Developing Number Sense: Make and Take

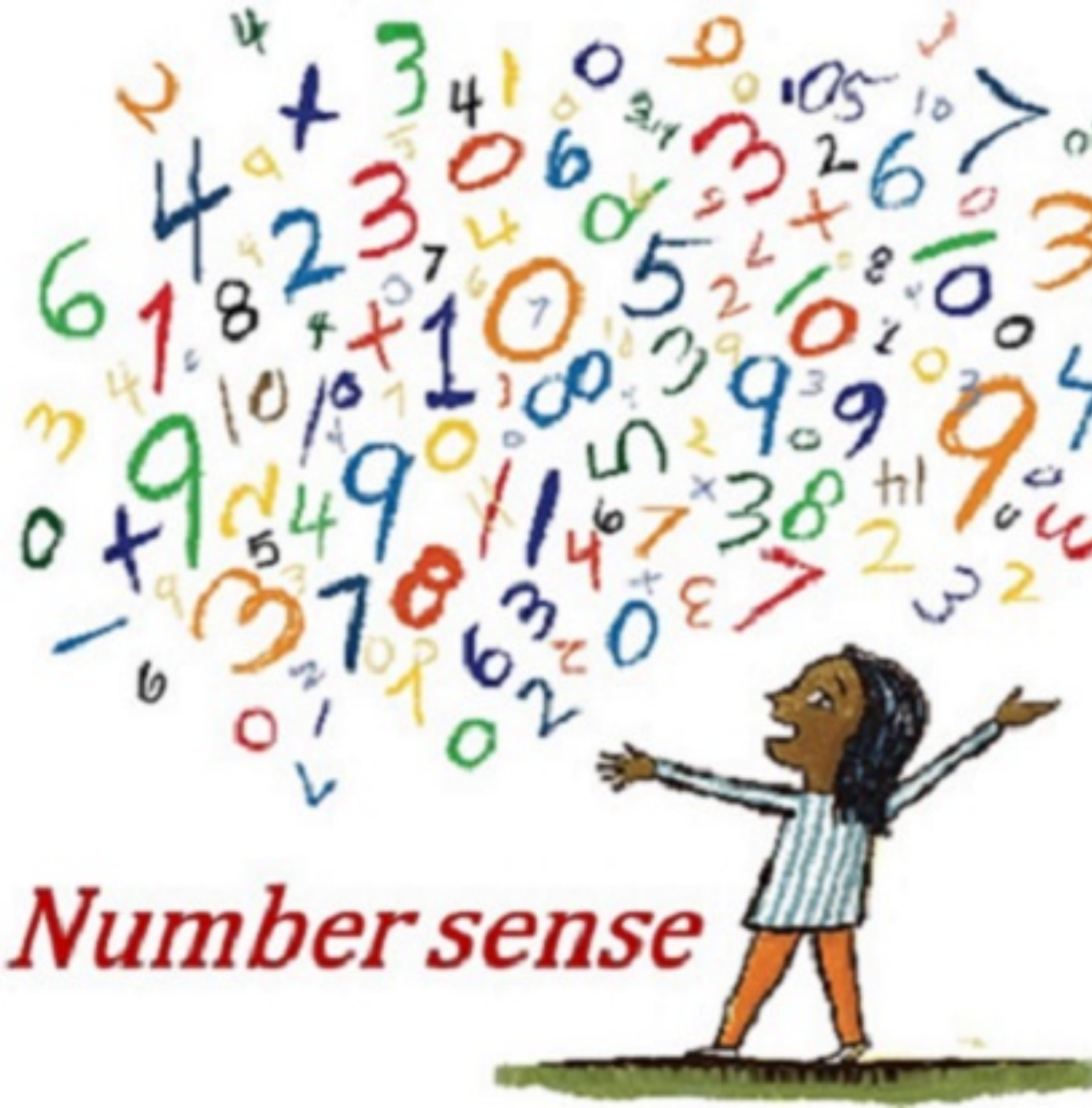
Port Hardy, BC
November 23rd, 2018

Facilitated by Jen Barker

Intentions...

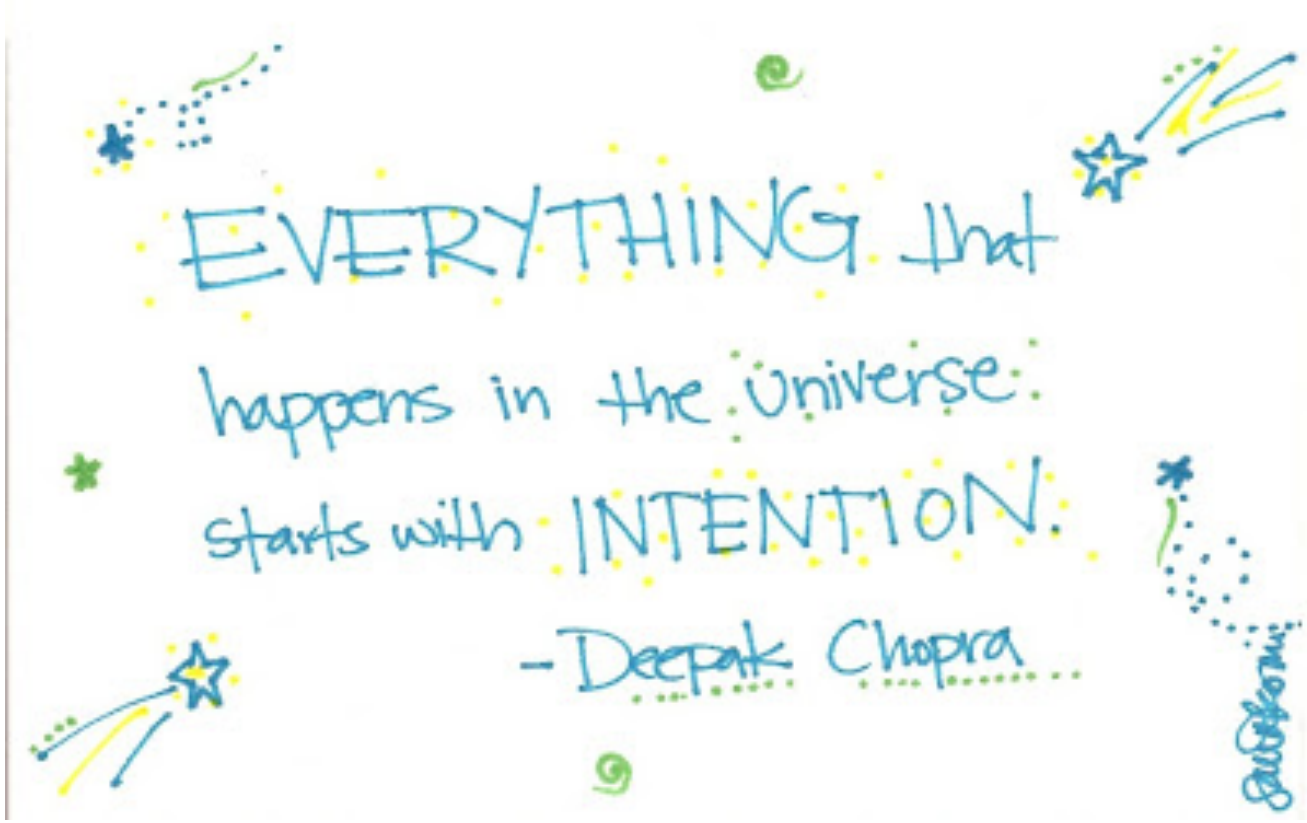
To understand what is meant by Number Sense, including the four foundational relationships:

