

Building a Nurturing Math Talk Community

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My website is
karenfusonmath.com



A nurturing meaning-making visual Math Talk Community:

is an inquiry-based teaching/learning environment, and has a continual focus on sense-making by all participants.

Students are expected:

- to understand what they are doing,
- come to be able to explain their thinking,
- understand the thinking of other students,
- learn to seek help when they need it, and
- help others who need it.

Create a Nurturing Sense-Making Math Talk Community

The teacher orchestrates collaborative instructional conversations focused on the mathematical thinking of students, using these responsive means of assistance that facilitate learning and teaching by all:

- Engaging and involving
- Managing
- Coaching which is modeling, clarifying, instructing/explaining, questioning, feedback

Support Sense-Making in the Math Talk Community

The teacher supports the sense-making of all classroom members by using and assisting students to use and relate:

- Mathematical situations

- Pedagogical supports especially drawings

- Cultural mathematical symbols and words

- Student's own explanations of their thinking



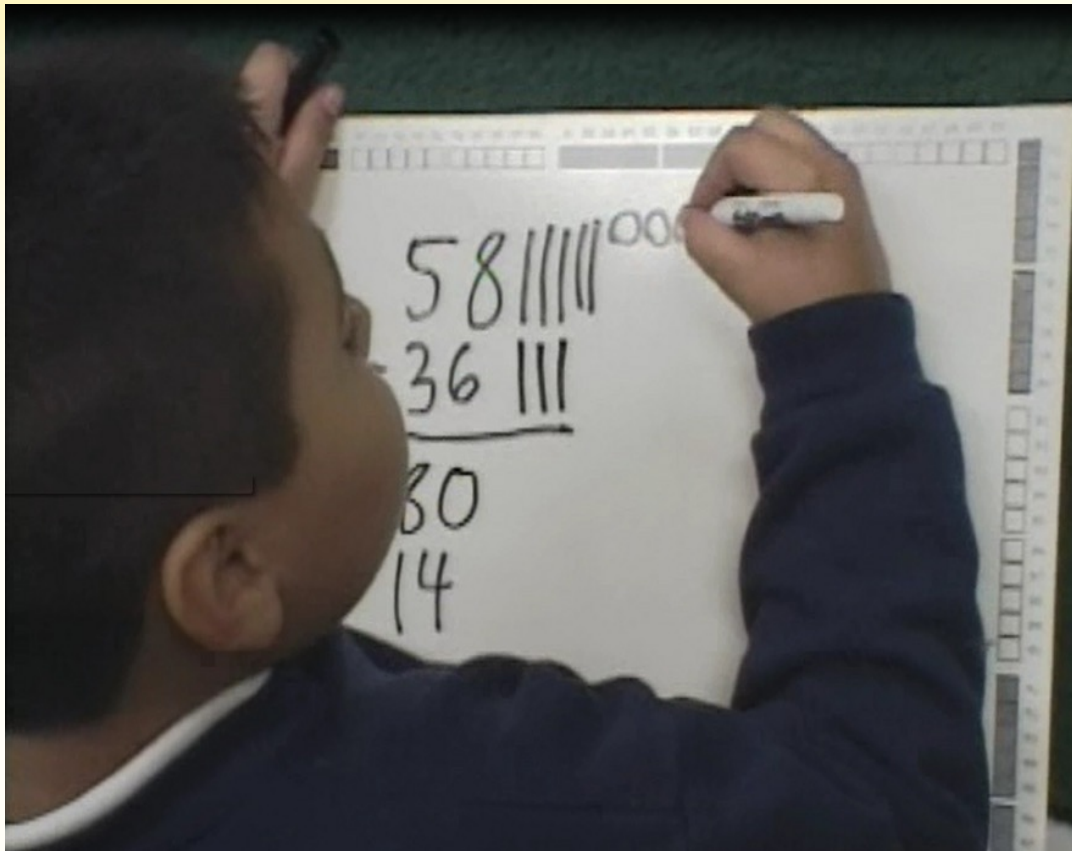
Solve and Discuss Classroom Structure

Solve	Explain	Question	Justify
<p>All students solve. Some solve at the board, and the rest at their seats.</p>	<p>One student at the board explains and then asks, “Are there any questions?”</p>	<p>Other students ask questions to clarify or extend.</p>	<p>The original explainer responds to the questions by explaining more (justifying the original explanation).</p>

Any student at any time can ask for help from anyone.

