

CCSSM K-2 2014

Day 3

Number Talks

*Helping Children Build Mental
Math and Computation Strategies*

What is a Number Talk?

- A short, daily routine that provides students with meaningful ongoing practice with computation.
- Classroom conversations designed to elicit specific strategies that focus on number relationships and number theory.
- Powerful tools for helping students develop computational fluency.

Key Mathematical Concepts

- Numbers are composed of smaller numbers.
 - i.e. $5 = 3 + 2$ OR $2 + 2 + 4 = 8$
- Numbers can be taken apart and combined with other numbers to make new numbers.
 - i.e. $18 + 12$ could be solved $18 + 2 = 20$ and then $20 + 10 = 30$
- What we know about one number can help us figure out other numbers.
 - Adding 10 can help when we add multiples of 10

Key Mathematical concepts

- What we know about parts of smaller numbers can help us with parts of larger numbers.
 - If 15 is 10 and 5 it helps me know 25 is 20 and 5
- Numbers are organized into groups of tens and ones (and hundreds, tens and ones and so forth.)
 - 42 is 4 tens and 2 ones OR 538 is 5 hundreds, 3 tens and 8 ones
- What we know about numbers to 10 helps us with numbers to 100 and beyond.
 - Knowing $2 + 5 = 7$ helps us to know that 2 tens and 5 tens equals 7 tens or 70

Number Talk Format

- Teacher presents problem
- Students figure out the answer
- Students share their answers
- Students share their thinking
- Class agrees on the “real” answer for the problem

Key Components

- Classroom environment
 - Safe and supportive
- Student discussions
 - clarify their own thinking
 - Incorrect answers DO happen so learn from them
 - consider and test other strategies
 - investigate/apply key mathematical concepts
 - build a toolbox of efficient strategies

Key Components

- Mental math
 - Students build on number relationships RATHER than rely on memorized procedures
 - Helps strengthen understanding of place value
- Purposeful computation problems
 - Teacher's goals and purposes for the number talk should determine the numbers and operations that are chosen
 - Specific types of problems typically elicit certain strategies

Teacher's role

- Provides a safe environment where each child's thinking is valued.
- Selects groups or strings of problems that allow access to all children.
- Selects problems that intentionally highlight mathematical concepts.
- Values everyone's thinking, focusing on how children get their answers.

Teacher's Role

- Provides adequate wait time.
- Shifts the focus from, “See what I see,” to “What do YOU (the child) see?”
- Records, clarifies, restates.
- Realizes that if the children don't get it, then it is the teacher's responsibility to figure out their misconceptions or lack of proficiency and to begin instruction at that point.

Video Clip #1

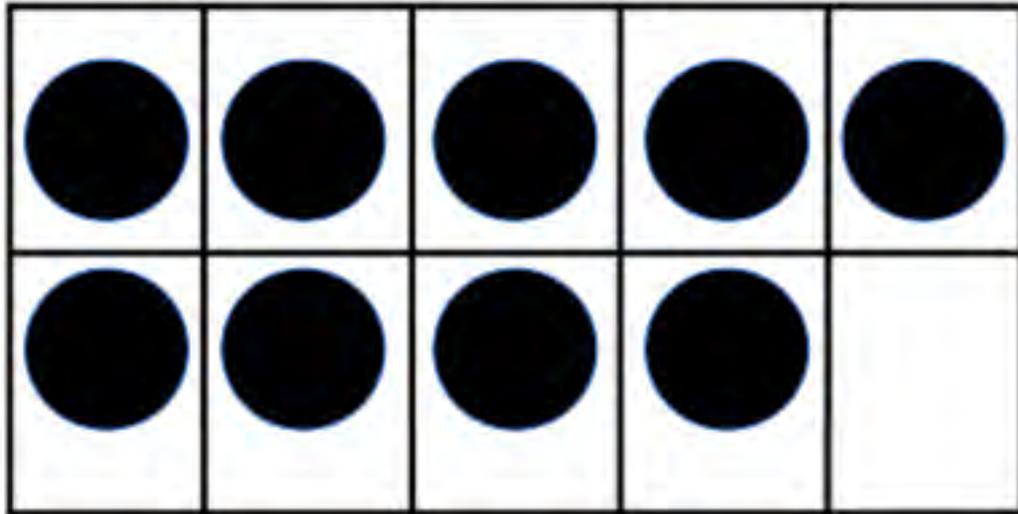
- Please watch the following video of second grade number talk and be prepared to discuss:
 - How the students communicated their answers and strategies
 - The role of the teacher
 - What is the teacher doing and saying?

Video Clip #2

- Watch the following Kindergarten Number Talk and be prepared to discuss:
 - How the students communicated their answers and strategies
 - The role of the teacher
 - What is the teacher doing and saying?
 - Any differences/similarities between the second grade number talk and the Kindergarten number talk?