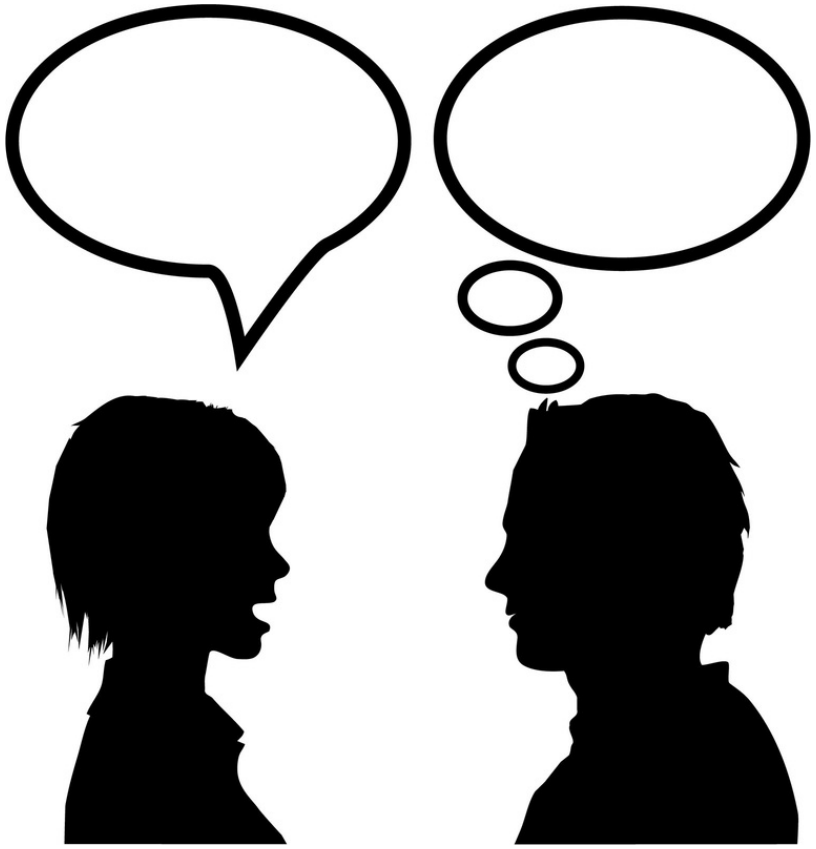
- Spatial Relationships
- One and Two More, One and Two Less
- Benchmarks of 5 and 10
- Part-Part-Whole
- Share practical learning experiences that embody teaching principles



To share practical learning activities that are reflective of effective teaching principles, including:

- The value of rich mathematical conversation
- The value of learning with concrete objects, representing students' understanding pictorially, and connecting this to more abstract symbols and numbers.
- The value of providing entry points for ALL and differentiation
- The importance of listening to the child





How would you describe a student with number sense?

Number Sense is...

"[They] can think and reason flexibly with numbers, use numbers to solve problems, spot unreasonable answers, understand how numbers can be taken apart and put together in different ways, see connections among operations, figure mentally, and make reasonable estimates."

Burns, Marilyn. About Teaching Mathematics: A K-8 Resource. 3rd ed. Sausalito, CA: Math Solutions, 2007. Print.

Our role

- Provide repeated opportunities to bump into number sense ideas.
- Set up number sense experiences that develop conceptual understanding through concrete manipulatives and models.
- Facilitate number sense discussions.
- Support students' understandings as they journey towards numerical literacy.

Instructional Approach

Concrete

Representational (Pictorial)

Abstract (Symbolic)

WHY USE VISUAL TOOLS?

- Students need a strong foundation with concrete and representational experiences before moving to abstract.
- Supports learners in being able to visualize these tools and scaffold their thinking towards mental mathematics and abstraction.
- Create various learning opportunities for students to layer thinking about number in different ways and representations.
- Nurturing both flexibility and fluency in working with numbers.

"...just because there is a predictable pattern to growth, and a predictable season for blooming, doesn't mean that every flower on the plant will bloom on the same day. Each flower opens at its own rate within the growing season. For a flower, the season for blooming may be a matter of weeks or months. "

- Amanda Morgan

Differentiation

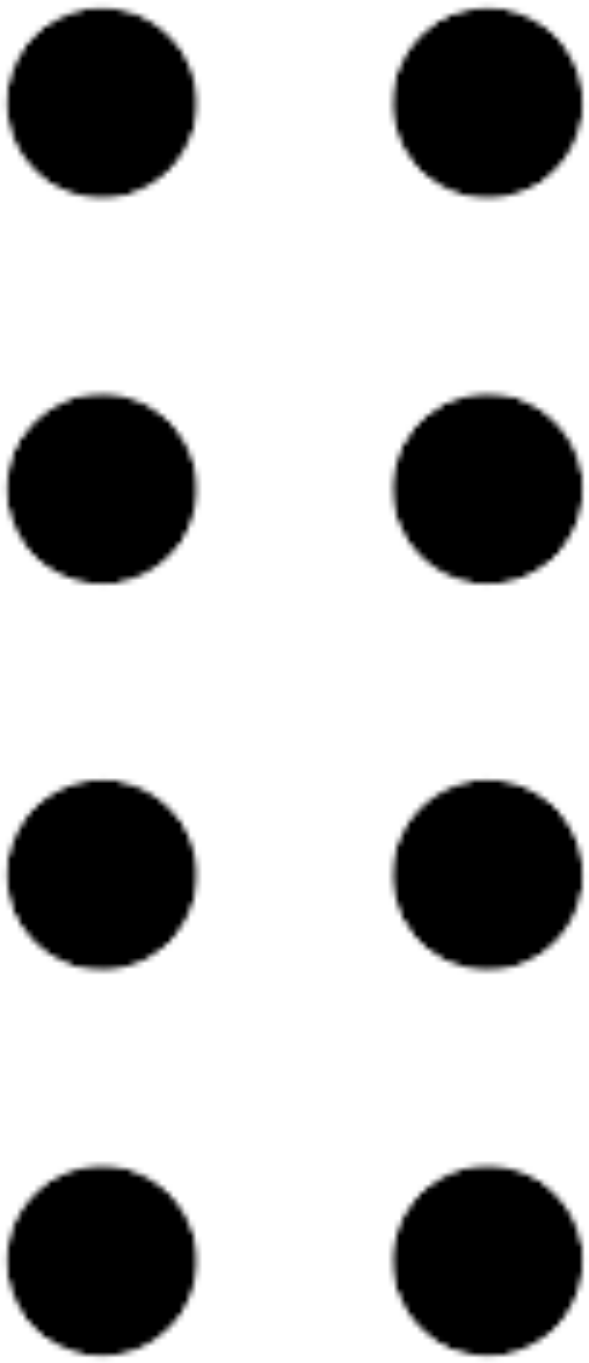
Where are our learners at?

Where do our learners need to go?

Is this learning experience open such that all learners have an entry point and can work to their fullest potential?

John Van de Walle (2006) describes four relationships that need to be developed for students to develop number sense. They are:

- Spatial Relationships
- One and two more, one and two less
- Benchmarks of 5 and 10
- Part-Part-Whole