For more practice, Solve and Discuss can take place in pairs or small groups.

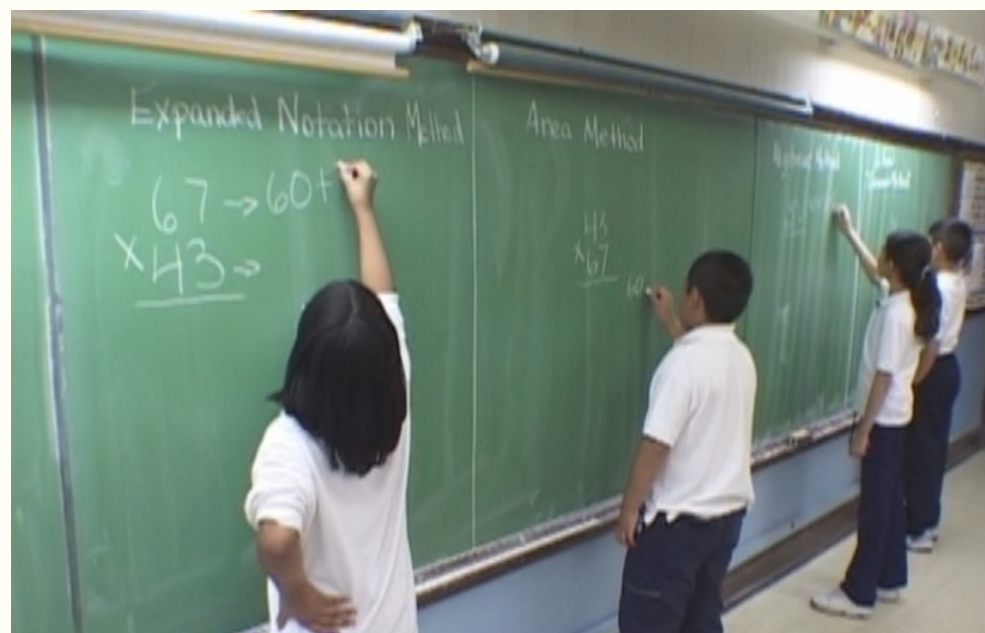
Make the math thinking visible



- Students must make some kind of math drawing related to the math symbols to show their thinking.
- This supports understanding by the listeners and promotes meaning.

Make the math thinking visible

- This is important for **equity**: less advanced students and English Learners are helped by the math drawing linked to the explanation by pointing.
- Be sure that **important methods remain** on the board or can be made visible again (e.g., on a Math Board) so they can be compared with other methods.





2. “Bite your tongue” to provide wait time. Students will explain, ask questions, or add a comment if you wait.

Students must speak and not just listen

1. Structure opportunities to explain to a partner and repeat what the partner says, if needed. Students eventually find their own words, but may need the security of saying an explanation they know is correct.
3. Help students speak to classmates by moving to the side or back of the room. Later remind students with a silent gesture to address each other.

A nurturing meaning-making visual
Math Talk Community
is what students and teachers need
to recover from the deprivations
of the covid years.

It is therapy for the soul and the self.
Everyone needs to belong to a community in
which your thinking and your self is valued and
in which you can help others.