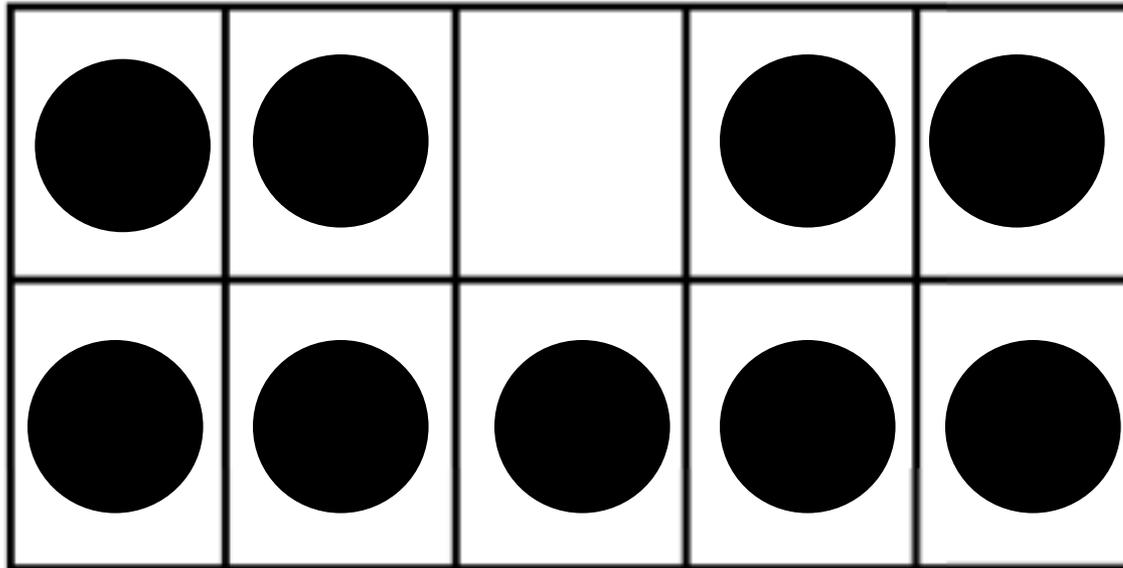
Let's try some ...

- If we want our students to work on the number pairs with a sum of 10, we could use the tens frames within a number talk.
- What questions may a teacher ask to focus on the number pairs with a sum of 10 when showing this tens frame?

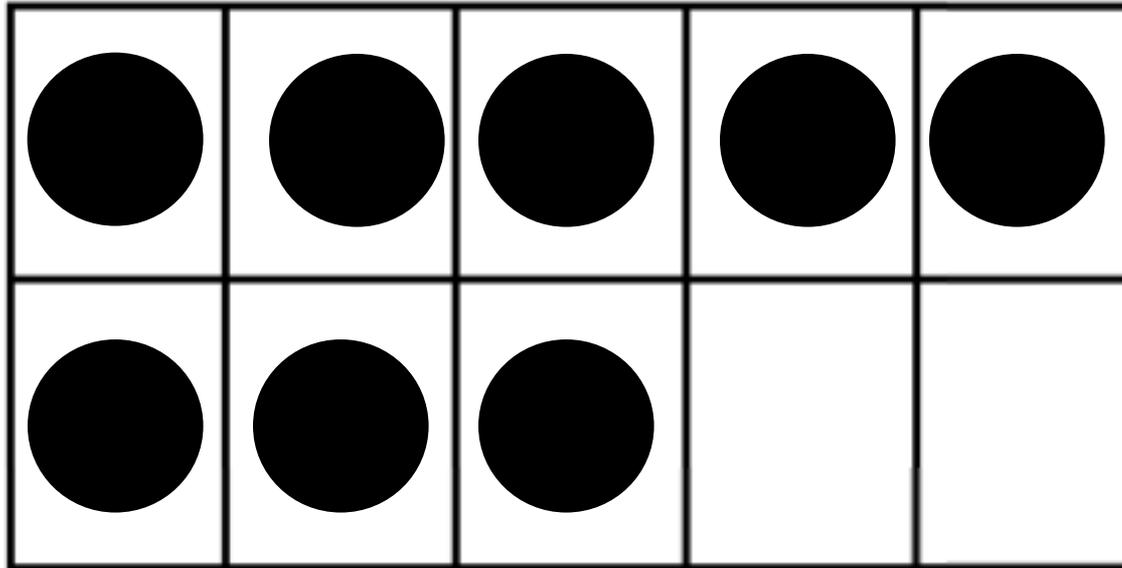


How many more dots do we need to make ten?
What would be the next number talk?