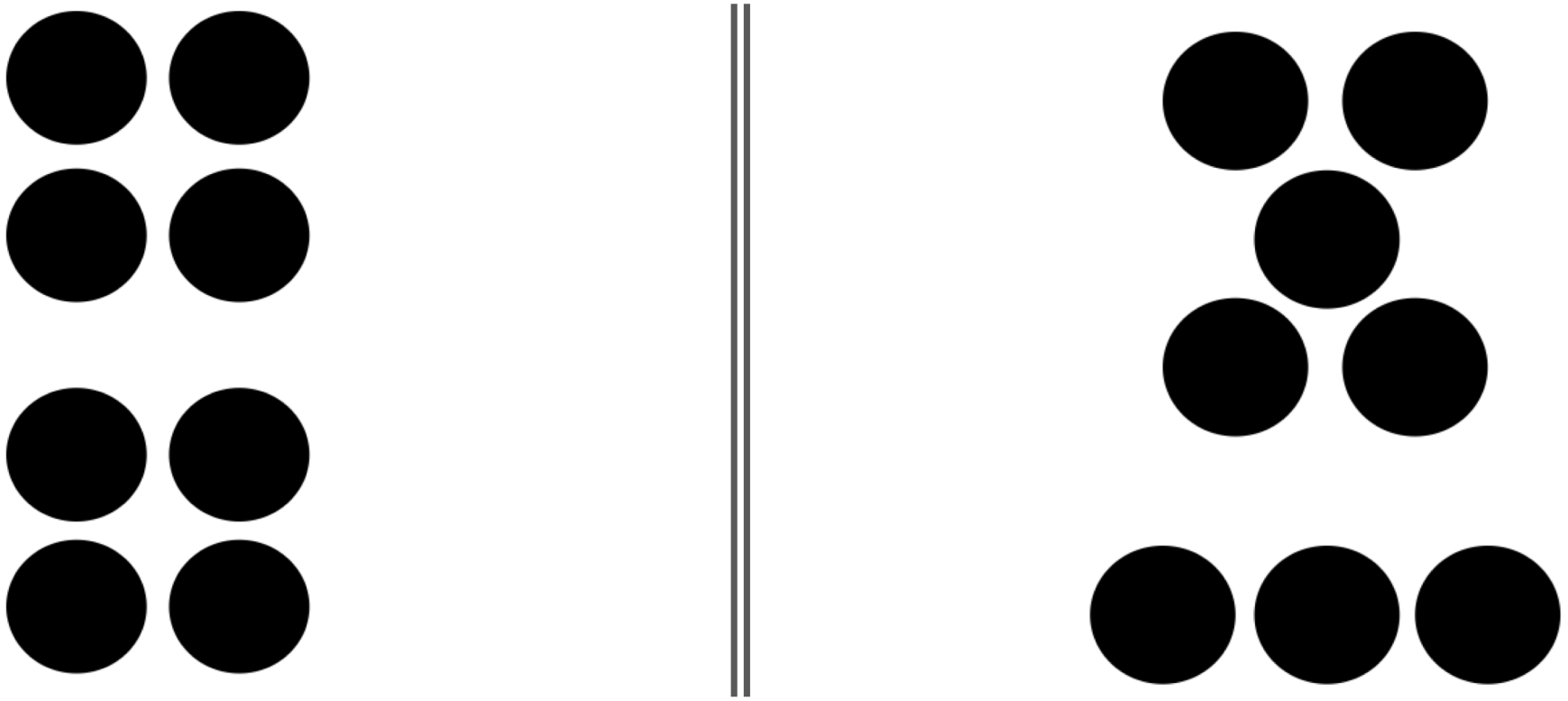


Spatial Relationships

Close your eyes and think of eight.

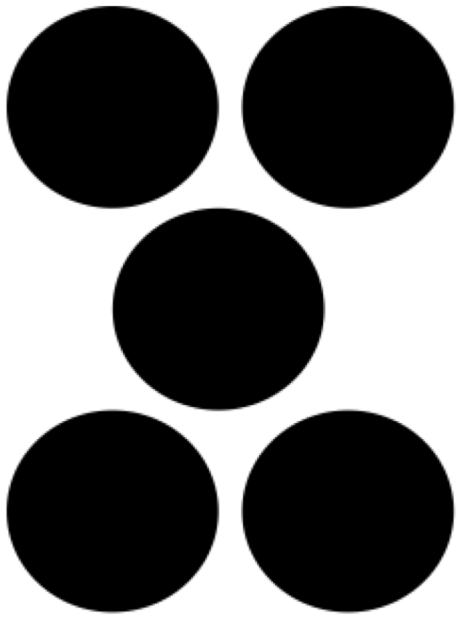
Raise your hand if you saw this

Building spatial relationships develops subitizing

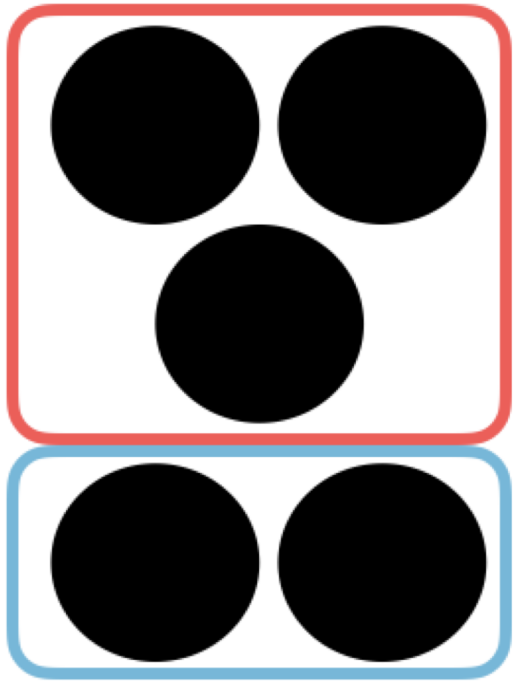


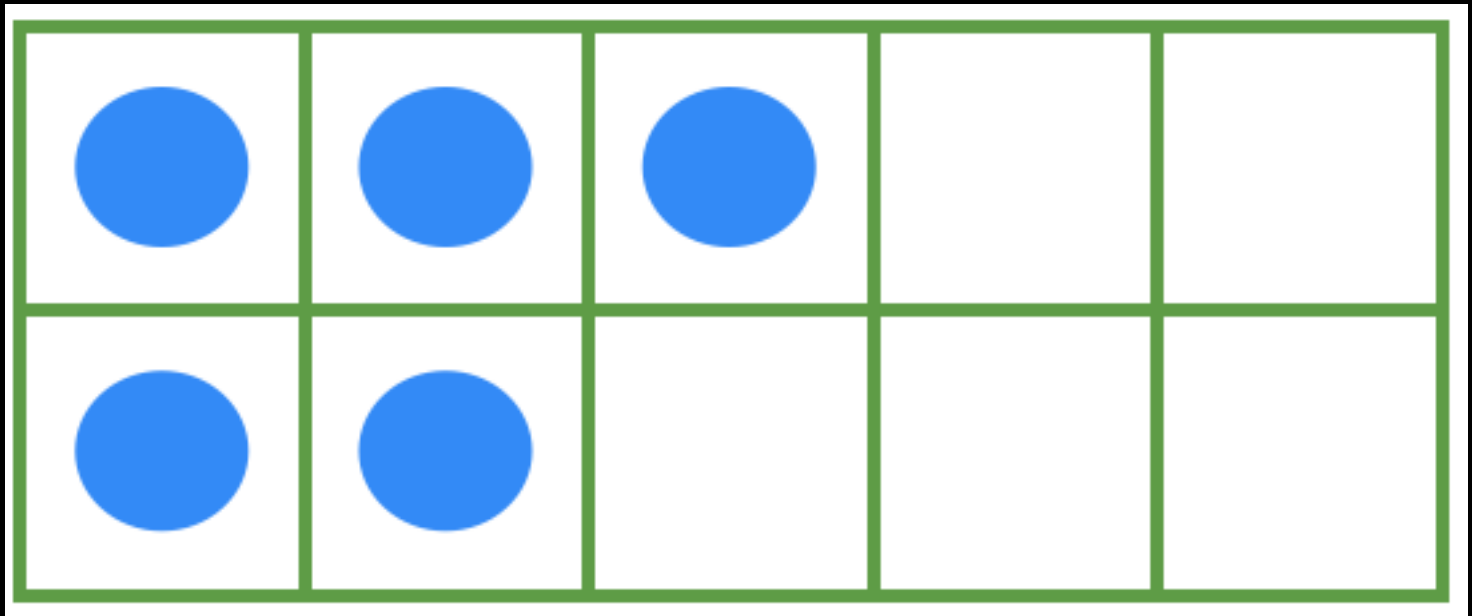
Subitizing – ability to see how many instantly