A nurturing meaning-making visual
Math Talk Community
allows you to individualize within
whole-class discussions:

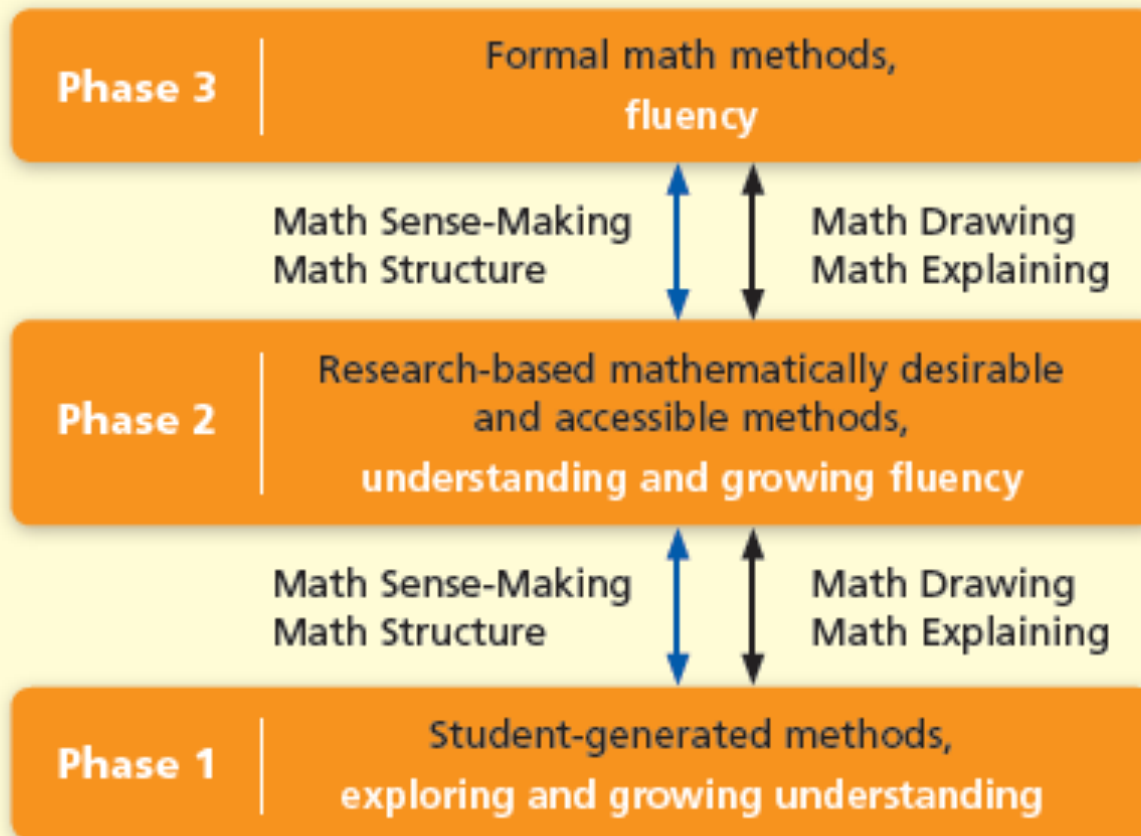
Several methods arise and are discussed, and
you can introduce research-based methods that
are accessible and mathematically desirable.

With the classroom math talk support, all
students move to a strong method.



Inquiry Learning Path in the Math Talk Community

Bridging for teachers
and students by coherent
learning supports



Learning
Path



Mathematical Practices

Math Sense-Making	Math Structure	Math Drawings	Math Explaining
Make sense and use of appropriate precision.	See structure and generalize.	Model and use tools.	Reason, explain, and question.
MP1 Make sense of problems and persevere in solving them. MP6 Attend to precision.	MP7 Look for and make use of structure. MP8 Look for and express regularity in repeated reasoning.	MP4 Model with mathematics. MP5 Use appropriate tools strategically.	MP2 Reason abstractly and quantitatively. MP3 Construct viable arguments and critique the reasoning of others.

Teachers continually assist students to do math sense-making about math structure using math drawings to support math explaining.

Teachers continually assist students to do **math sense-making** about **math structure** using **math drawings** to support **math explaining**.

Balanced Inquiry Learning Path teaching requires mathematically desirable and accessible situational diagrams, drawings of numbers, and computational methods.

