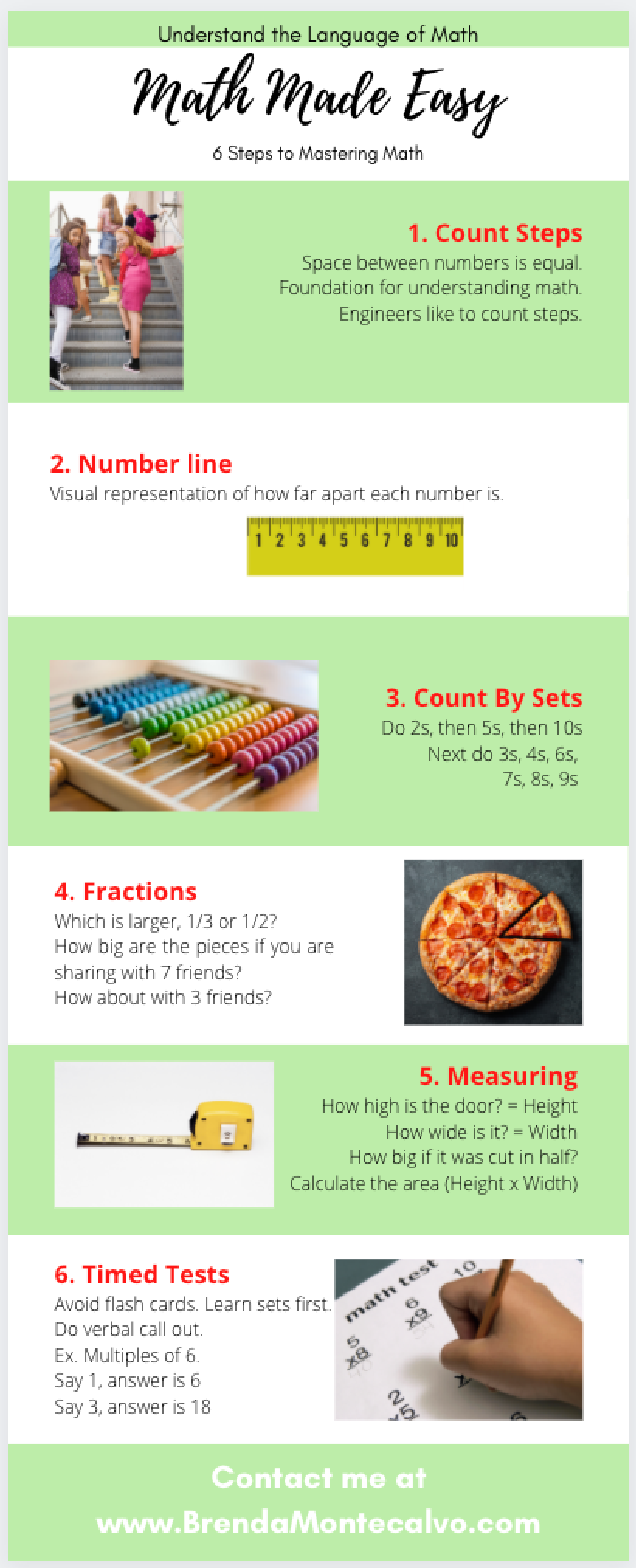

VISUAL SECRETS FOR MATH

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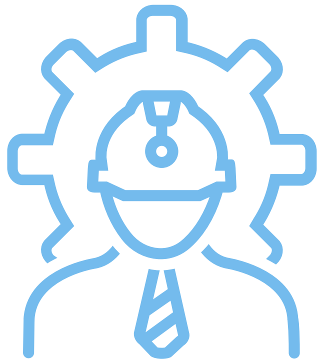
To understand the universe you must know the language in which it is written — and that language is mathematics.

GALILEO GALILEI

Who Needs Math?

BEING GOOD AT MATH ALLOWS THE STUDENT TO HAVE A FULL ARRAY OF OPPORTUNITIES WHEN CHOOSING A FUTURE CAREER.

Carpenters



Engineers

Accountants

Optometrists

Math Teaches Problem Solving

MATH MEASURES SPACE IN LOTS OF DIFFERENT WAYS

Linear Math: The amount of space represented by each number is the same, and the distance between numbers is always equal.

Counting Steps

ADULTS THAT DISLIKE MATH OFTEN DO NOT RECALL COUNTING STEPS WHEN YOUNG

Counting Steps

STEPS REPRESENTING A NUMBERLINE

Counting Steps

To build math concepts one must understand what numbers represent, and then learn how to manipulate them to measure or calculate the space they occupy.

Why Do So Many Have Difficulty with Math?

PAST EXPERIENCES

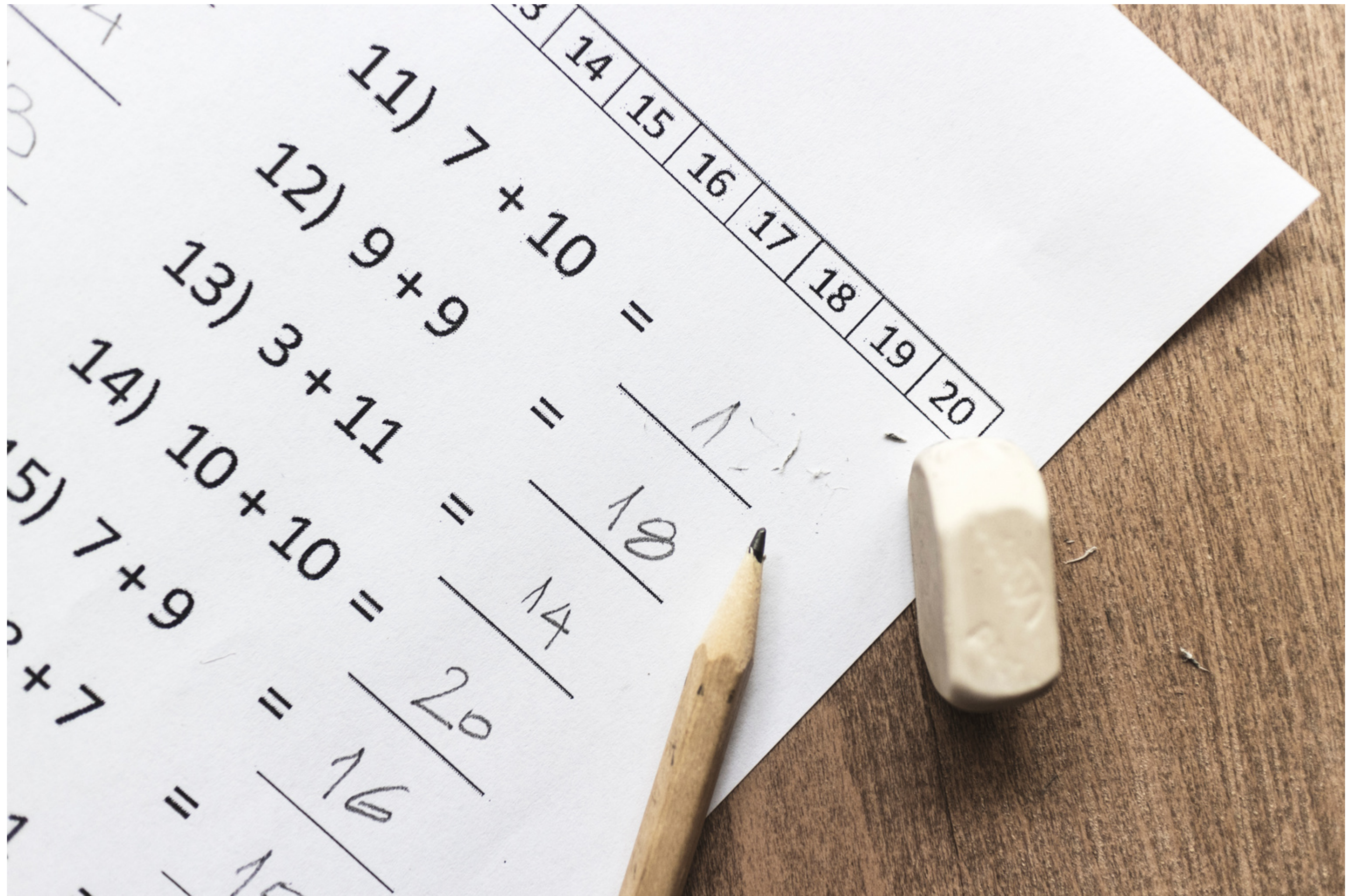
Play activities did not incorporate problem solving.

Passive vs. Interactive

Why Do So Many Have Difficulty with Math?

TIMED MATH TESTS

High pressure to get the answer without knowing the "why".



Why Do So Many Have Difficulty with Math?

TIMED MATH TESTS

When the linear math concept is not developed, a student must rely on memorization to determine mathematical answers. The student does not know why or how he achieved the correct answer.

Why Do So Many Have Difficulty with Math?

TIMED MATH TESTS

Students with good memories pass all of their math facts, giving everyone a false sense that they are good at math. They may struggle at higher math because they do not understand the basic concepts.

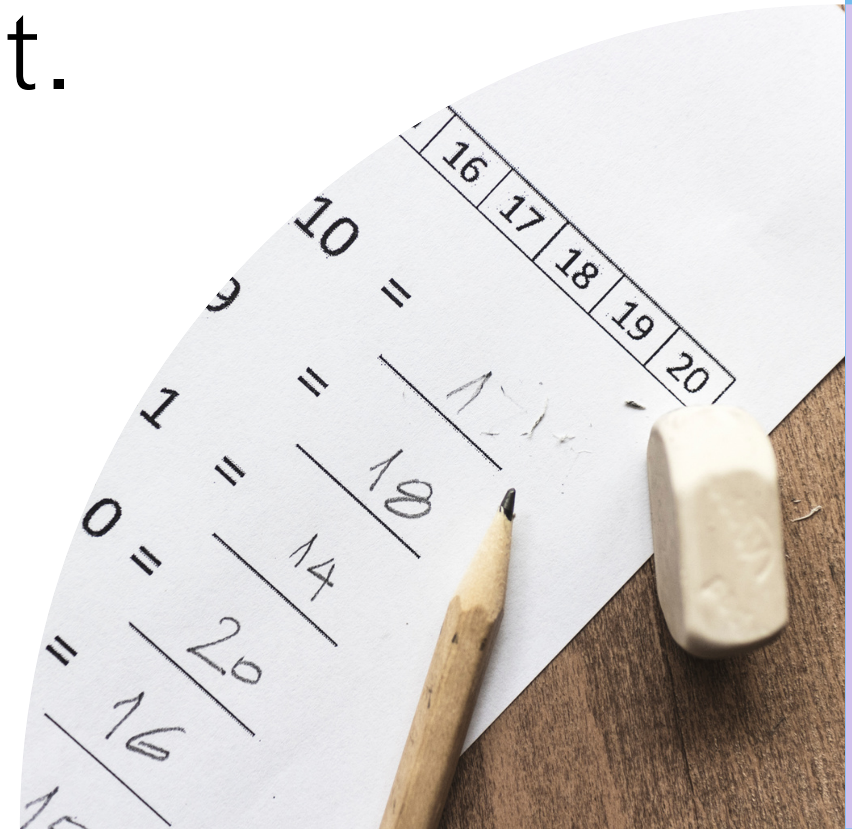
Those who are not good at memorization learn to "hate" math because they are always pushed to memorize and are timed to prove they know their math facts.