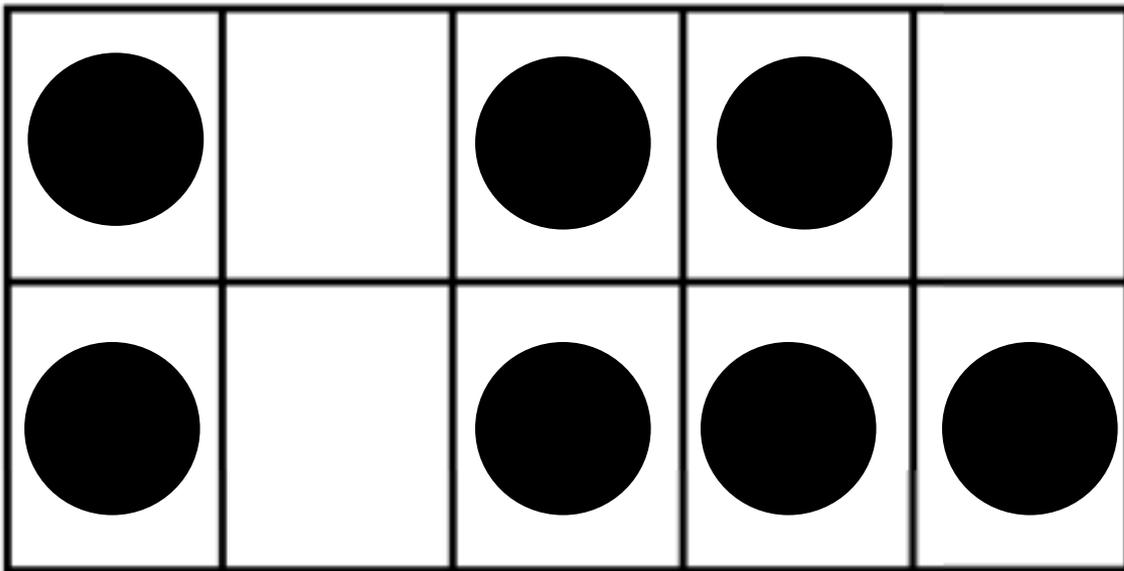
If students were struggling...



Or...move on



Then...



Making Landmark or Friendly Numbers

$$29 + 1$$

$$29 + 5$$

$$29 + 13$$

$$29 + 24$$

$$29 + 29$$

Tips for Implementing Number Talks

- Keep it short (5-15 minutes)
- Do them everyday
- Give a lot of practice with the same types of problems
- Encourage sharing and clarify student thinking through questioning
- Teach intentionally
- Create a safe and supportive environment

Tips for Implementing Number Talks

- Name/label the strategies that students use i.e. counting on, doubles, making a “10” etc.
- Vary the number talk to meet the range of student needs
 - Setting
 - Sharing
 - Materials
 - Level of difficulty

But this isn't how I learned math...

- Our classrooms are filled with students and adults who think of mathematics as rules and procedures to memorize without understanding the numerical relationships that provide the foundation for these rules

But this isn't how I learned math...

- Our current understanding and approaches used to be sufficient, but today's students need to be able to problem solve
- Students need to develop the ability to reason
 - Do the numbers makes sense?
 - Can I apply them to specific situations?
 - Can I communicate solutions to problems?

Connection to CCSSM and Math Practices

- Take a few minutes to think about how Number Talks support the Mathematical Practices and their connection to the CCSSM at your grade level.
- Write down a few thoughts in your journal and be prepared to share
 - A Mathematical Practice that relates to number talks
 - A specific standard that could be supported through Number Talks

Your turn...

1. Get into groups of 2 or 3 with teachers of your same grade level
2. Choose specific standards from the CCSSM at your grade level and create 2-3 Number Talks
3. Scaffold the concept so that you will actually be creating 3-4 problems per Number Talk
4. Be prepared to present one of your Number Talks to the group

Summary

- Number talks are a purposeful vehicle for:
 1. Making sense of mathematics;
 2. Developing efficient computation strategies;
 3. Communicating mathematically; and
 4. Reasoning and proving solutions

Think About It...

- How did you learn your facts?
- Why do students struggle with basic facts?
- What approaches do you currently use that help students learn facts?

Basic Fact Strategies

- What role does *number sense* play in learning basic facts?
- How can we think differently about supporting students so they master the basic facts?

Two Points of View

Conventional Approach

Mastery grows out of memorizing individual facts by rote through repeated practice and reinforcement.

Number Sense

Mastery that underlies computational fluency grows out of discovering the patterns and relationships that interconnect the basic facts.

Memorize this sequence of numbers

25811141720

How many digits can you recall?

“Clumping” strategy:

25811141720

258 111 417 20

Making sense.....

25811141720

2 5 8 11 14 17 20

Two Points of View

Conventional Approach

Difficulties with mastering facts are due to deficits inherent with the learner.

Number Sense

Difficulties are due to deficits inherent in conventional instruction.

- **By the end of the K-2 Program: Demonstrate fluency in addition and subtraction facts with addends through 10.**
- **By the end of the 3-4 program: Demonstrate fluency in multiplication and division facts with factors through 10.**

Big Idea #1: Composition

Numbers can be “put together” in different ways

How many ways can you line up 5 tiles using only 2 colors?