My many years of classroom research focused on finding, developing, and testing these in varied classrooms of students. They all involve **learning paths** to bring students from where they start to fluency with advanced enough methods.

You can find details of all of these on my website in the Teaching Progressions and in the classroom videos. karenfusonmath.com

The strong state standards support schools to teach using learning paths of students because the math standards progress and build sensibly.

Teaching Progressions on karenfusionmath.com

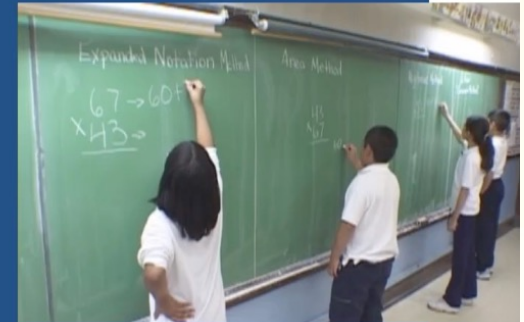
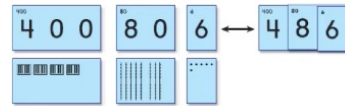
A Functioning Math Talk Community

Source of Math Ideas

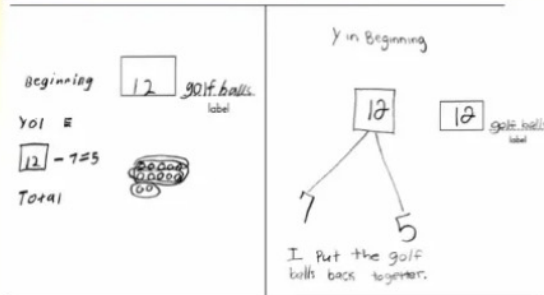
- The students contribute their ideas as the teacher or other students are teaching, confident that **their ideas are valued**.
- The students spontaneously compare and contrast and **build on ideas**.
- The teacher is **still engaged and deciding what is important** to continue exploring.

Responsibility for Learning

- The students listen to understand, then **initiate clarifying other students' work** and ideas for themselves and for others.
- The students **assist each other** in understanding and correcting errors.
- The teacher **supports students** as they help one another.



Yolanda has a box of golf balls. Eddie took 7 of them. Now Yolanda has 5 left. How many golf balls did Yolanda have in the beginning?

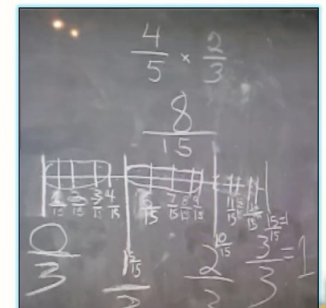
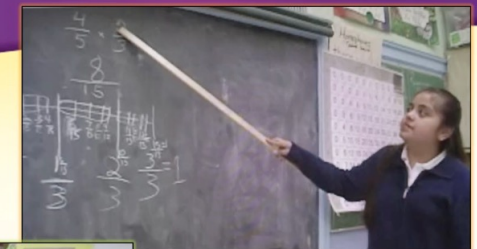


$$\begin{array}{r} 7 \text{ E} \\ + 5 \text{ Yolanda} \\ \hline 12 \text{ in all} \end{array}$$