This scenario creates stress for these students.

Why Do So Many Have Difficulty with Math?

Research shows that students who approach mathematics as a subject of memorization are lower achieving than those who approach it as a subject of ideas that they can think deeply about.

Boaler and Zoido, 2016



Why Do So Many Have Difficulty with Math?

A common myth is that students believe to be good at mathematics they have to be fast, when some of the world's leading mathematicians are slow thinkers. Boaler, 2016

Why Do So Many Have Difficulty with Math?...

MINDSET

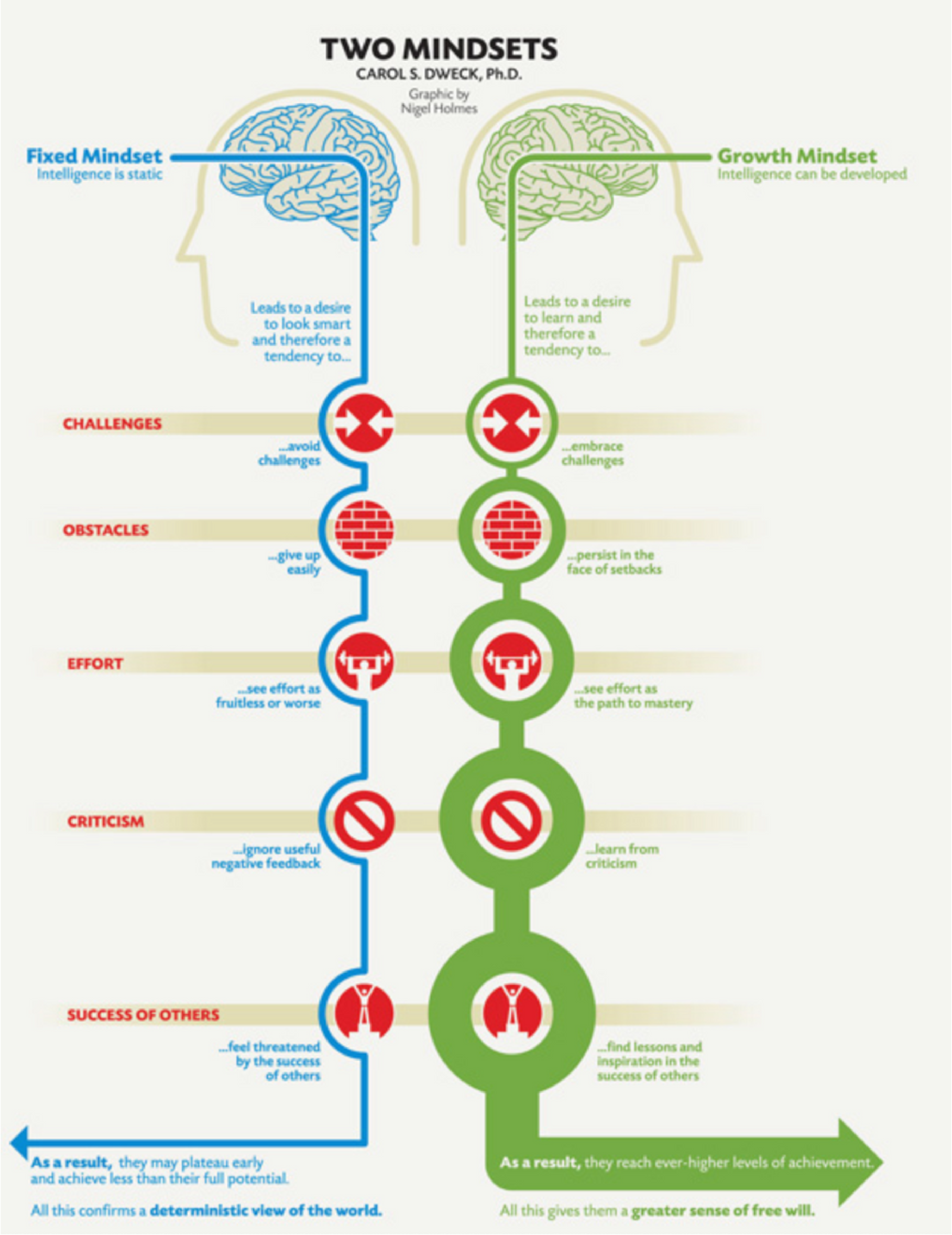
Carol Dweck, PhD, has shown that students with a growth mindset achieve at higher levels than those with a fixed mindset.

Why Do So Many Have Difficulty with Math?...

GROWTH MINDSET

Mathmatical ability can be developed.

Fixed Mindset



Growth Mindset

Visual Skills for Math

Binocularity

Laterality and Directionality

Spatial Organization and Orientation

Visual Closure

Visual Figure Ground

Association

Categorization

Binocularity

Relates to higher math when perceiving and rotating objects in order to measure them.

Hundreds more jobs today are dependent upon binocularity especially, in the field of engineering.

Laterality and Directionality

The concepts of right and left, and the cardinal directions (North, South, East, West) are dependent upon this visual skill.

Knowing these concepts is critical to understanding visual space.

Laterality and Directionality

Since math is measuring space in lots of different ways, the student needs a foundation, which is "self," from which to reference visual space.

Spatial Organization and Orientation

The ability to arrange information and relate it to self and surroundings.
These abilities serve the student well when trying to figure out geometry and calculus.

Visual Closure

This helps in solving math problems and story problems.

Figure Ground

Differentiating figure (center) from ground (peripheral) is critical in determining which part of the math problem is important to pay attention to.

Association

Important when grouping items that have something in common.

Categorization

Helpful when doing sets & subsets, Building a foundation for more complex mathematical structures.

MATH HOMEWORK

When the student's answer is not the correct one, figure out how to ask a question so the student can discover the right answer.

If the student does not understand the concept, then repetition is only memorization.

If there are many errors at the current level, reduce the level of math knowledge demand.

MATH HOMEWORK

When correcting math papers, tell the student how many problems are correct.

When there are incorrect answers, have the student figure out which ones they are.

Don't tell the students which ones are right or wrong. Let them tell you.

Give a big reward when they get 100 percent correct.

Determining Math Concepts

PLACE 5 CLIPS ON TABLE.
HOW MANY ARE THERE?

Determining Math Concepts

IS THE SPACE BETWEEN 2 AND 3 SMALLER THAN, EQUAL TO, OR LARGER THAN THE SPACE BETWEEN 52 AND 53?

2 and 3

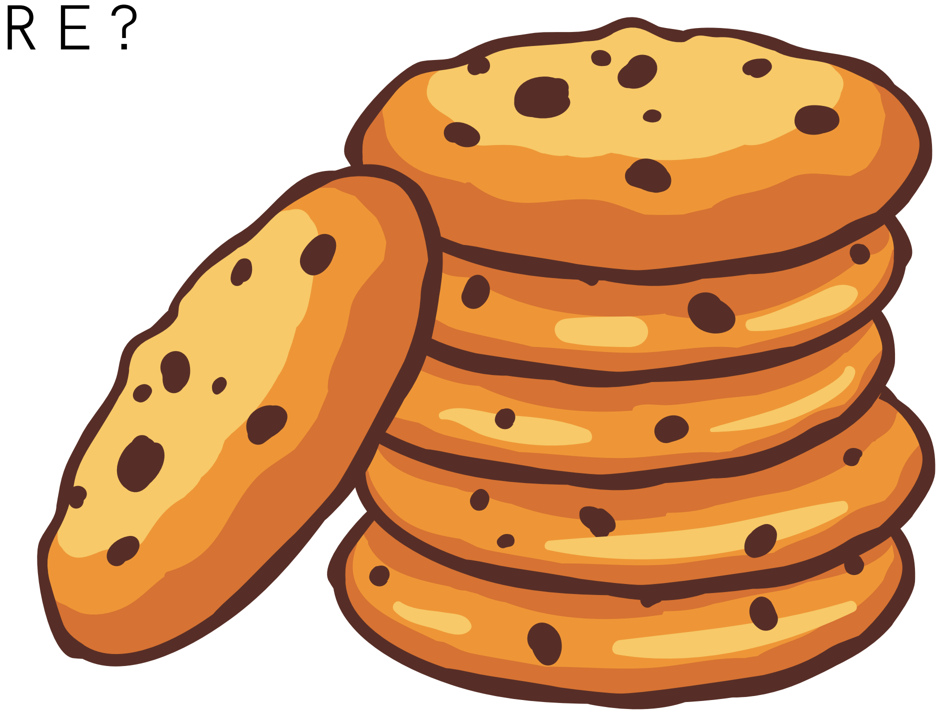
52 and 53

Determining Math Concepts

IF YOU ARE STANDING ON STEP 8, HOW MANY STEPS DO YOU NEED TO TAKE TO GET TO STEP 10? HOW ABOUT FROM 28 TO 30? 58 TO 60?...