PERCEPTUAL



CONCEPTUAL



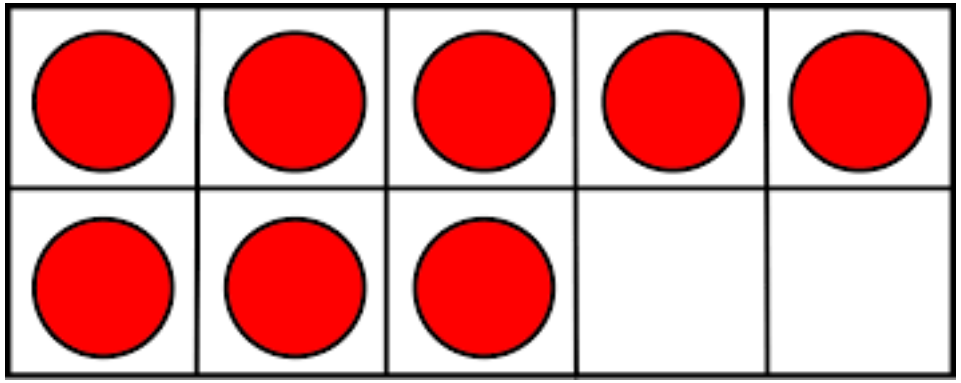


Making TEN Frames

EACH PERSON NEEDS:

- 2 cookie sheets
- Magnets
- Colourful duct tape

FLASH AND SHOW OR SAY



Build a number on your Ten Frame. Flash it for a few seconds. Invite students to show how many they see on their fingers.

Guiding Questions

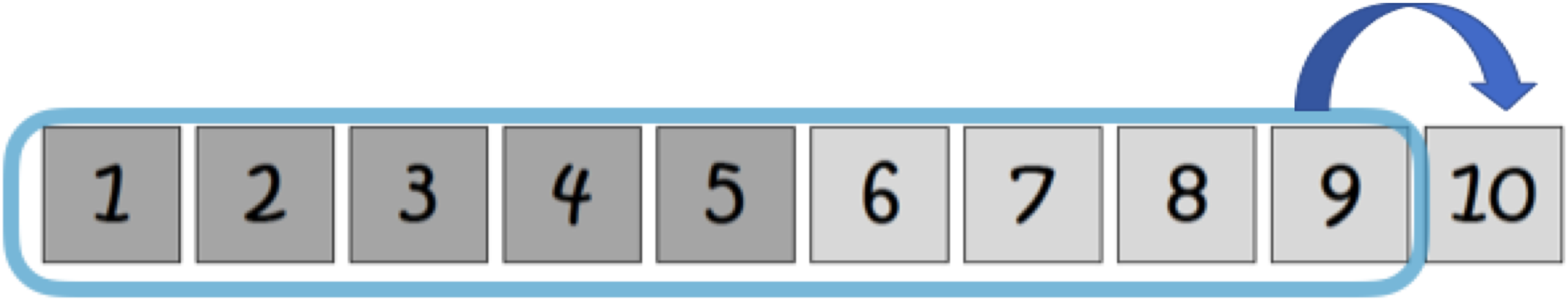
How many do you see?
How did you know?
Did anyone see it another way?
How might we record this?

What to Look For:

*Are children able to explain how they knew the total number of magnets?
*What strategies are students using to determine the total number of magnets? *Are they trying to count by ones?
*Are they using the benchmarks of 5 and 10?

One and Two More, One and Two Less

It is not the ability to count on two or count back two, but instead knowing which numbers are one and two less or more than any given number. It is about relationships.