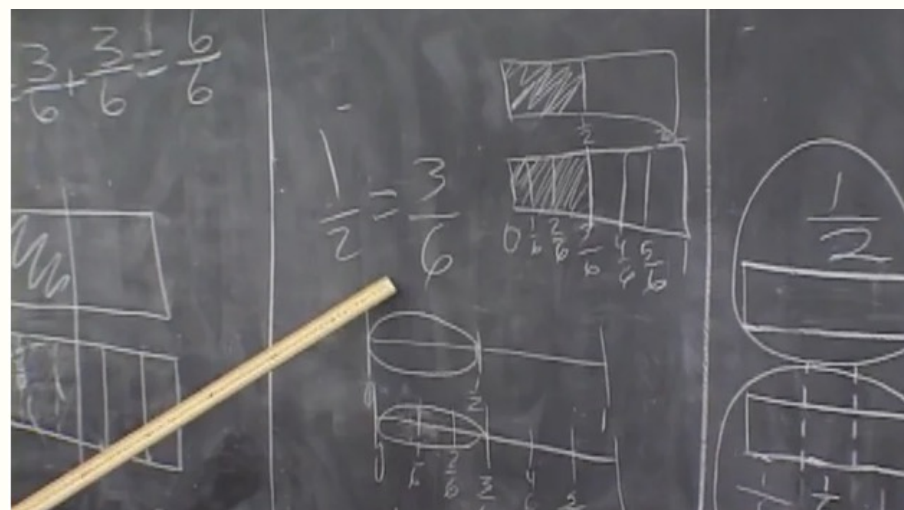
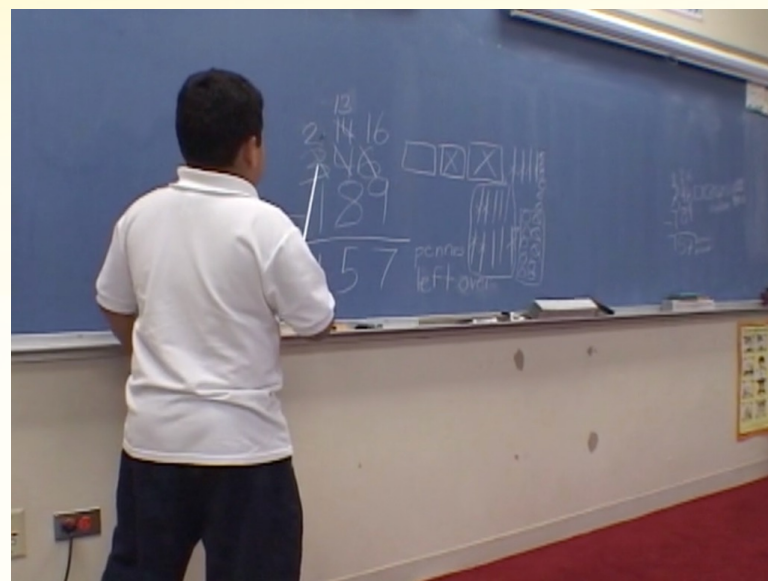
The key to solving story problems is **understanding the situation**. Students' equations often show the situation rather than the solution. Students drawings should be labeled to show which numbers or objects show which parts of the story situation.

Math Talk Structure

- Solve
- Explain
- Question
- Justify



Classroom Videos on karenfusonmath.com



Remote Teaching Materials on karefusonmath.com

Name: _____

1 2 3 4 5 6 7 8 9 10

8

6 + 2

Counting Mar 5-groups Unit 2 12 to end of unit

× 10 (larger)			ONES	÷ 10 (smaller)		
Thousands	Hundreds	Tens	ONES	Tenths	Hundredths	Thousandths
1,000	100	10	1	0.1	0.01	0.001
1000	100	10	1	1/10	1/100	1/1000