Determining Math Concepts

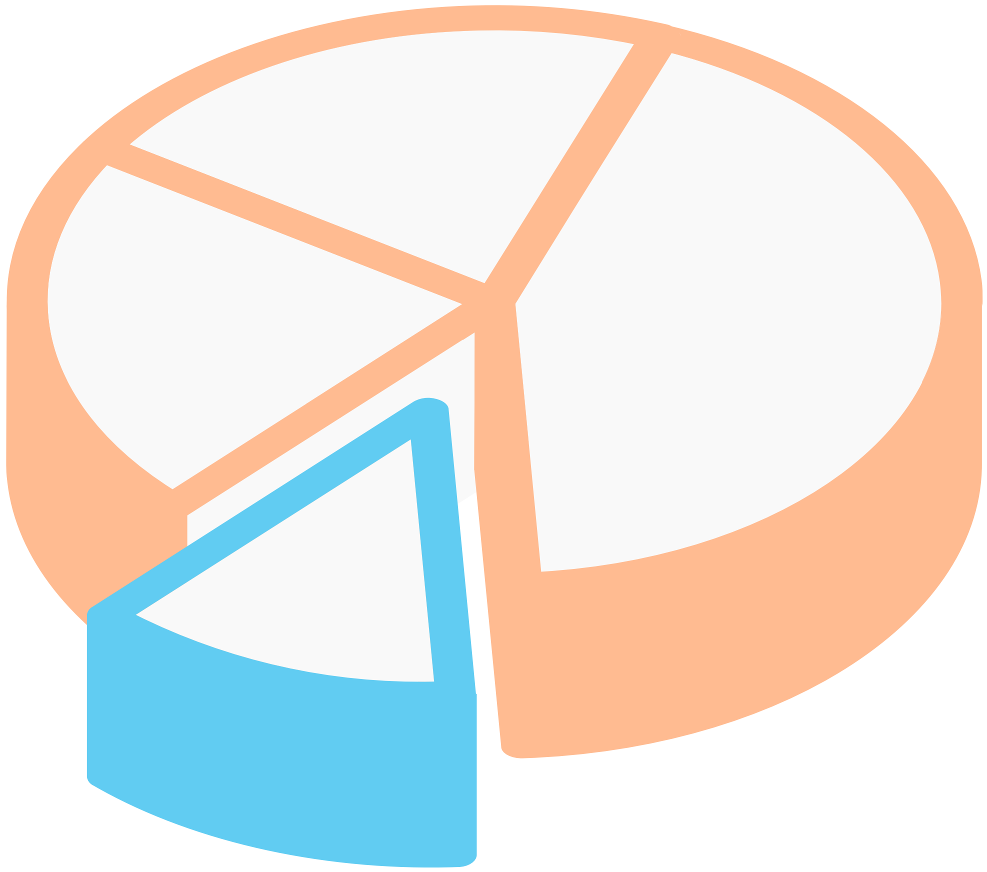
I HAVE 6 FRIENDS. EACH HAS 2 COOKIES.
HOW MANY COOKIES ARE THERE?



Multiplication

Determining Math Concepts

WHICH IS BIGGER, 1/3 OR 1/2?



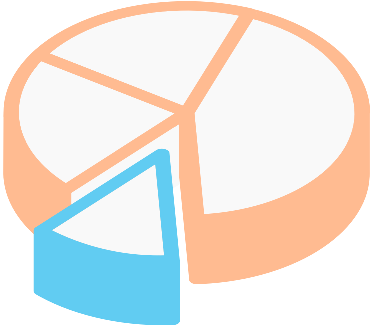
Developing Math Concepts

SIMPLE QUESTIONS TO DISCOVER WHAT MATH CONCEPTS ARE SECURE AND WHICH ARE NOT.

Linear

Adding

Multiplication



Fractions

Linear Math Concept

Begins when young. Remember when your toddler was learning to count?

He assigned number 1 to the thumb, then 2 to the pointer finger, then he counted up to ten to the pinky finger.

Linear Math Concept

This shows he understood 1 and 2, but beyond that, 3 through 10 had no meaning.

When each item represents a number, he will begin to understand linear concepts.

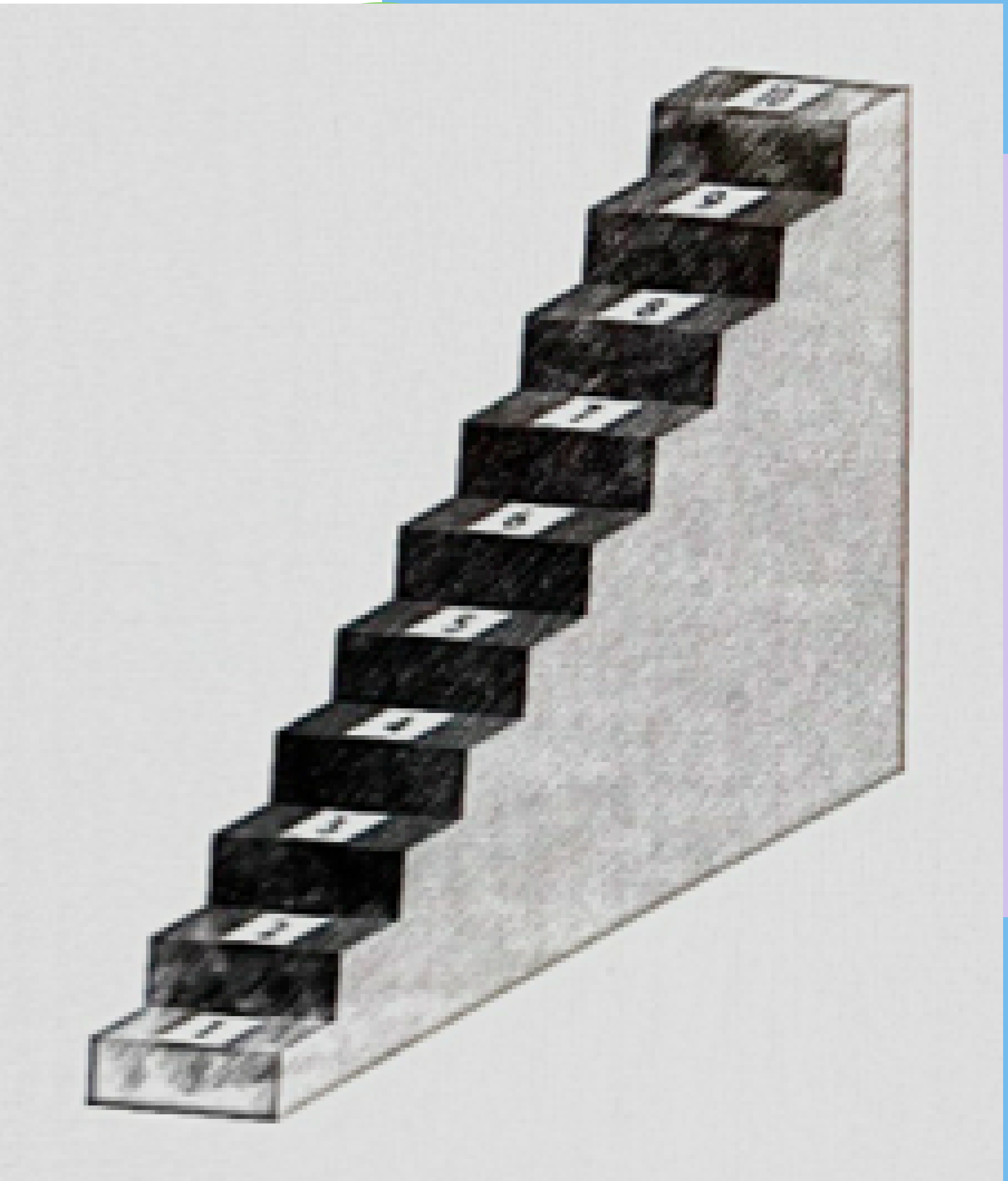
Linear Math Concept

This is reinforced when he begins counting steps.

Counting equal items is better than counting on fingers.

Linear Math Concept

Counting steps will begin to reinforce the concept that 1 is the same distance or space from 2 as 8 is from 9.



Adding & Subtracting

COUNTING STEPS

Place labels 1 through 10 on a set of steps.
Student stands on step 5.
Ask, "How many steps to 6? 8? 3? etc."

Adding & Subtracting

COUNTING STEPS

Looking for Automaticity.

When no hesitation or counting is needed to know how far each number is from the others, 1-10.

Adding & Subtracting

COUNTING STEPS

1: Number ten steps in your house 1 through 10.

2: Have the student walk forward and backward up and down the steps counting and looking at each number as he goes.

Adding & Subtracting

3: The student stands on step number 5. Ask, "How many steps do you need to take to reach step number 8?" Ask him to figure it out by counting the number of steps as he moves from 5 to 8. Repeat this by moving forward and backward between all of the numbers.

Adding & Subtracting

COUNTING STEPS

4: Ask the same question but have him figure it out in his head first, then check himself as he moves and counts between steps.

Adding & Subtracting

5: Have him imagine the steps in his head. Have him see himself on Step 5. Call out any number 1 - 10 and he should respond with the number of steps to get to that number, without counting.

When he can give an immediate response to any number 1 - 10, ask him to then move to step 4 and repeat.