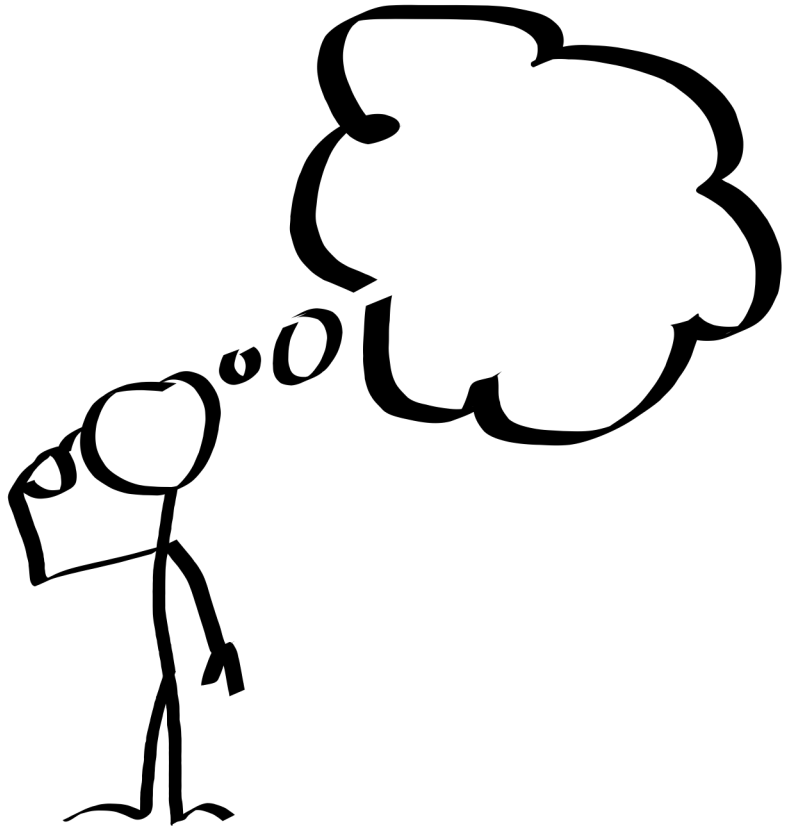


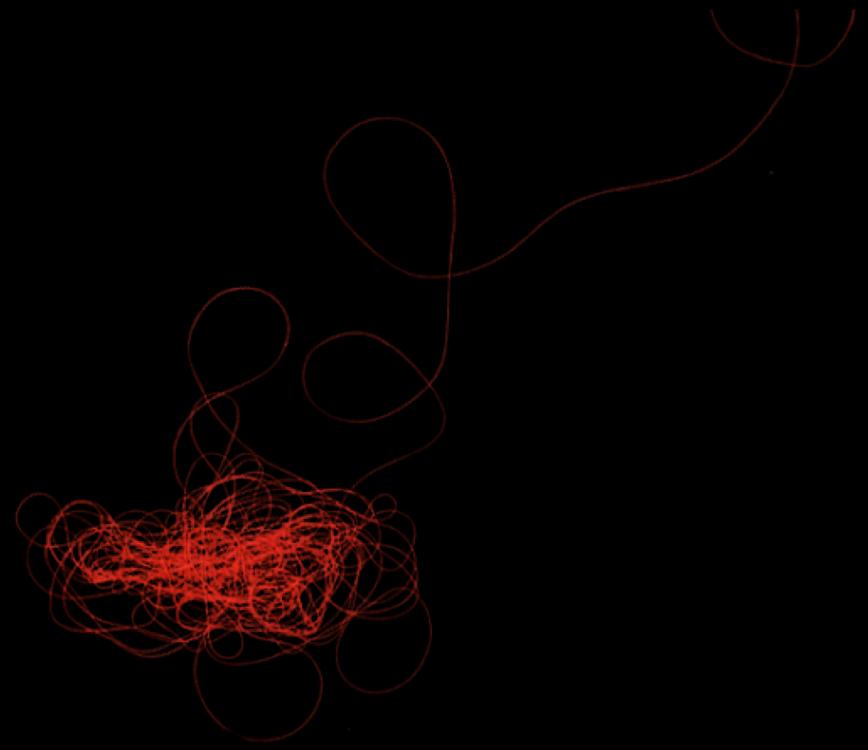
9 + 3 =

I know 9 is 1 less than 10

So I can think 9 + 3 which is 12

so it is just one less





Making Clotheslines

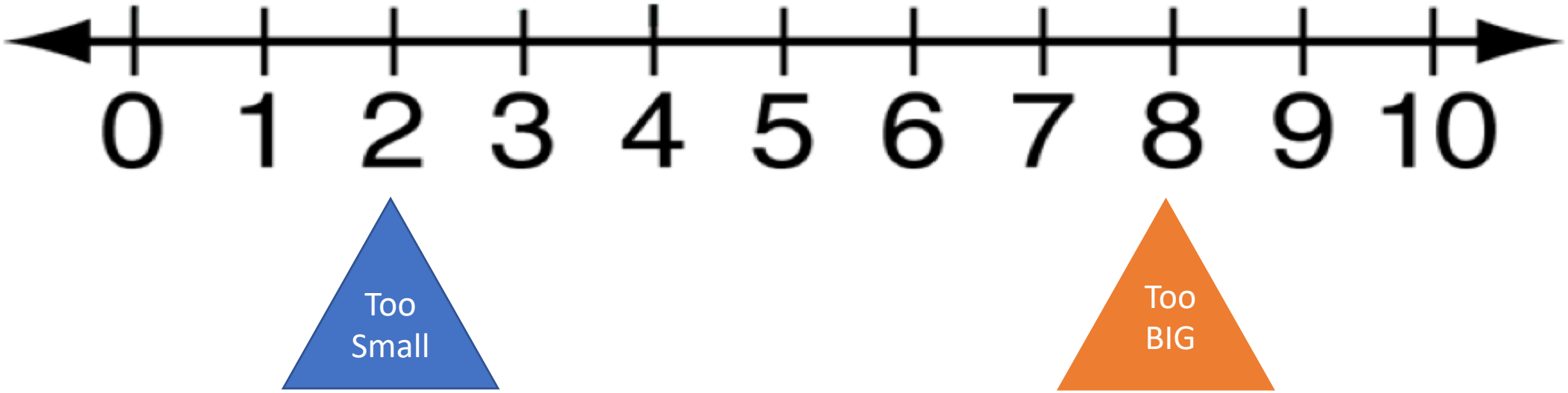
EACH PERSON NEEDS:

- 4 magnets
- 4 hooks
- String
- Clothesline cards

Working with the Clothesline

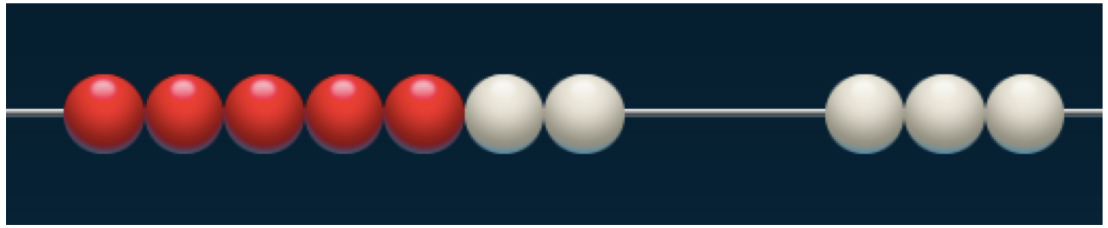
- Build the line
- What are my mystery numbers?
- Can you fix the line?
- Parallel lines - multiple representations

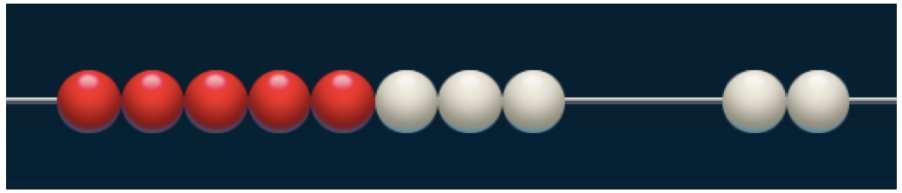
Guess My Number!



Benchmarks of 5 and 10

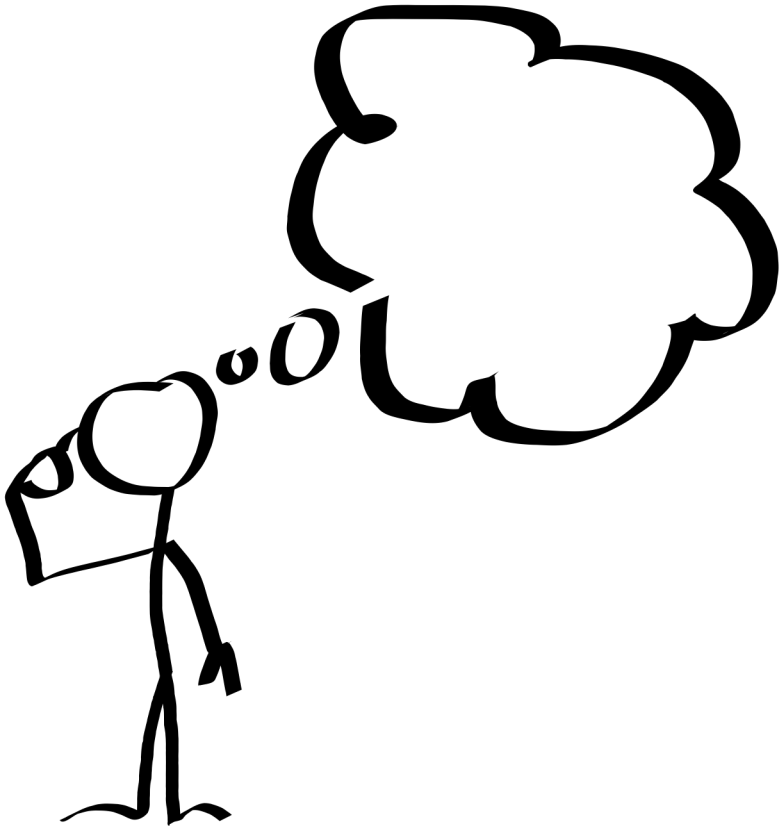
Helping students to see how numbers relate to 5 and 10 becomes useful as students start to compute with numbers.