What is $9 + 8$? How do you know this is true?

$$9 + 8 = 9 + 1 + 7 = 10 + 7 = 17$$

Big Idea #2: Decomposition

Numbers can be “taken apart” in different ways

$$15 = 10 + 5$$

$$15 = 9 + 6$$

$$15 = 8 + 7$$

Big Idea # 3: The commutative property

+	0	1	2	3	4	5	6	7	8	9
0	0	1	2	3	4	5	6	7	8	9
1	1	2	3	4	5	6	7	8	9	10
2	2	3	4	5	6	7	8	9	10	11
3	3	4	5	6	7	8	9	10	11	12
4	4	5	6	7	8	9	10	11	12	13
5	5	6	7	8	9	10	11	12	13	14
6	6	7	8	9	10	11	12	13	14	15
7	7	8	9	10	11	12	13	14	15	16
8	8	9	10	11	12	13	14	15	16	17
9	9	10	11	12	13	14	15	16	17	18

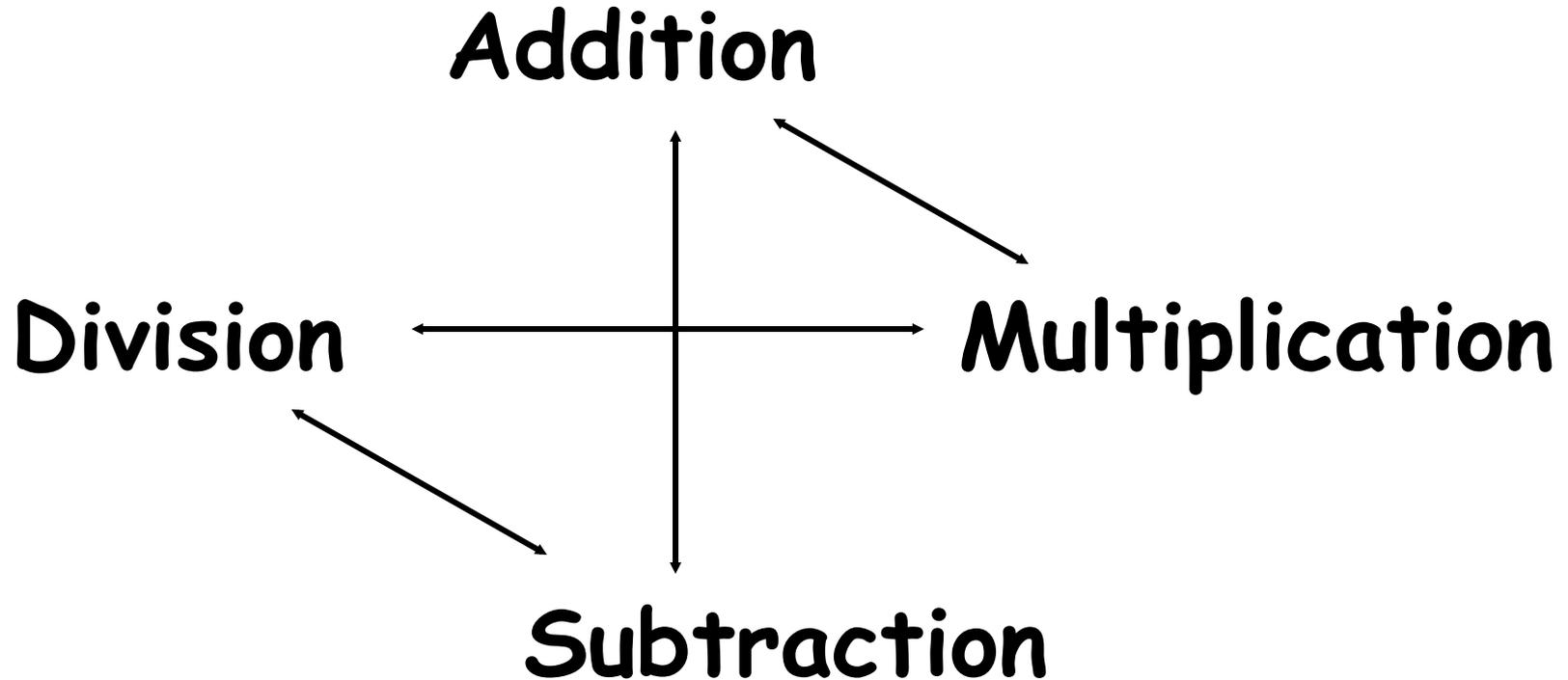
Big Idea #4: Relationships

More Than

Less Than

Same As (Equality)

More Relationships



Developing Fluency

Phase 1 - Counting strategies

Using object counting (e.g., blocks, fingers, marks) or verbal counting to determine answer