Adding & Subtracting

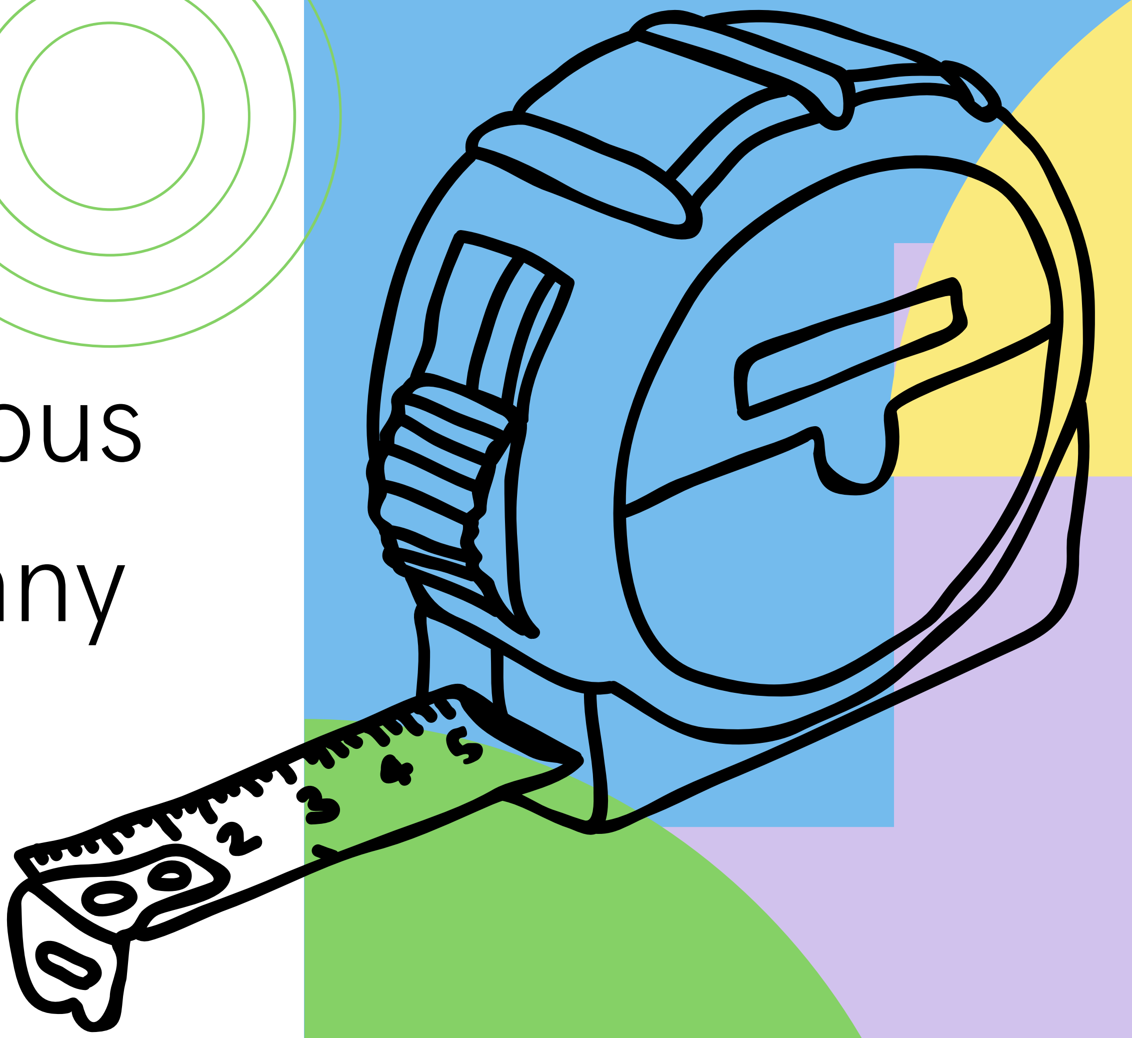
This activity is complete when he can imagine any number and know instantaneously how far that number is from the one of which he is thinking.

This activity can be performed in the car when commuting to the student’s various activities, saving time and helping the student complete math assignments more quickly.

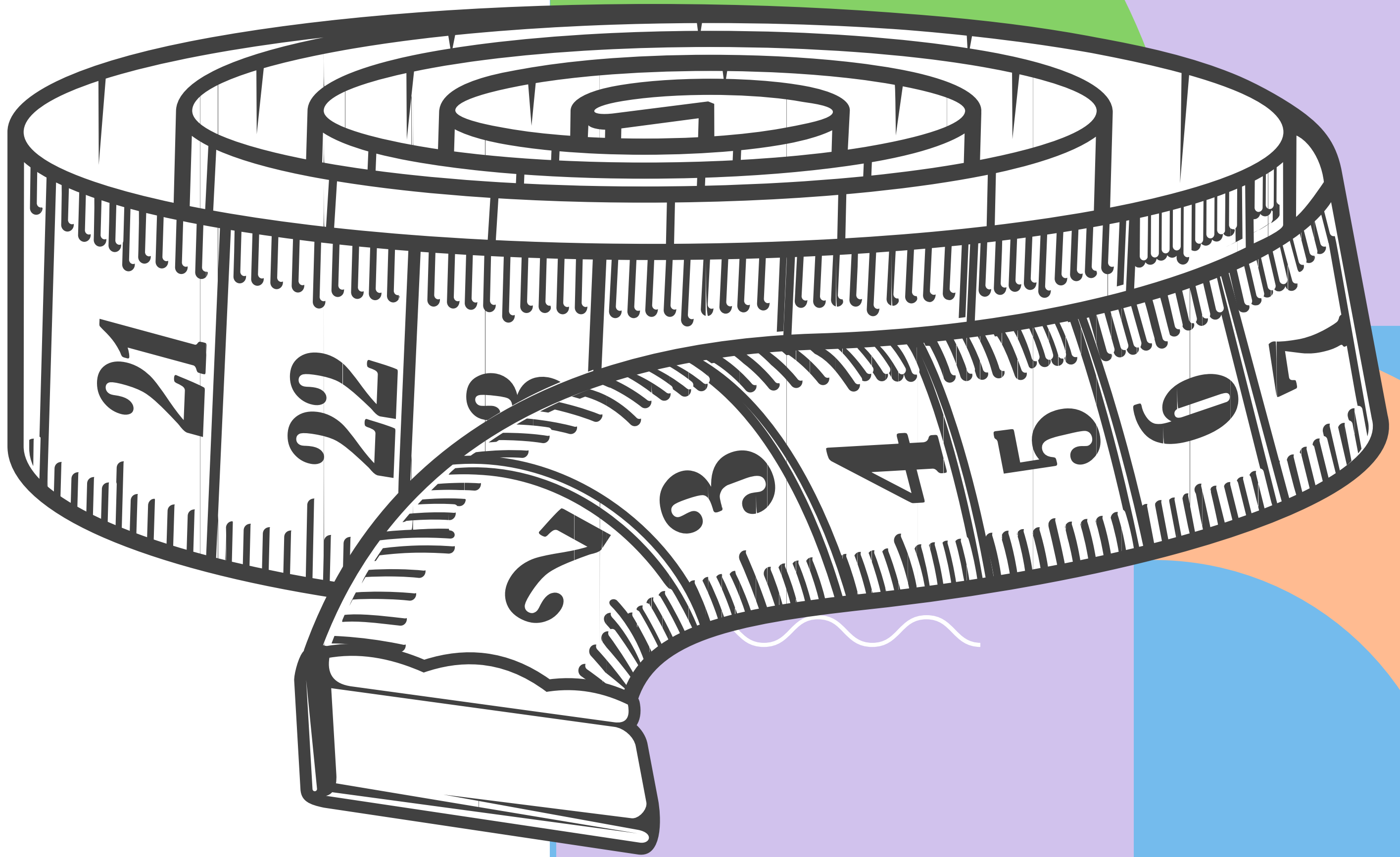
Adding & Subtracting

MEASURING THINGS

Step 1: Cut several pieces of string into various lengths. Have your student estimate how many inches each string is.



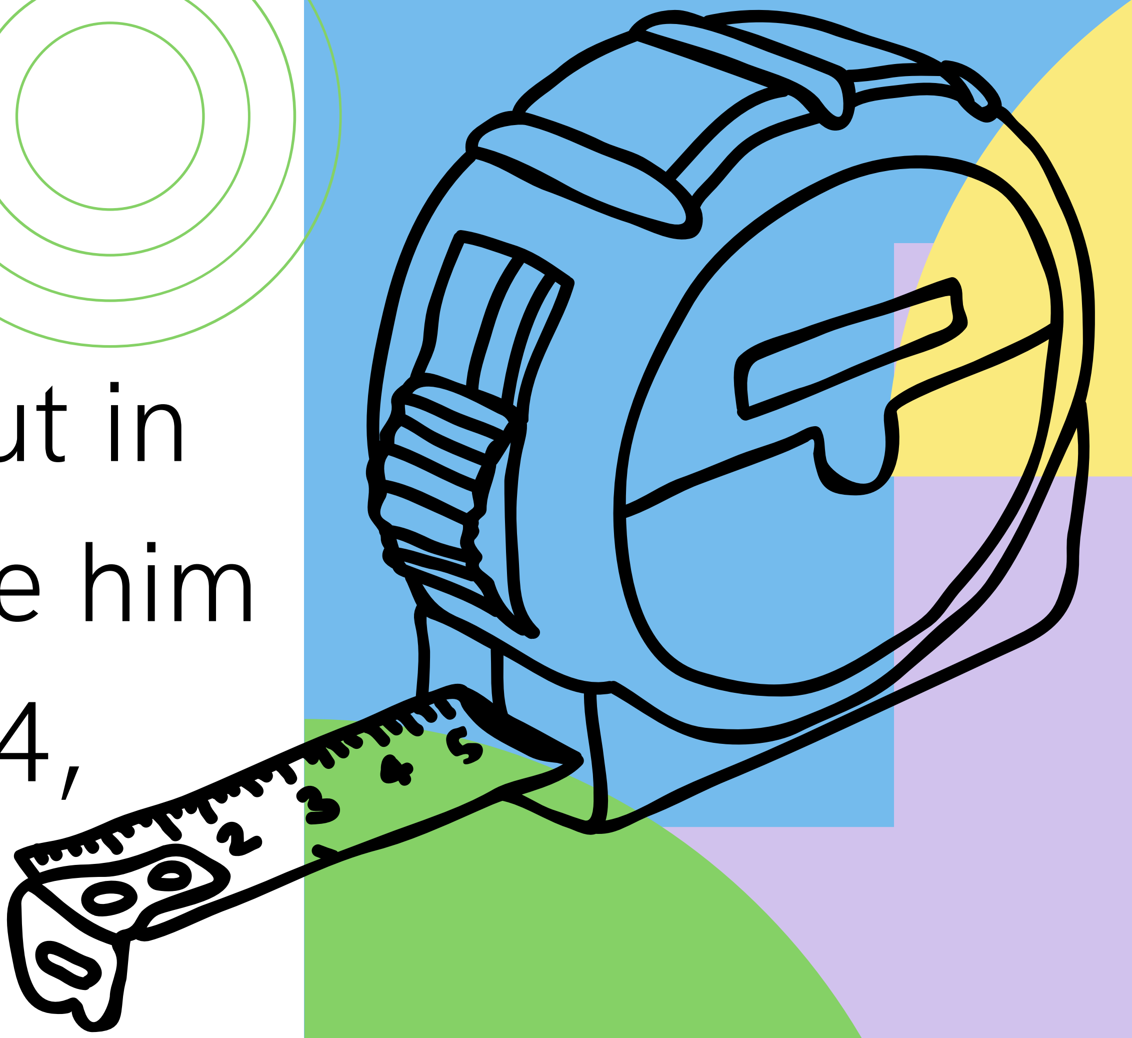
Step 2: Measure the strings with a measuring tape and see how closely the student estimated the string length Repeat and see if the estimation skill improves.