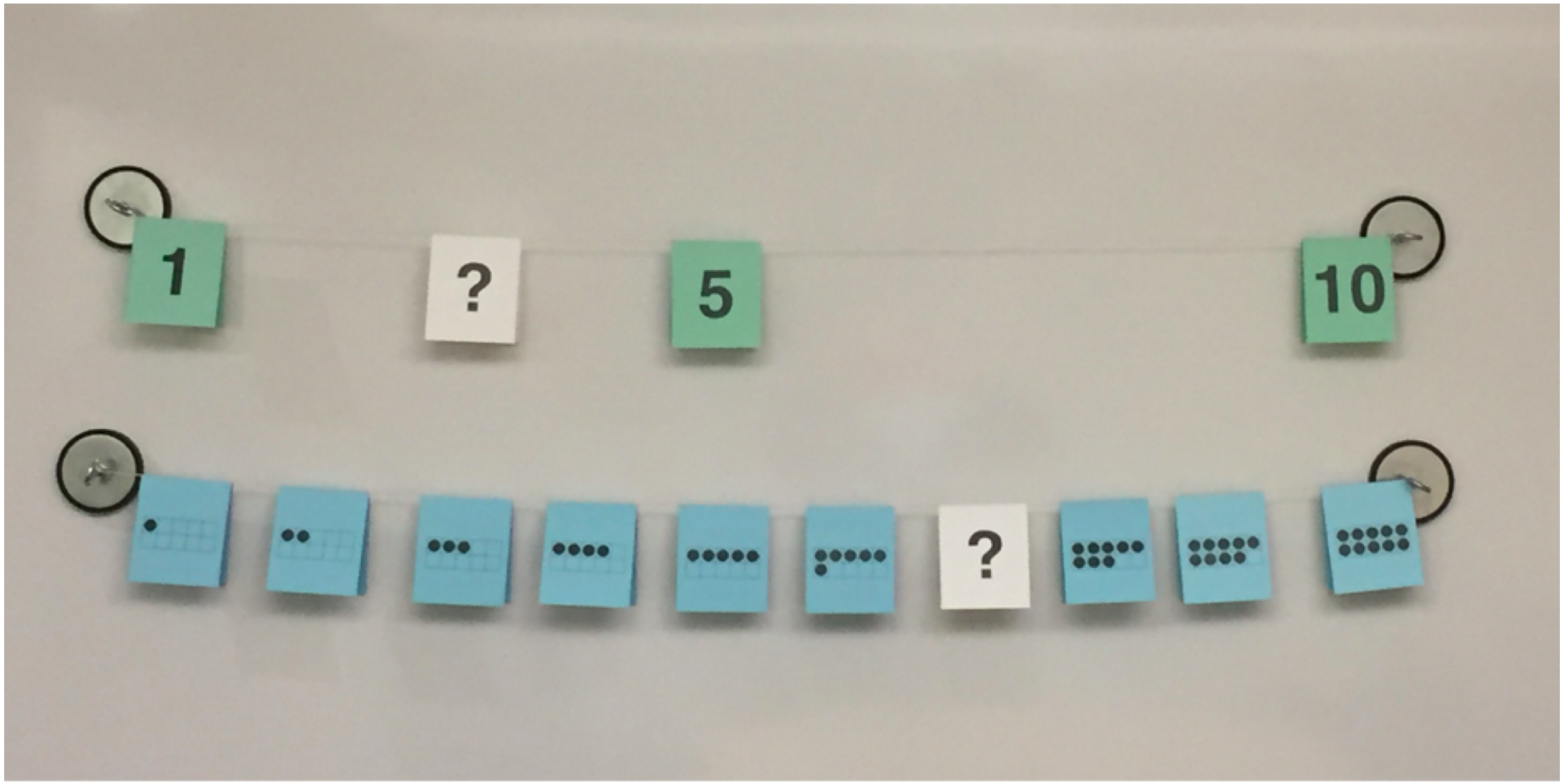




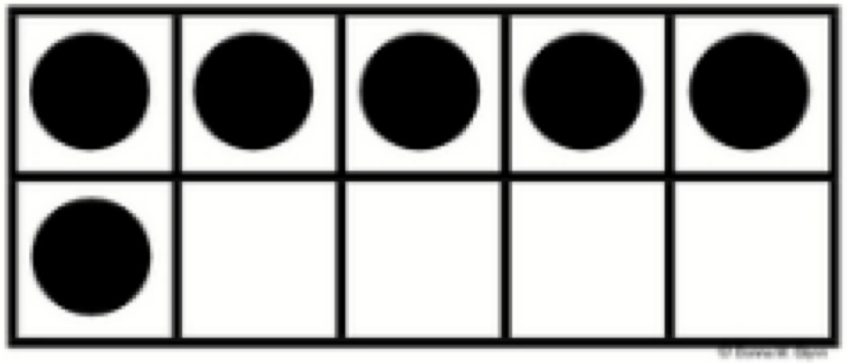
I know that 5 and 3 more is 8

I also know 8 is 2 less than 10




1
?
5
10
?

PARTNERS TO 5, 10, and 20



Build a number on your ten frame(s). Ask, "How many more do we need to make 5, 10, or 20?"

Guiding Questions

*How many do you see? Can you build the same quantity on your ten frame?

*How many more do you need to have ____? (5, 10, or 20)

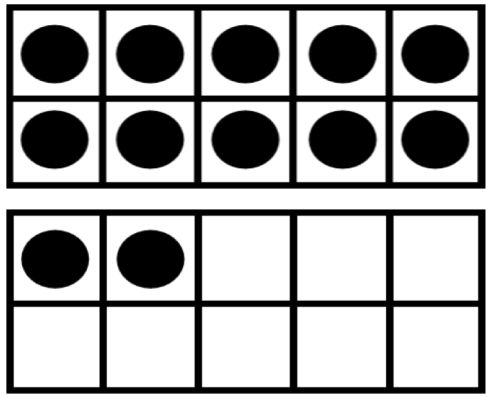
*How did you know you needed that many more?

What to Look For:

*Are children able to explain how they determined how many more counters they needed?

* What strategies are students using to determine how many more? Do they know the partners for ten? Are they using the benchmarks of 5 and 10? Or are they counting by ones?

SHRINK AND GROW



Roll a die or pull a numeral. Students build that number on the large ten frame mats. Roll a die or pull a numeral again. "Are we shrinking or growing?"

Guiding Questions

*How many do you see?

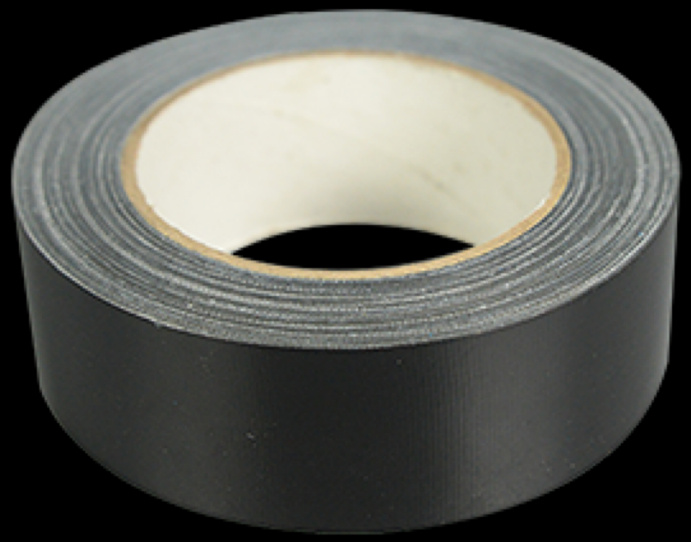
*Are we shrinking or growing? How can we make our new number?

*How did you know you needed to add _____ more or take ____ away?

What to Look For:

*Are children able to add on or take away from their current quantity to make the new quantity?

*What strategies are students using to determine how many more they need to add or how many they need to take away?