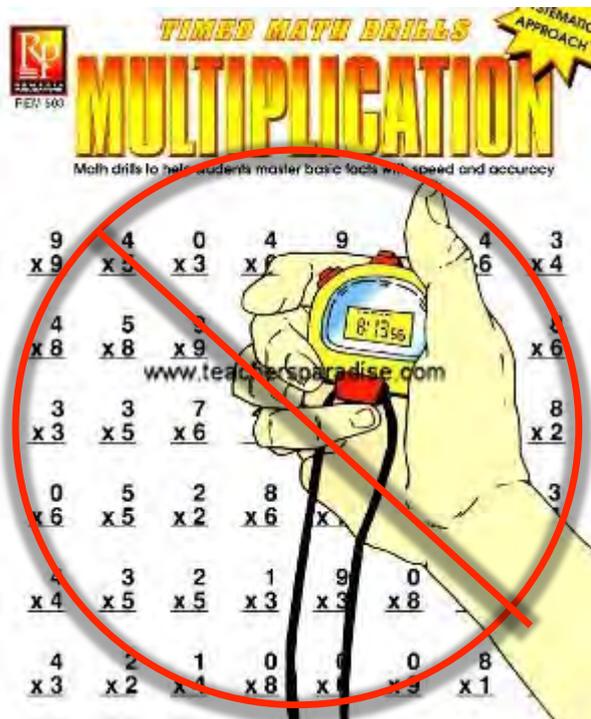
Phase 2 - Reasoning Strategies

Using known information (e.g., known facts and relationships) to logically determine (deduce) the answer of the unknown combination

Phase 3 – Mastery

Efficient (fast and accurate) production of answers

- Fluency with a basic fact means that a child can give a quick response (in about 3 seconds) without resorting to inefficient means such as counting.
- All children demonstrate fluency they can construct efficient **mental models** that will help them.



**Drill of inefficient
methods does
NOT
produce fluency!**

From bottom to top:

- The big base--conceptual understanding of what the operation means and number sense.
- The middle layer--strategies for learning the facts
- The top layer--the ultimate goal of instant recall. The child can answer, "What is $7 + 8$?" as quickly as if asked, "What is your name?"



- An efficient strategy is one that can be done mentally and quickly. Counting is not efficient.
- **The use of strategies is not new.**
- You may think you “just know” the facts but it is because you have developed such efficient strategies for retrieval and they are now automatic.
- **For your students to develop efficient strategies, you must have command of as many “good strategies” as possible even if you have never used them. This will help you to recognize your students’ strategies.**

Hints for Helping Students to Master Basic Facts

- Avoid premature drill
- Practice strategy selection/retrieval
- Make strategies explicit
- Drill established strategies
 - games
 - manipulatives
 - worded problems
- Individualize instruction

Materials that support sensemaking

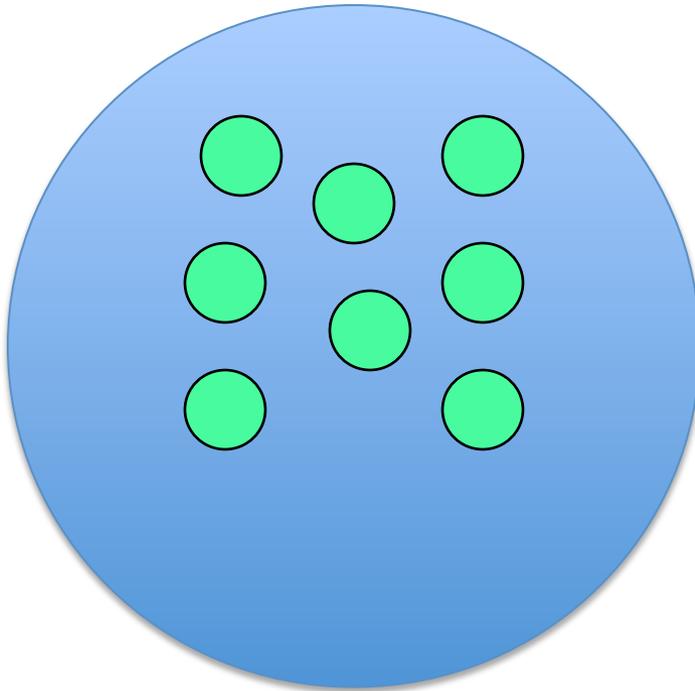
- Tens frames
- Hundreds Chart
- Linking cubes
- Quick Image Cards
- Dice
- Playing Cards
- Number Talks
- Others?

Strategies For Addition Facts

1. One-More-Than & Two-More-Than Facts
2. Facts with Zero
3. Doubles
4. Near Doubles
5. Make-Ten-Facts
6. Doubles-Plus-Two / Two-Apart Facts
7. Make Ten Extended

Quick Images

- How many  do you see?



Strategies for Addition Facts

One more than...

Two more than...

$$3 + 1 =$$

$$3 + 2 =$$

$$8 + 1 =$$

$$8 + 2 =$$

Strategies for Addition Facts

Facts with Zero

- $2 + 0 =$

- $0 + 2 =$

- $5 + 0 =$

- $0 + 5 =$

What's Alike? Zero Facts

1. Write about 1-10 facts on the board, some with the zero first and some with the zero second.
2. Discuss how these facts are alike.
3. Have the students use counters and a part-part-whole mat to model the facts at their seats.