1,629.261 7,345.437 2,568.652

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

30
29
28
27
26
25
24
23
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3
2

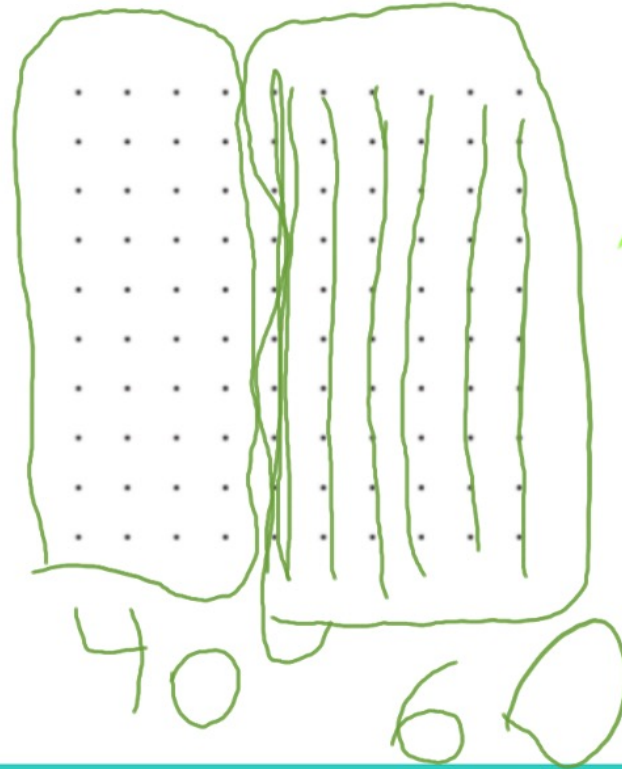
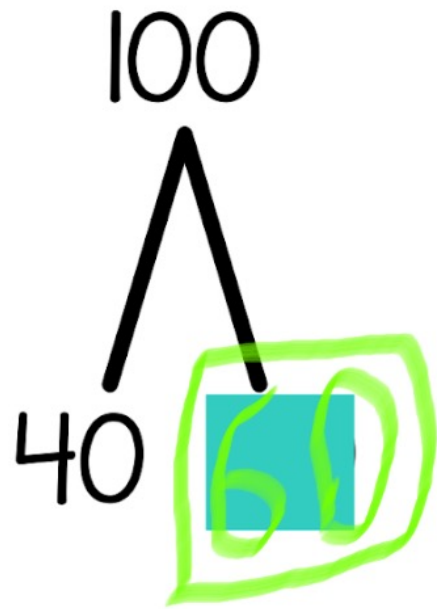
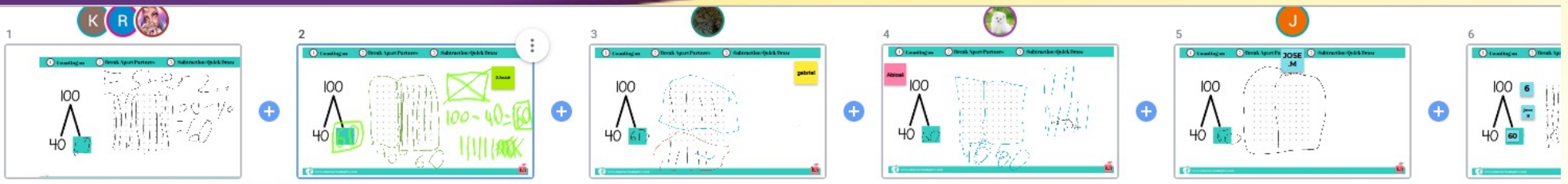
278
+ 156

434

100 10

300
400
500
600
700
800
900
1000

10 20 30 40 50 60 70 80 90



2.Josiah

The About menu on karenfusonmath.com gives my background and describes each of the menu choices.

These include my publications and visual presentations about my research.

The Teaching Progressions and Classroom Videos show the visual representations that help students show their thinking. They have been used in my math program *Math Expressions* to show that they work, but they can be used by anyone.

My email is karenfuson@mac.com

Expanding Number Talks to Build Equitable Math Talk Classrooms

by Karen Fuson and Steve Leinwand

The paper above will appear in the March NCTM journal
Mathematics Teacher: Learning and Teaching PK to G12.

It describes how limiting Number Talks are and how they can be extended to Math Talk in all lessons by having students use and discuss drawings and written methods.

It discusses some kinds of drawings students can make for different math domains.



There is no one “standard algorithm.” There are variations in ways to record efficient, accurate, and generalizable methods that form the collection of standard algorithms.

There are better methods; my research is about these. These are in classroom videos, papers, and Teaching Progressions on my website.

These are the mathematically desirable and accessible methods that are standard algorithms.

Most taken to be “standard algorithms” are difficult or misleading.

The CCSS say in the critical area for the **first year** of a given computation: “Students develop, discuss, and use **efficient, accurate, and generalizable methods.**”

They **do not say** to wait until Grade 4 to do “standard algorithms.”