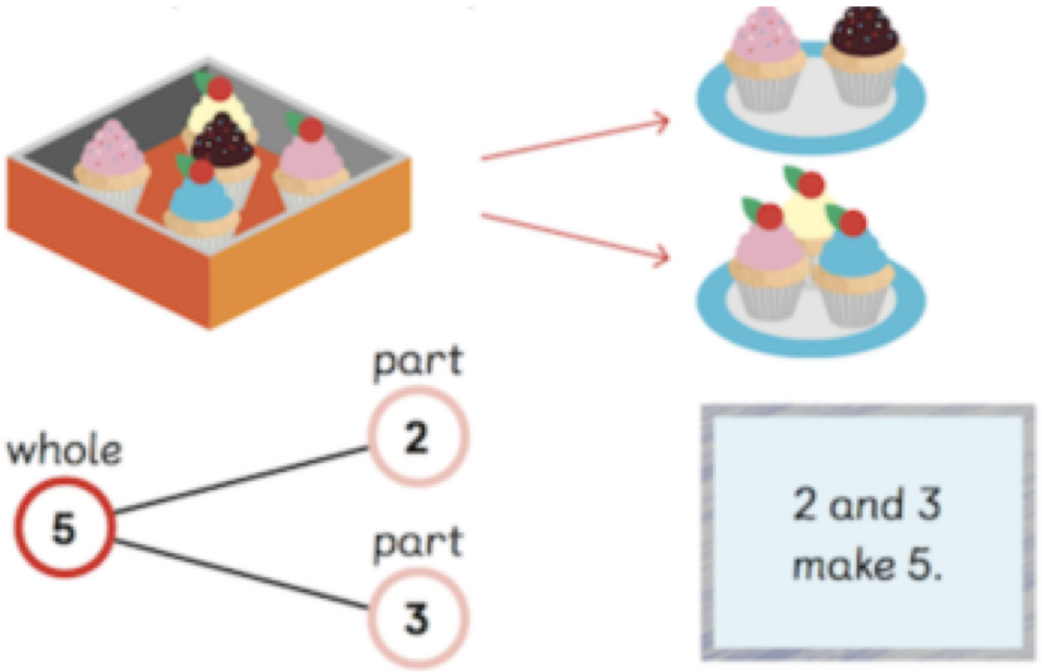
Making Life Size TEN Frame

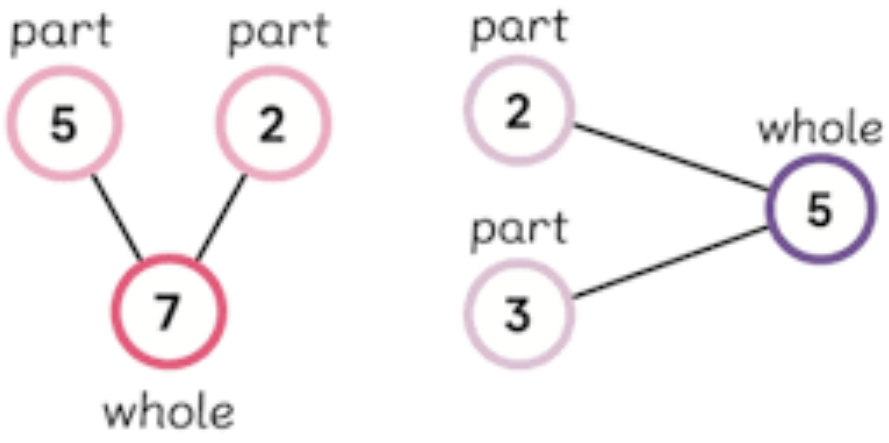
EACH PERSON NEEDS:

- 2 mats
- 2 rolls of black duct tape
- marker

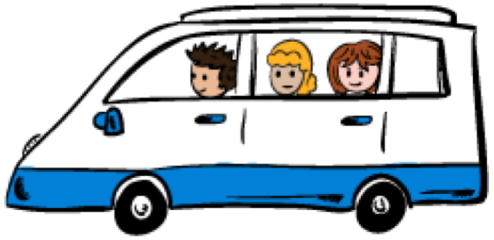
Part-Part-Whole

Seeing a number as being made up of two or more parts.





HOW MANY WAYS?



Pick a context that has two levels/stories. For example, there are 5 people in the car. Some are sitting in the back seat and some in the front. Have students show how many people might be in the front seat and how many people could be in the back seat using the ten frame. Focus on the different possibilities for decomposing 5 and connect to the abstract.

<u>Guiding Questions</u>

How can you show the story using both rows of the ten frame?

How did you break _____ apart?

How could we record that using a number sentence/equation?

<u>What to Look For:</u>

*Are children counting the spots individually to make the quantity?

* Are they using their knowledge about how numbers are connected to break them apart and put them back together?

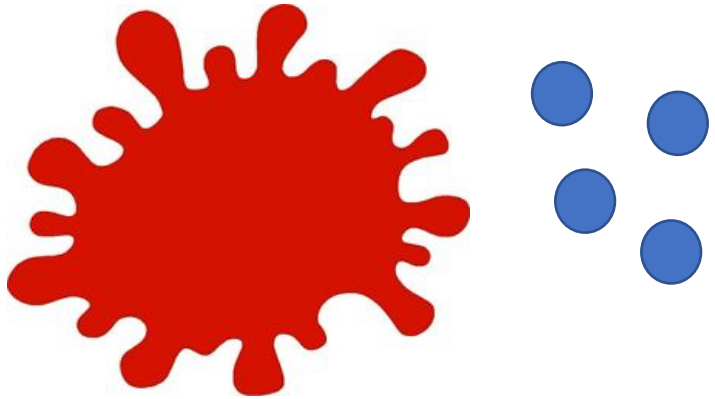
* Do they see and understand the commutative property of addition (e.g., 2 + 3 = 5 therefore 3 + 2 = 5)

Making SPLATS

EACH PERSON NEEDS:

- 2 glitter foams
- Magnetic tape

SPLAT



Flash and show some dots on your cookie sheet. Ask the students “How many do you see?” and “How do you see them?” Add a SPLAT (cover some of the magnets). Ask students “How many dots are hiding behind the SPLAT?” “How do you know”

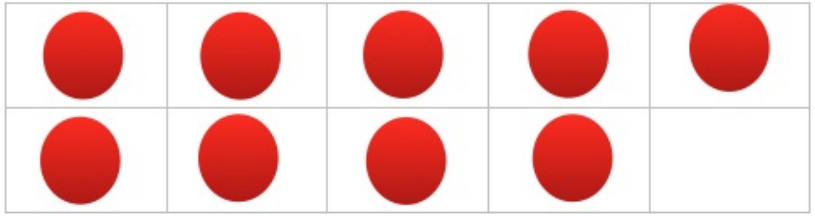
<u>Guiding Questions</u>

How many do you see?
How do you see them?
How many are hiding?
How do you know? How else could you know?

<u>What to Look For:</u>

*Are children able to determine how many are hiding?
* Are they able to explain the strategies they used for determining how they knew?
* Do they see the related facts?

ROLL AND ADD OR SUBTRACT



Roll a dice. Invite students to build that number on one of the ten frames. Roll another dice. Again, invite the students to build that number on the second ten frame. Ask "How many do we have altogether?"

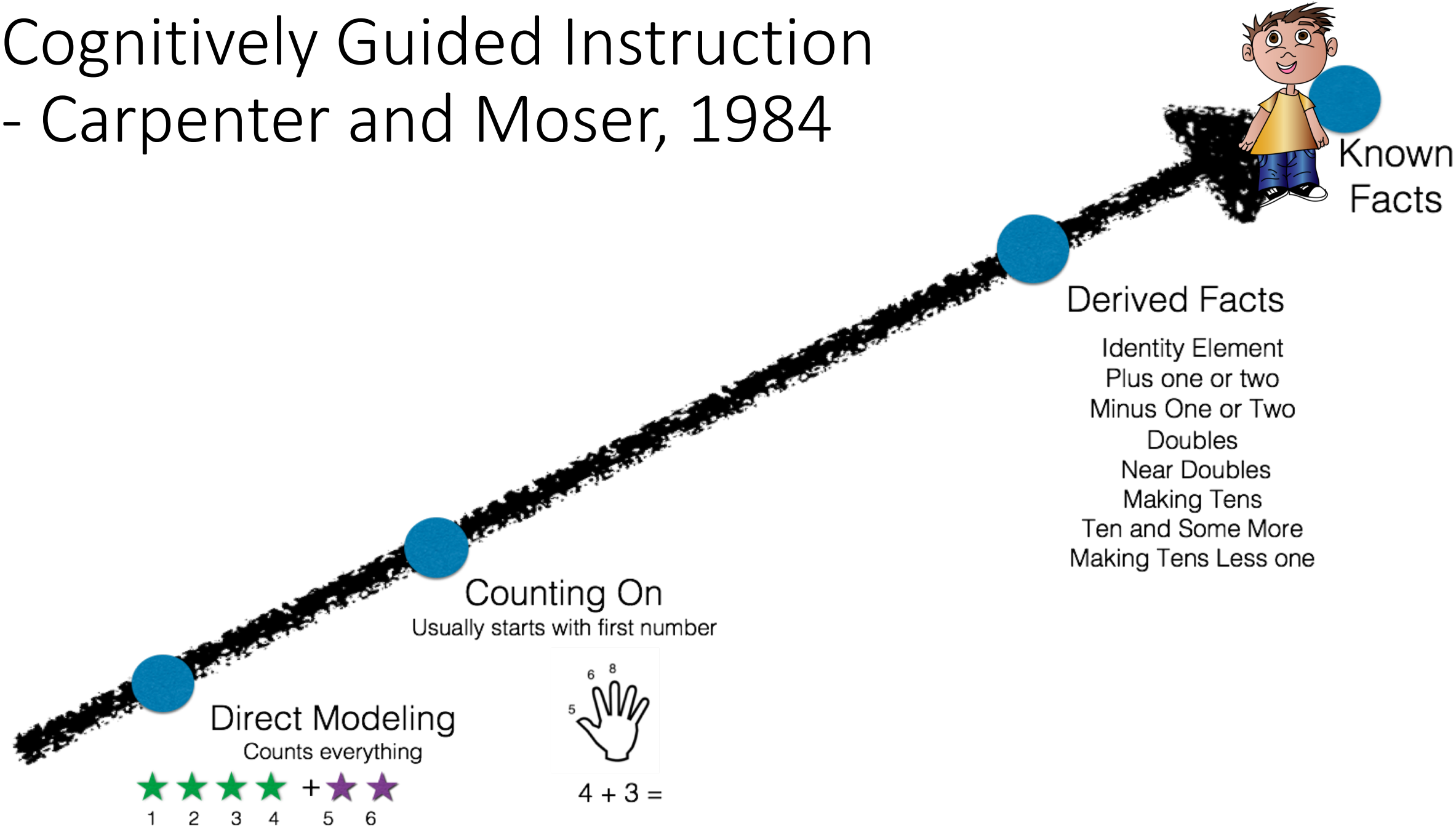
<u>Guiding Questions</u>

How many are there altogether?
How do you know? What strategies did you use?
How could we record that using a number sentence/equation?