$5 + 0 =$

$8 + 0 =$

$0 + 2 =$

$0 + 6 =$

$9 + 0 =$

$3 + 0 =$

$0 + 4 =$

$0 + 7 =$

$10 + 0 =$

Strategies for Addition Facts

Doubles

- $2 + 2 =$

- $6 + 6 =$

- $7 + 7 =$

- $9 + 9 =$

Strategies for Addition Facts

Near Doubles

- $2 + 3 =$

- $6 + 5 =$

- $6 + 7 =$

- $7 + 8 =$

Doubles Dice...

1. Play with a partner.
2. You will need one die and a doubles graph recording sheet. Players roll a die and double the number.
3. Graph the sum and look for patterns.

This game can be extended by rolling the die, doubling the number and adding 1. (doubles plus one)

Graph the results and compare the two graphs.

Strategies for Addition Facts

Make a Ten

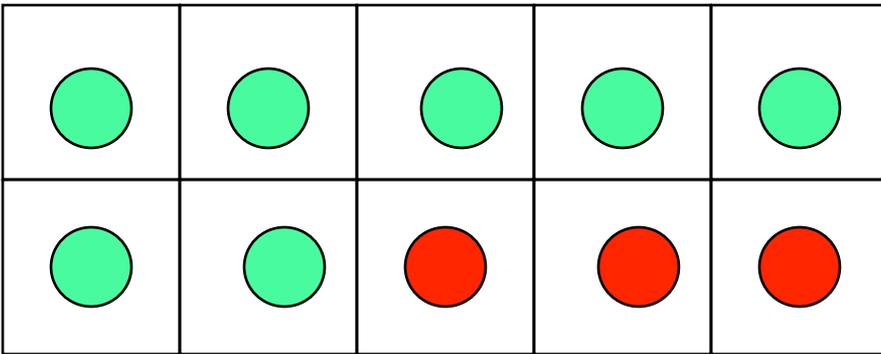
- $3 + 7 =$

- $6 + 4 =$

- $1 + 9 =$

- $8 + 2 =$

Tens frames



$$7 + 3 = 10$$

Strategies for Addition Facts

“Make-Ten Extended” Strategy

$7 + 4$, think 7 and 3 more makes 10
and 1 left equals 11.

$6 + 8$, think 8 and 4 more makes 10
and 4 more makes 14.