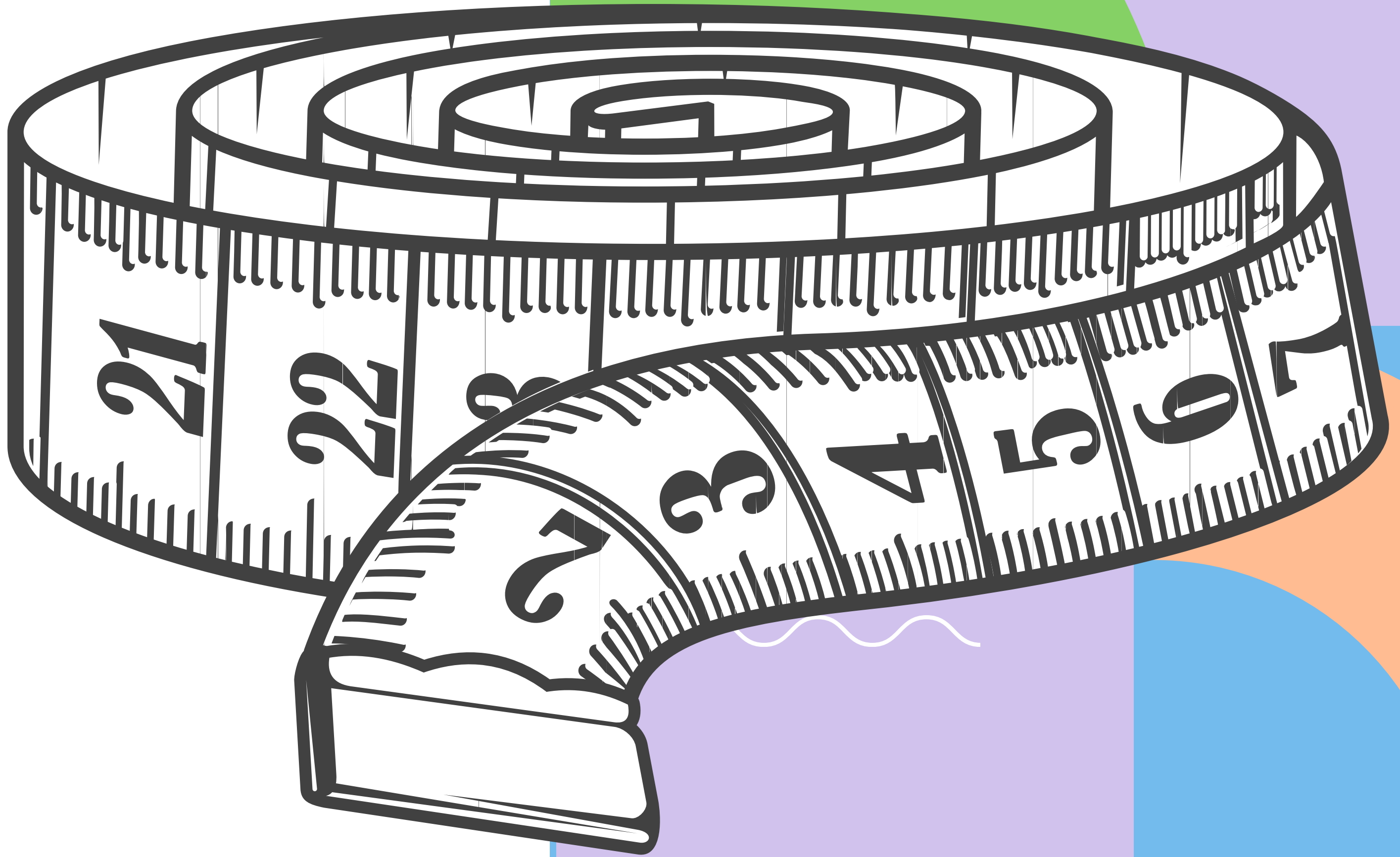
Adding & Subtracting

MEASURING THINGS

Step 3: Ask how long each string will be if cut in half. After he answers, cut it in half and have him measure it to confirm. Repeat using 1/3, 1/4, etc.

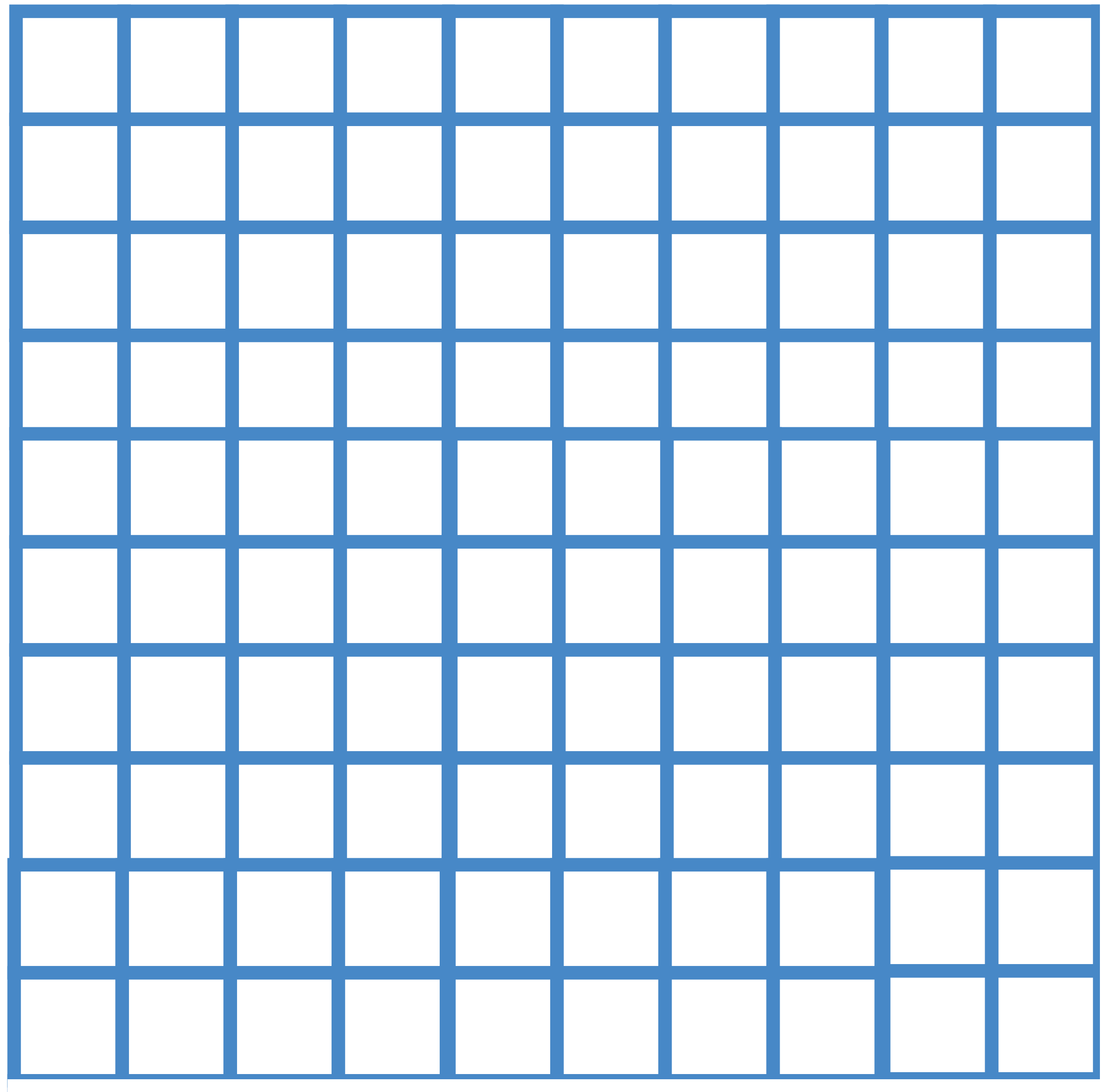


Step 4: Ask what size the door is. Have him measure the door's height and width. Relate it to the area of the door. Measure the student's room and calculate how much carpet it would take to cover the floor.