More details are in the paper below (it is on my website under publications).

Fuson, K. C. & Beckmann, S. (Fall/Winter, 2012-2013). Standard algorithms in the Common Core State Standards. *National Council of Supervisors of Mathematics Journal of Mathematics Education Leadership*, 14 (2), 14-30.

G1 New Groups Below 1.NBT.4



$$\begin{array}{r} 58 \\ 36 \\ \hline 1 \\ 4 \end{array}$$



New Groups Below

$$\begin{array}{r} 58 \\ + 36 \\ \hline 4 \end{array} \quad \begin{array}{r} 58 \\ + 36 \\ \hline 94 \end{array}$$



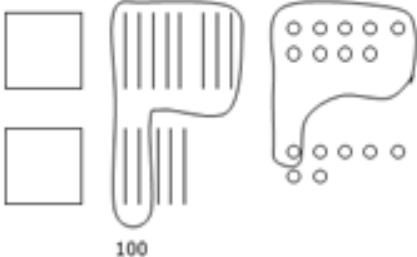
New Groups Above

$$\begin{array}{r} 1 \\ 58 \\ + 36 \\ \hline 4 \end{array} \quad \begin{array}{r} 1 \\ 58 \\ + 36 \\ \hline 94 \end{array}$$



Drawings and Written Variations of Standard Algorithms

Quantity Model ← → **Good Variations** **Current Common**



New Groups Below

$$\begin{array}{r} 189 \\ + 157 \\ \hline 346 \end{array}$$

Show All Totals

$$\begin{array}{r} 189 \\ + 157 \\ \hline 200 \\ 130 \\ 16 \\ \hline 346 \end{array}$$

New Groups Above

$$\begin{array}{r} 11 \\ 189 \\ + 157 \\ \hline 346 \end{array}$$

Ungroup Everywhere First, Then Subtract Everywhere

Left → Right

$$\begin{array}{r} 13 \\ 24416 \\ \underline{346} \\ - 189 \\ \hline 157 \end{array}$$

Right → Left

$$\begin{array}{r} 13 \\ 2316 \\ \underline{346} \\ - 189 \\ \hline 157 \end{array}$$

R → L Ungroup, Then Subtract Everywhere

$$\begin{array}{r} 13 \\ 2316 \\ \underline{346} \\ - 189 \\ \hline 157 \end{array}$$

Area Model

	40	+ 3
60	2400	180
+		
7	280	21

Place Value Sections

$$\begin{array}{r} 2400 \\ 180 \\ 280 \\ + 21 \\ \hline 2881 \end{array}$$

Expanded Notation

$$\begin{array}{l} 43 = 40 + 3 \\ \times 67 = 60 + 7 \\ \hline 60 \times 40 = 2400 \\ 60 \times 3 = 180 \\ 7 \times 40 = 280 \\ 7 \times 3 = 21 \\ \hline 2881 \end{array}$$

1-Row

$$\begin{array}{r} 1 \\ 2 \\ 43 \\ \times 67 \\ \hline 301 \\ 258 \\ \hline 2881 \end{array}$$

Rectangle Sections

	40	+ 3	= 43
67	2881	201	
	- 2680	201	
		0	
	201		

Expanded Notation

$$\begin{array}{r} 3 \\ 40 \\ \hline 67 \overline{) 2881} \\ - 2680 \\ \hline 201 \\ - 201 \\ \hline \end{array}$$

Digit by Digit

$$\begin{array}{r} 43 \\ 67 \overline{) 2881} \\ - 268 \\ \hline 201 \\ - 201 \\ \hline \end{array}$$

The Digital Learning Environments are free and can be accessed on my website karenfusonmath.com by clicking in the top right menu choice Remote Teaching Materials.

There are **Quick Practices for grades K to 6** and **Daily Routines for grades K to 2** that help to build and practice vital knowledge.

The Math Expressions **strategy/fluency cards** are available to use with the whole class or by individual students at home (as of December 2022).

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