$9 + 5$, think $10 + 5$ and subtract 1

Number Talks

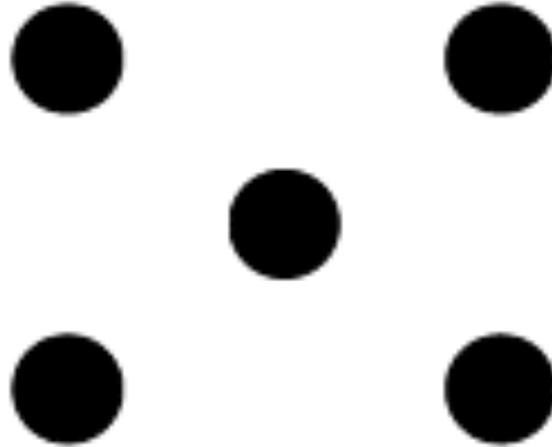
$$5 + 3 =$$

$$6 + 3 =$$

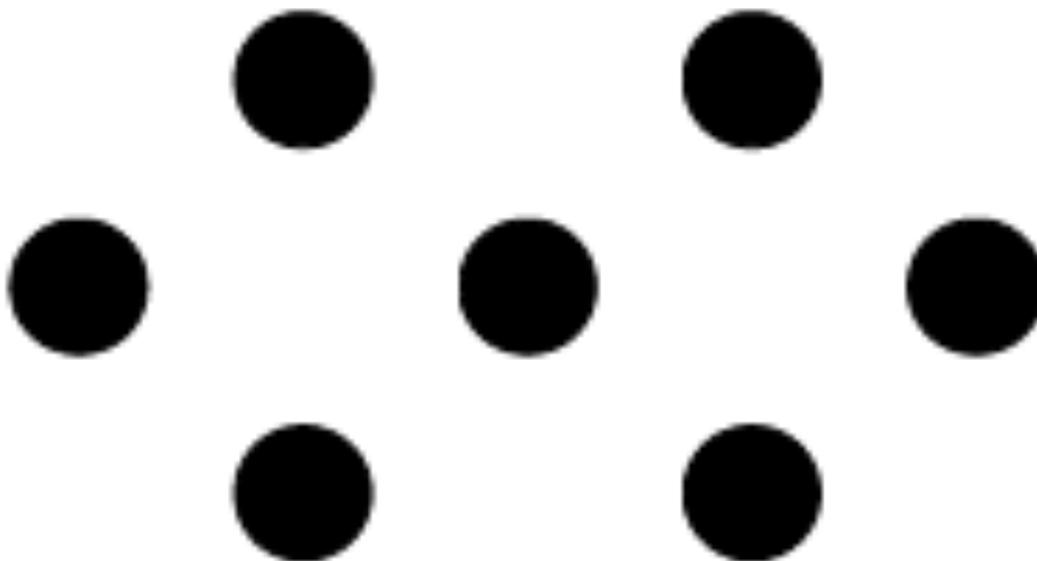
$$4 + 7 =$$

$$5 + 7 =$$

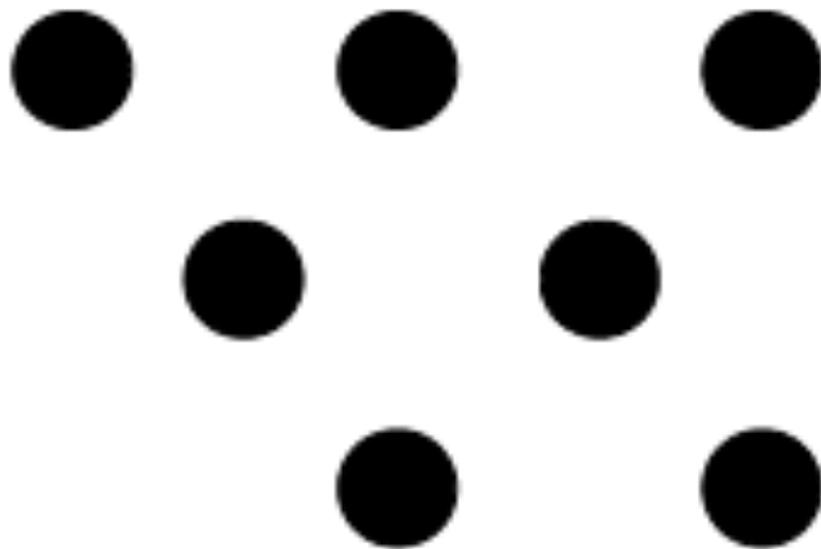
Quick Images



Quick Images



Quick Images



Sensemaking

from the NCTM Standards

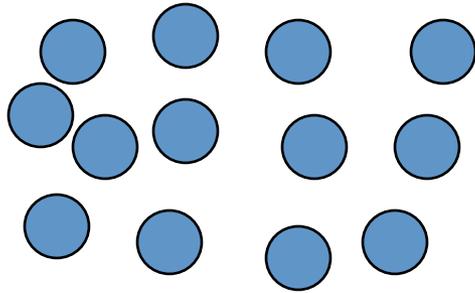
‘Students acquire the view that mathematics is a mysterious domain that is accessible to only the select few who are granted god-like status.

Teachers give you rules for solving problems and exercises, which you memorise and use. These rules don’t have to make sense . . . and they probably don’t . . . but if you do what you are told you’ll get the right answer and then everyone’s happy.’

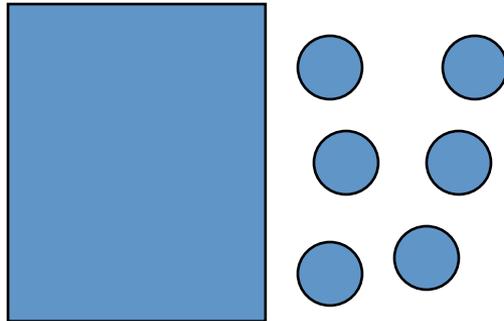
Strategies for Subtraction Facts

- Subtraction as Think-Addition
- Subtraction Facts with Sums to 10
- Build up Through 10
- Back Down Through 10
- Extend Think Addition

Think Addition



$$13 - 6$$

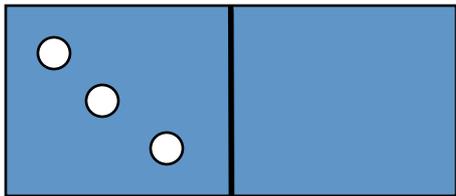


How many are under the rectangle?

Sums to 10

$$8 - 5 =$$

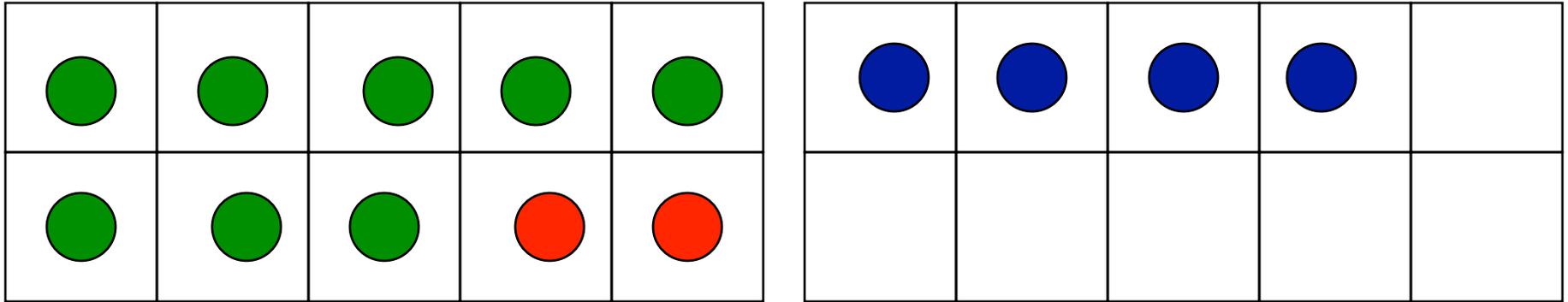
Think: 5 and
how many more
make 8?