Adding & Subtracting

100 SQUARES



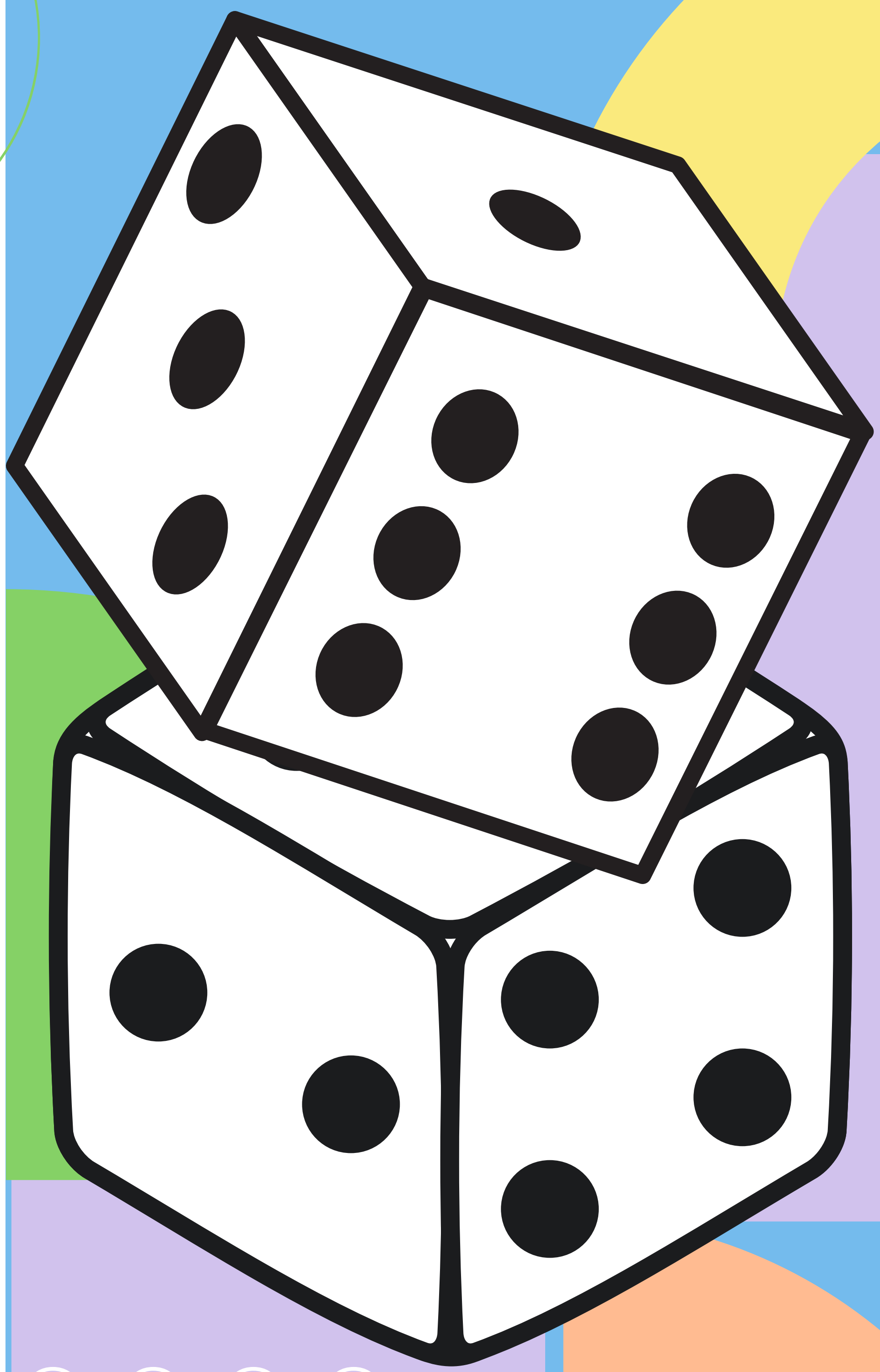
Adding & Subtracting

DICE GAME

Step 1: Throw one die on the table.

Step 2: Call out the number of dots seen. Repeat by throwing the other die and having the student call out the correct number of dots that shows up. Continue until the student does not need to count the dots, but can answer with the correct response without hesitation. Once this has occurred, the student has developed automaticity in recognizing one through six.

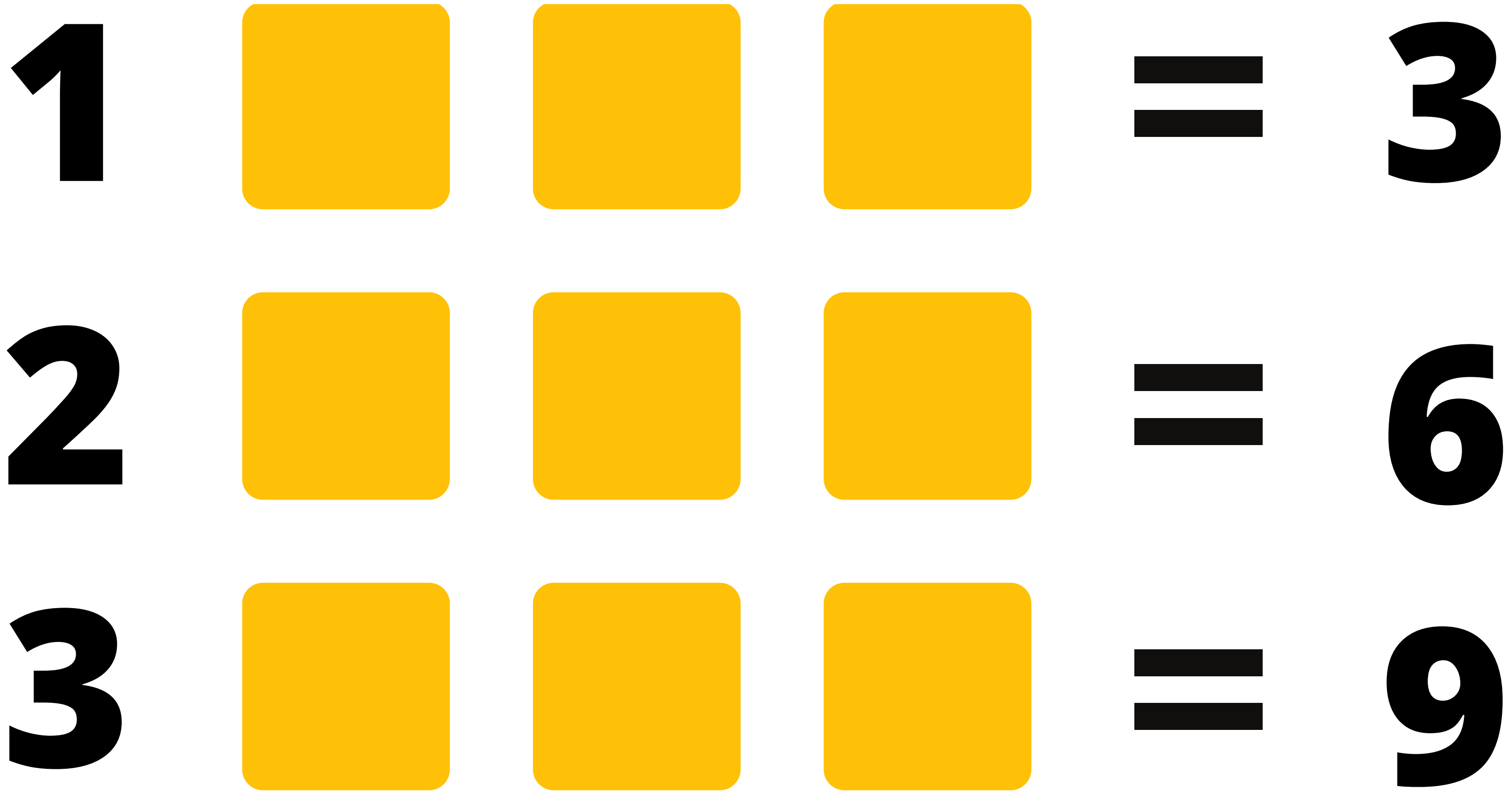
Step 3: Repeat Steps 1 and 2, but use both dice. After this is accomplished, the student has developed automaticity of number recognition from 1 through 12.



Multiplying & Dividing

Just adding sets of items.

3 BLOCKS EACH ROW

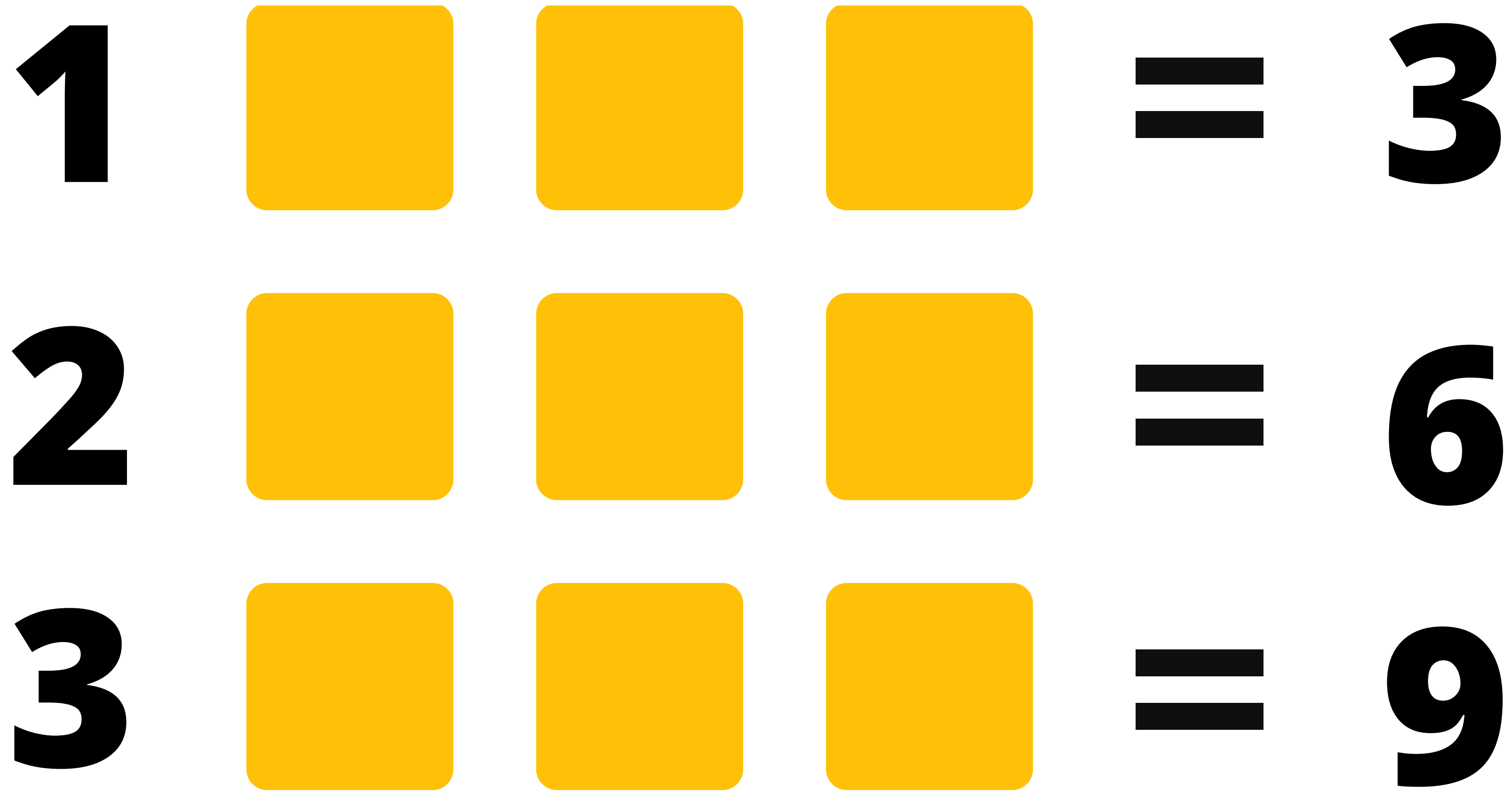


How many are in the first row?