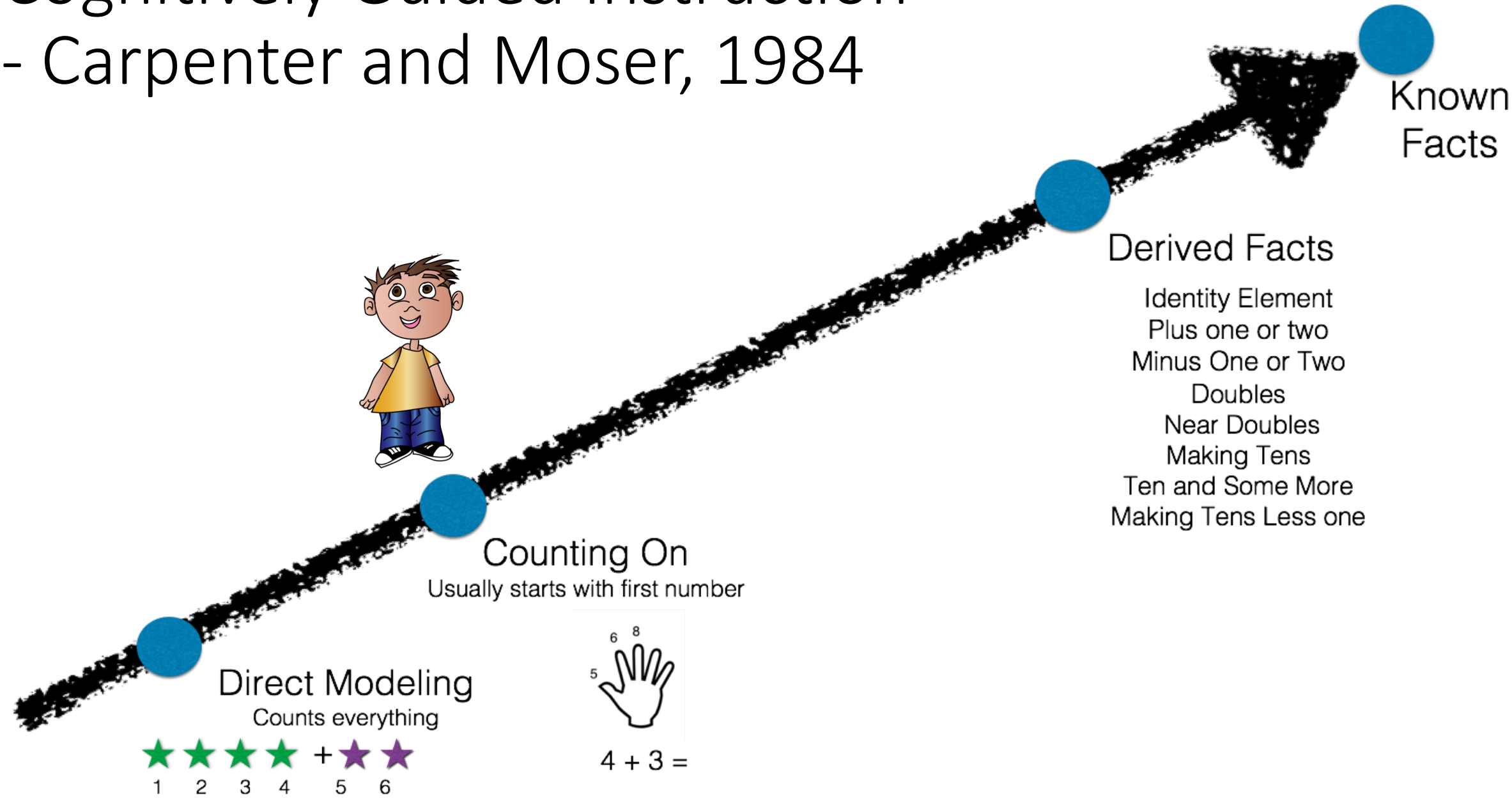
<u>What to Look For:</u>

*Are children counting the spots individually to determine how many?
* Are they using their knowledge about how numbers are connected to break them apart and put them back together?

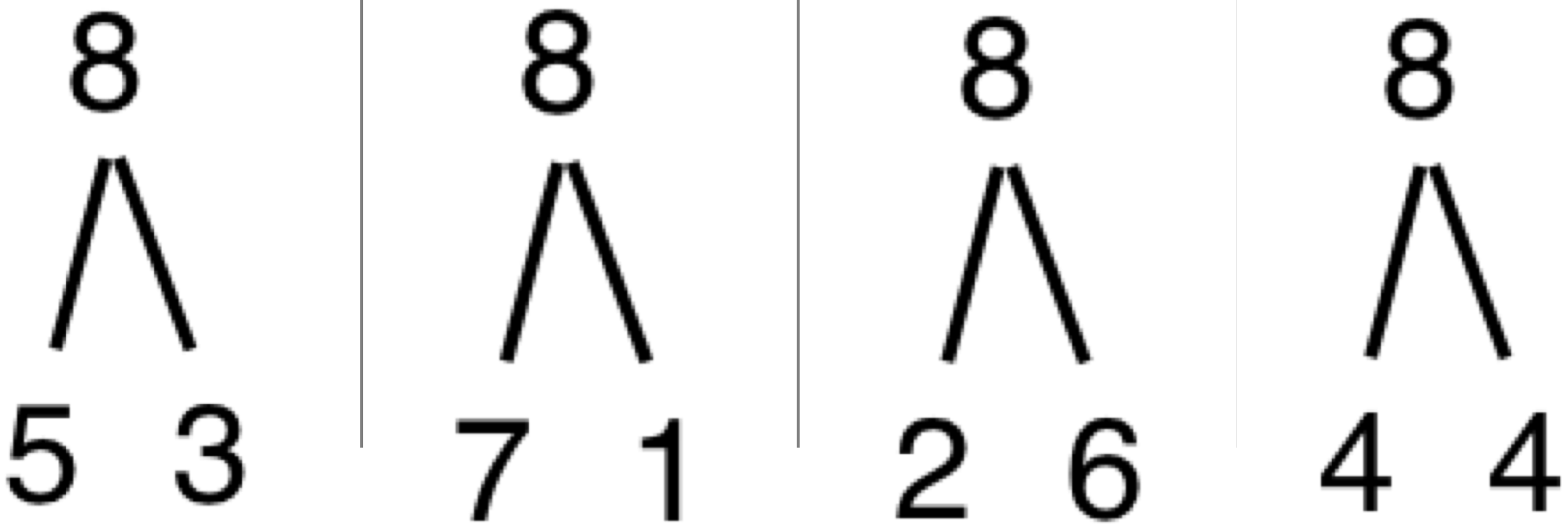
Cognitively Guided Instruction - Carpenter and Moser, 1984



Cognitively Guided Instruction - Carpenter and Moser, 1984



When presented with 8 + 7 do your students know which decomposition of 8 can be used to help solve the problem?



$$8 + 7 =$$

$$5 \quad 3$$

$$5 + (3 + 7) =$$