The total is 8.
how many are on
The other side?

Build to 10

$$14 - 8 =$$



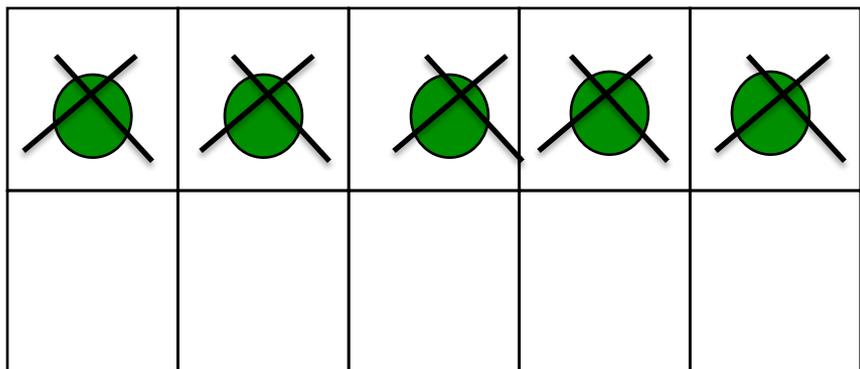
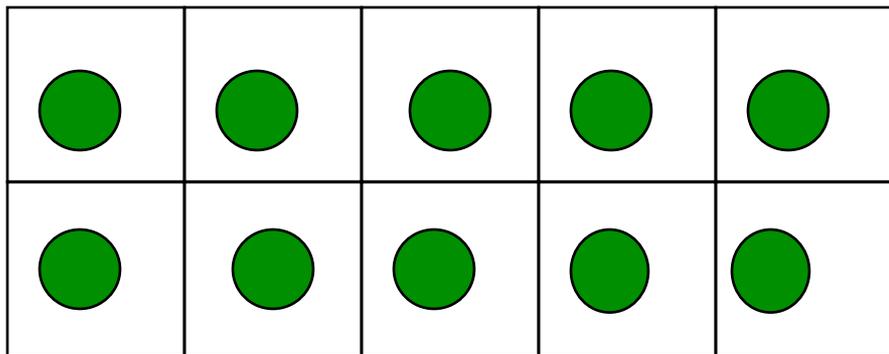
Think: Start with 8.

How many more to get to 10?

How many more to get to 14?

Back Down Through 10

$$15 - 6$$



Take away 5 to get to 10
and 1 more leaves 9.

Effective Drill

- Drill without strategy development and number sense has repeatedly been deemed as ineffective.
- It is unreasonable to expect all children to be comfortable with the same strategies. Listen for strategies used by individuals.
- A child that has not mastered multiplication facts is not ready for division practice.

- Recognize that more drill does not work!
- Inventory the known and unknown facts for each student in need.
- Diagnose strengths and weaknesses.
- Build in Success!!!!

Implementation Model

- Introduce the strategy
 - Set the stage for students to discover the strategy by strategically selecting facts
- Reinforce
- Practice
- Extend

Timed Tests???

“Teachers that use timed tests believe that the tests help the kids learn basic facts. This makes no instructional sense. Children who perform well under time pressure display their skills. Children who have difficulty with skills or who work more slowly run the risk of reinforcing wrong practices under pressure. Also they can become fearful about or negative toward their mathematical learning!”

- Marilyn Burns

Where did you see evidence of these standards
in number talks?

Standard 1: Make sense of problems and
persevere in solving them

Standard 2: Reason abstractly and
quantitatively

Standard 3: Construct viable arguments and
critique the reasoning of others.

Jigsaw

1. Read one of these standards for your grade level.
2. Share 2-3 important ideas with your table partners.
3. Discuss how you saw these standards in the Number Talk videos.

- Standard 4: Model with mathematics
- Standard 5: Use appropriate tools strategically
- Standard 6: Attend to precision

Standard 4: Model with mathematics

What are the models we have used in the past 3 days?

Why are models valuable – especially for young children learning mathematics.

Standard 5: Use appropriate tools strategically

- What are some mathematical tools you use at your grade level?
- How do you know when/if they are appropriate?

Standard 6: Attend to precision

Precision in calculations

estimation vs exact answer

selecting and using units of measure

labeling answers

Precision in communication

talking and writing about mathematics

vocabulary

symbols

Think about it...

How can you work to develop precision at your grade level?

Homework

- Read Chapter 10 in *Teaching student-centered mathematics*. Complete the reflection sheet.