How many are in the first and second rows?

Goal: Understand that you add the same number for each set in the group.

3 BLOCKS EACH ROW



If there are 9 blocks, how many sets of 3 are there? This is division.

$$9 \div 3 = 3$$

3 BLOCKS EACH ROW

1 = 3

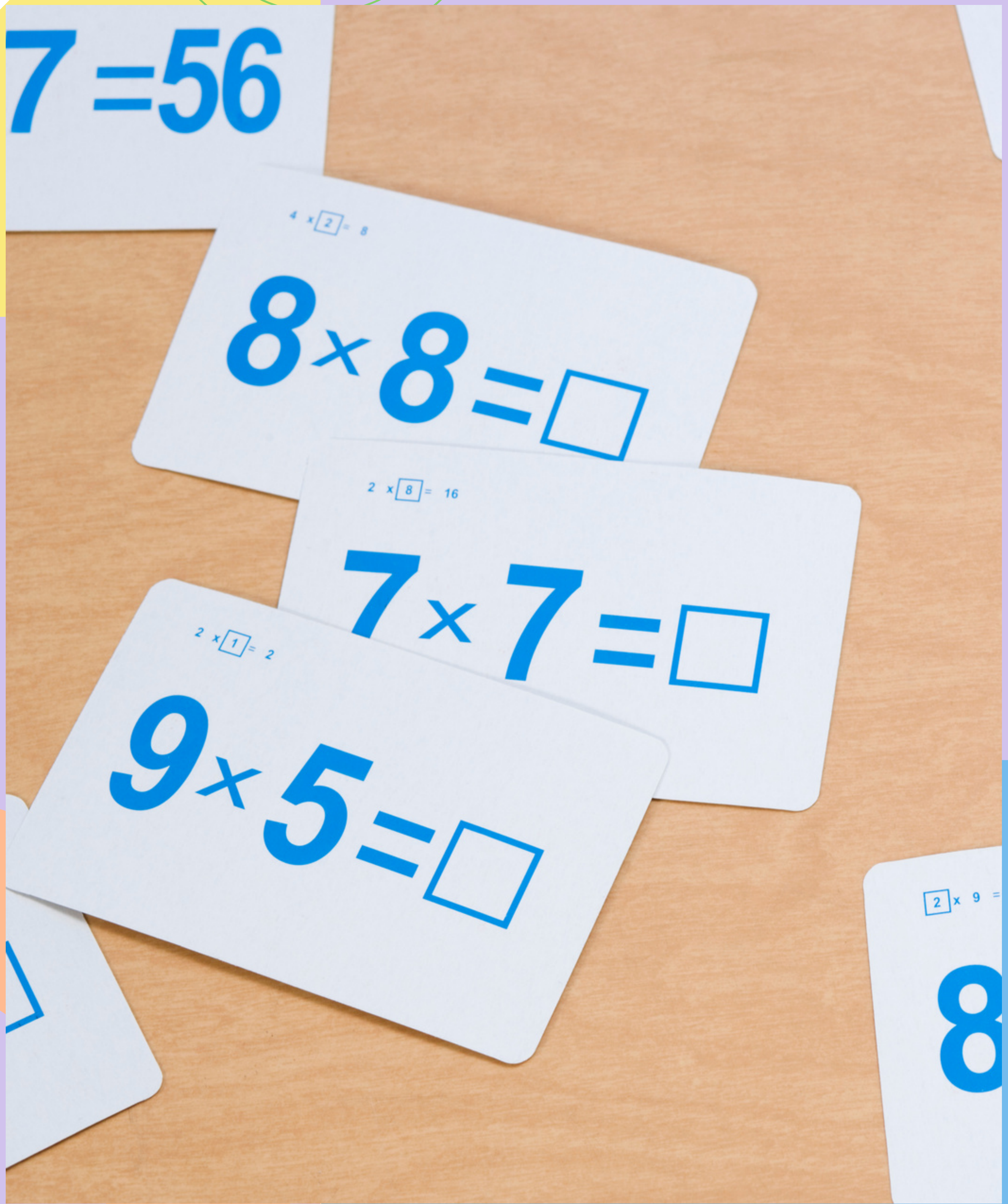
2 = 6

3 = 9

Multiplying & Dividing

NO MORE FLASH CARDS!

Learning math facts can be fun if incorporated into an enjoyable activity involving movement and vision.



Multiplying & Dividing

BODY MOVEMENT AND MULTIPLICATION

COUNT BY SETS

Count forward and backward: 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, and 24 while doing a rhythmic activity (such as bouncing a ball, hopping or marching).

Go through all twelve sets.

When easy add a metronome.

Multiplying & Dividing

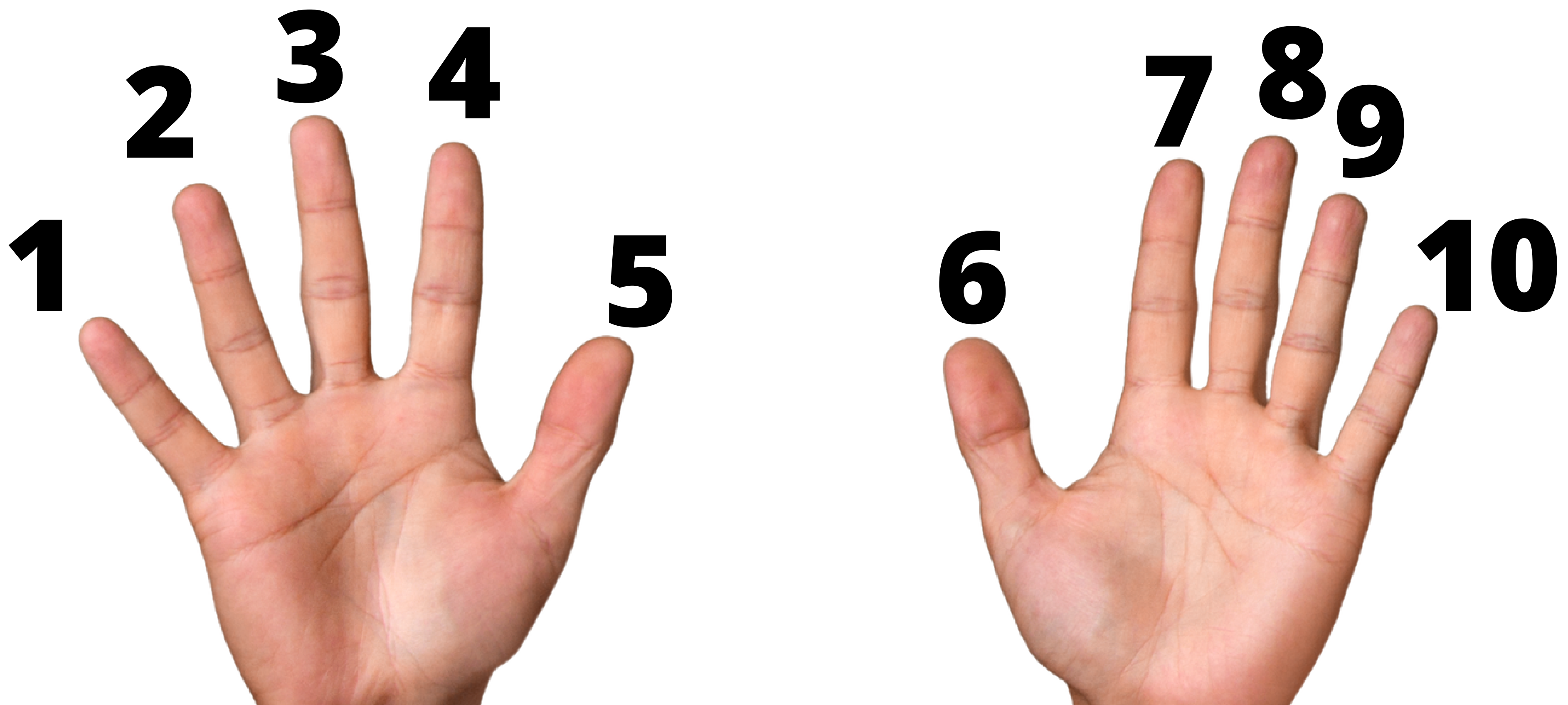
BODY MOVEMENT AND MULTIPLICATION COUNT BY SETS

Note: Once the twos are automatic, move to fives, then tens. These sets are first because they are the easiest. Next, move to threes, fours, sixes, sevens, eights, and nines.

Multiplying & Dividing

DR. M'S MULTIPLICATION TECHNIQUE

Step 1: Hold up ten fingers, palms facing student. Explain to the student that each finger will represent the number of the set.

