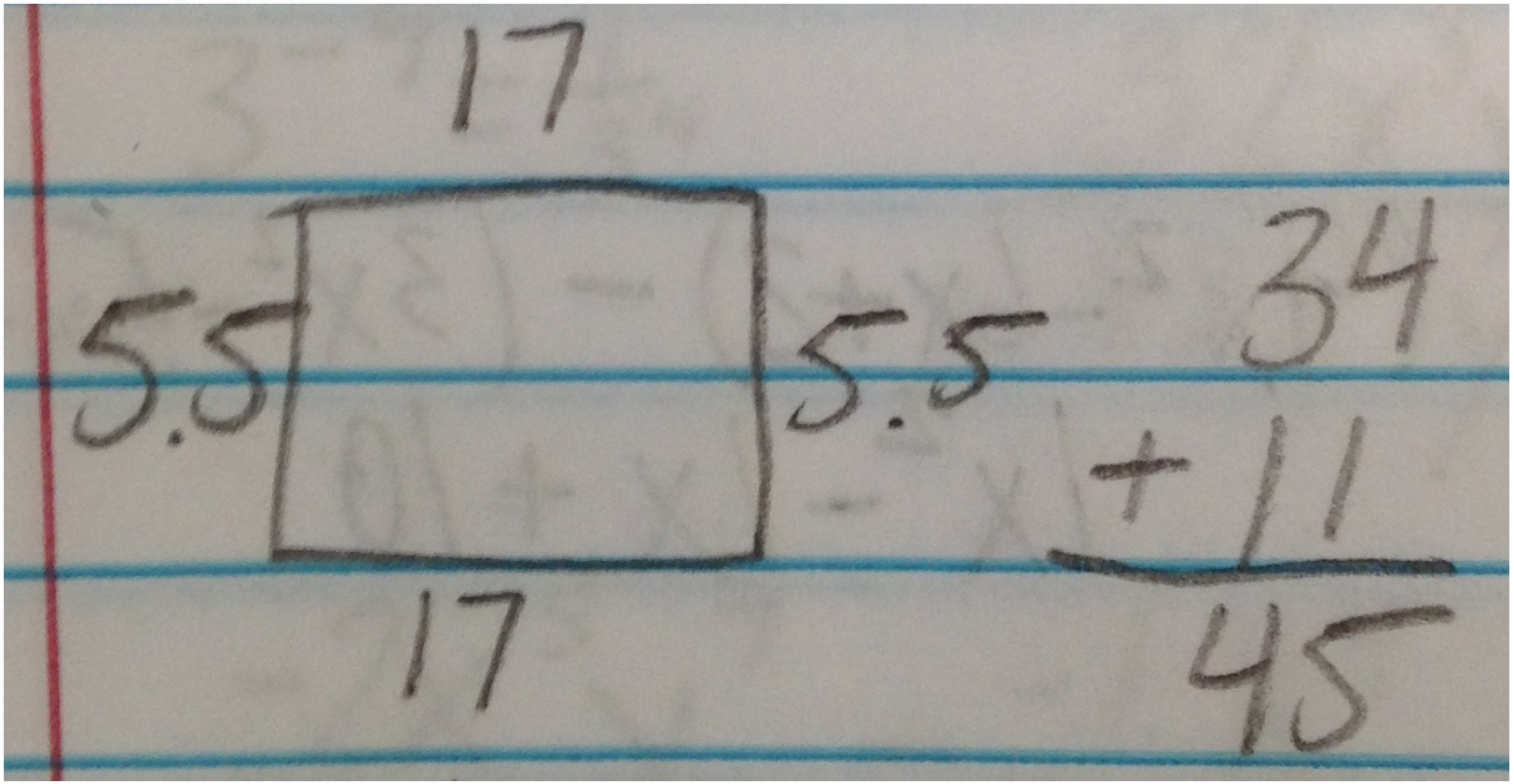
Samantha



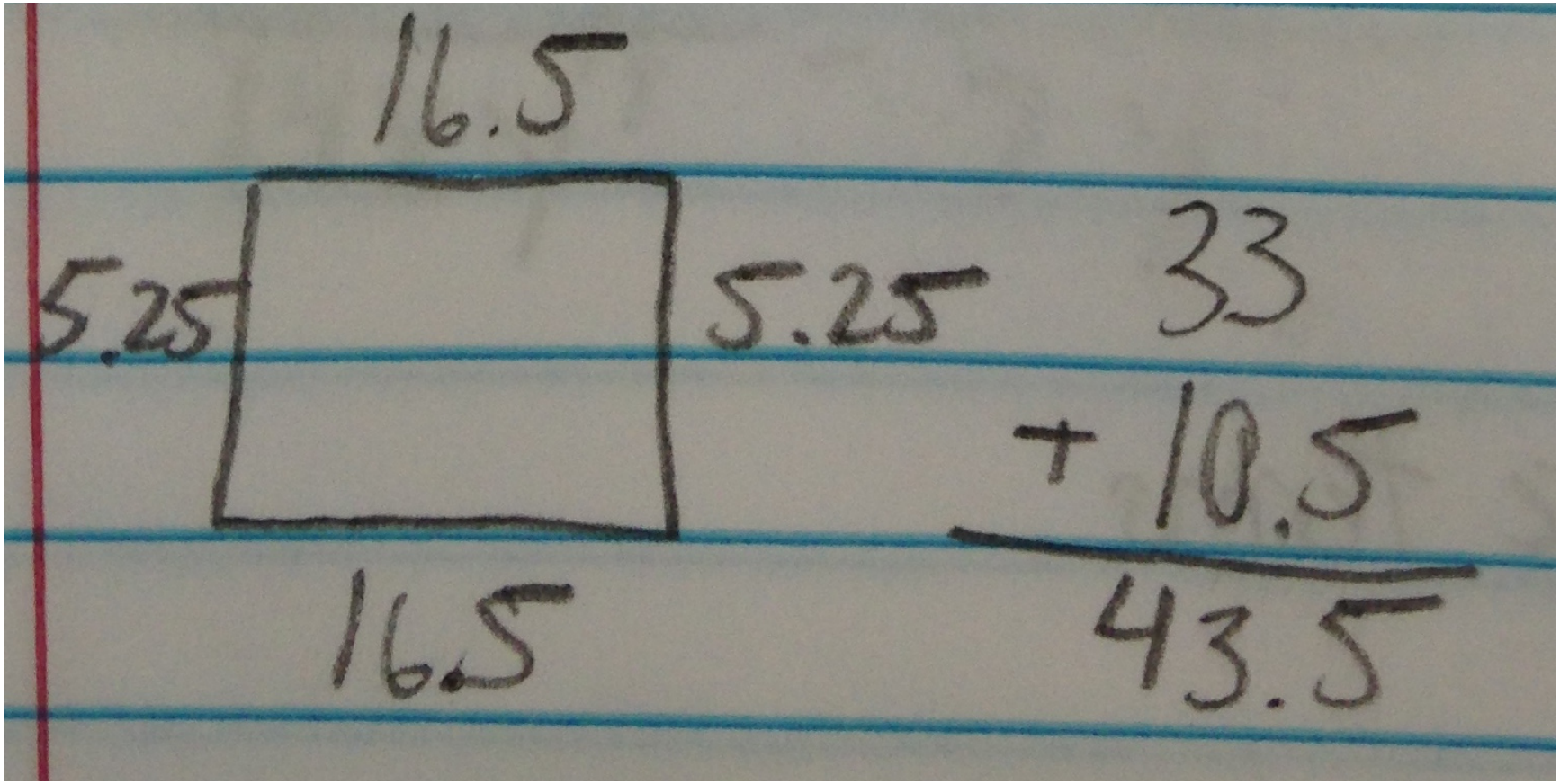
Samantha



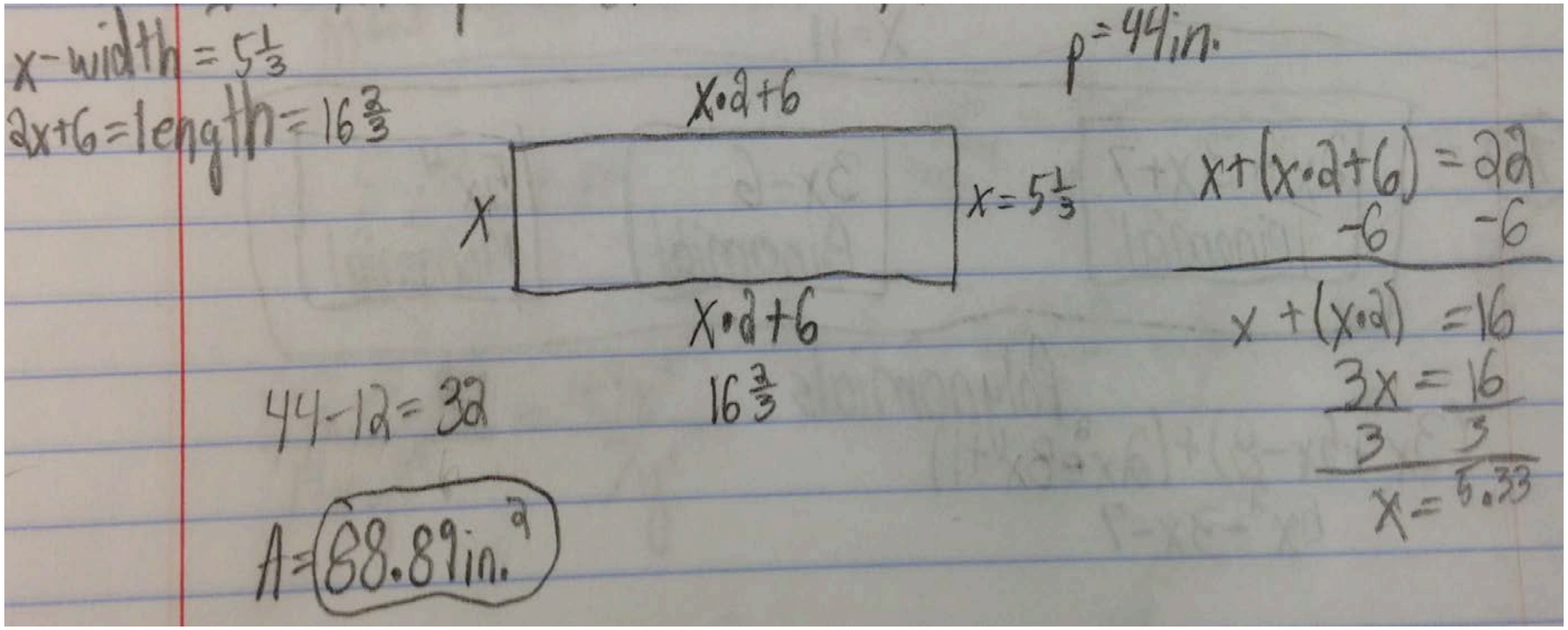
Samantha



Samantha



Eric


x-width = 5 1/3
2x+6 = length = 16 2/3
p = 44 in.
x·2+6
x
x = 5 1/3
x·2+6
16 2/3
x+(x·2+6) = 22
-6 -6
x+(x·2) = 16
3x/3 = 16/3
x = 5.33
44-12 = 32
A = 88.89 in.²

Time of Reflection

Take a few moments to reflect on our time of thinking and learning today.

-- Jot down the meaningful and significant things you thought about.

-- Jot down the ways you thought mathematically and pedagogically.

-- Jot down how you contributed to our shared community of professionals.

Stay Safe

- Please help us put the room in proper order.
- Please leave your name tags for next time.