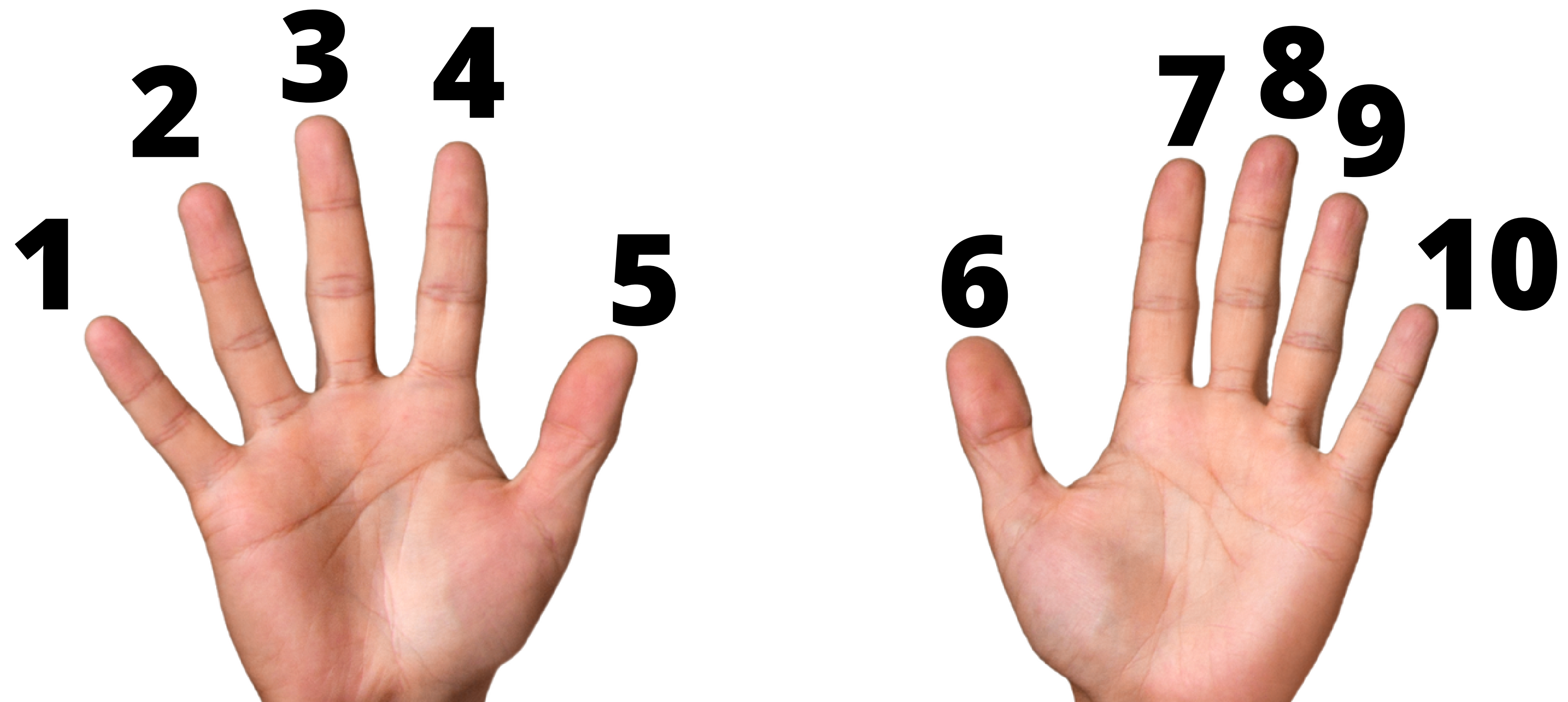


Multiplying & Dividing

DR. M'S MULTIPLICATION TECHNIQUE

Step 2: Count by "2s" beginning on finger 1.

Remembering the sets of "2s", when a random finger is wiggled give the answer that matches the set represented.

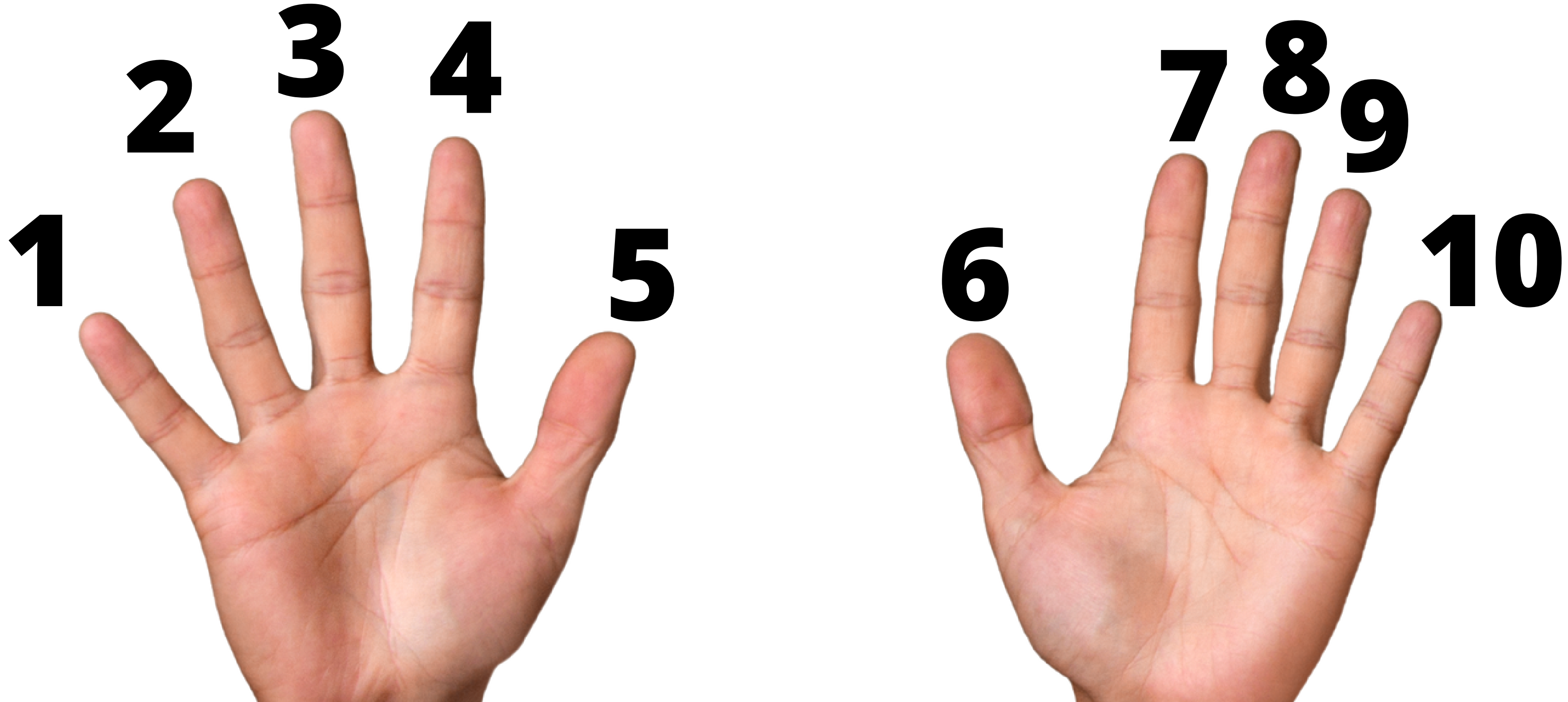


Multiplying & Dividing

DR. M'S MULTIPLICATION TECHNIQUE

If the answer is wrong, go to the finger they know and move toward the one not known, counting by 2s. Then go back and forth between 2 fingers until both are automatic.

Step 3: Repeat Steps 1-2 with 5s and 10s, then do all the other numbers.



Multiplying & Dividing

DR. M'S MULTIPLICATION TECHNIQUE

Step 4: After all 10 sets are learned, remove hands, start with multiples of 2s.

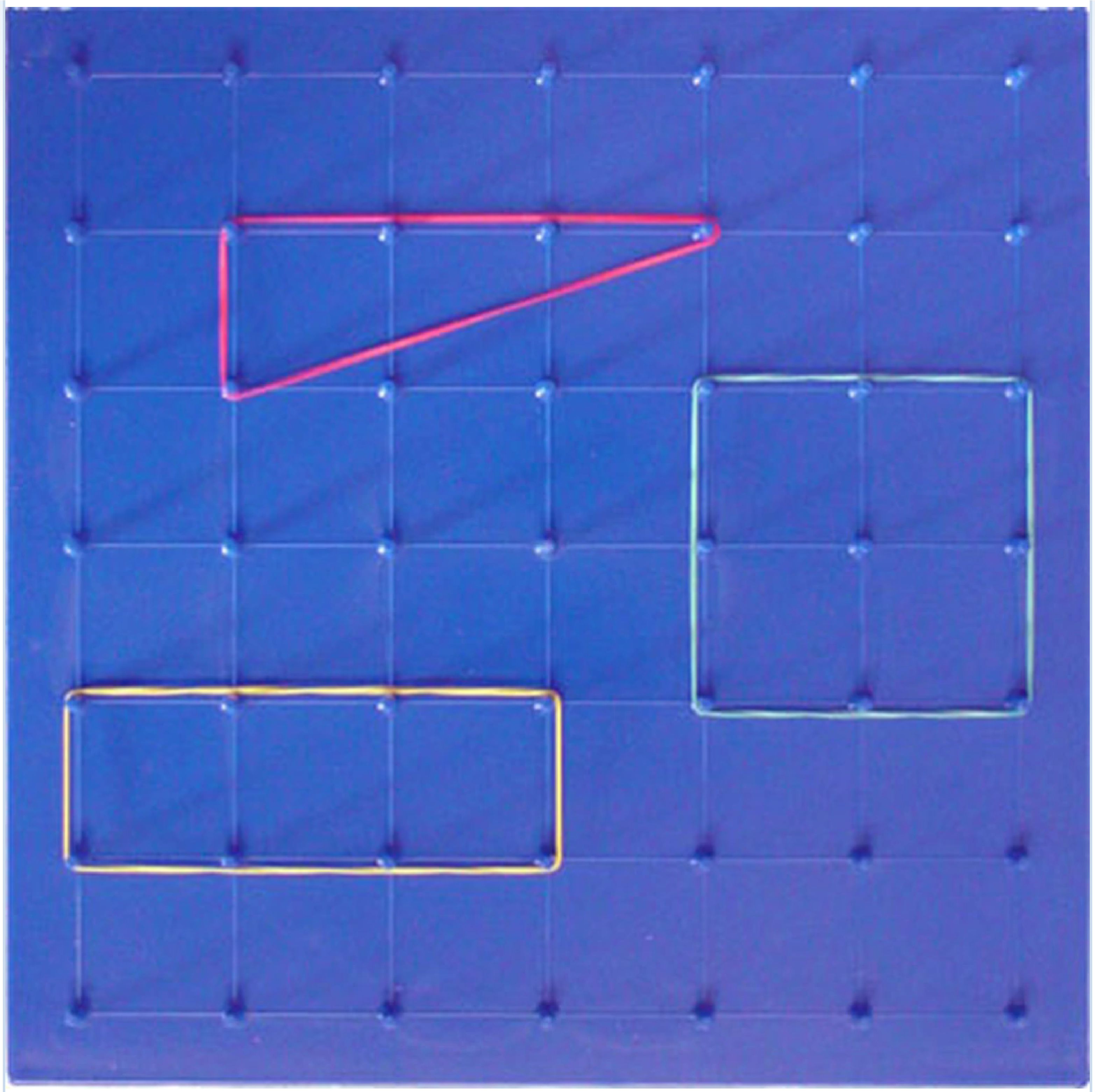
Call out a number and the student repeats the answer for that set from memory.

This is a good activity for car commutes.

Learning multiplication using the above technique will save your student time when it comes to solving algebraic and geometric problems in the future.

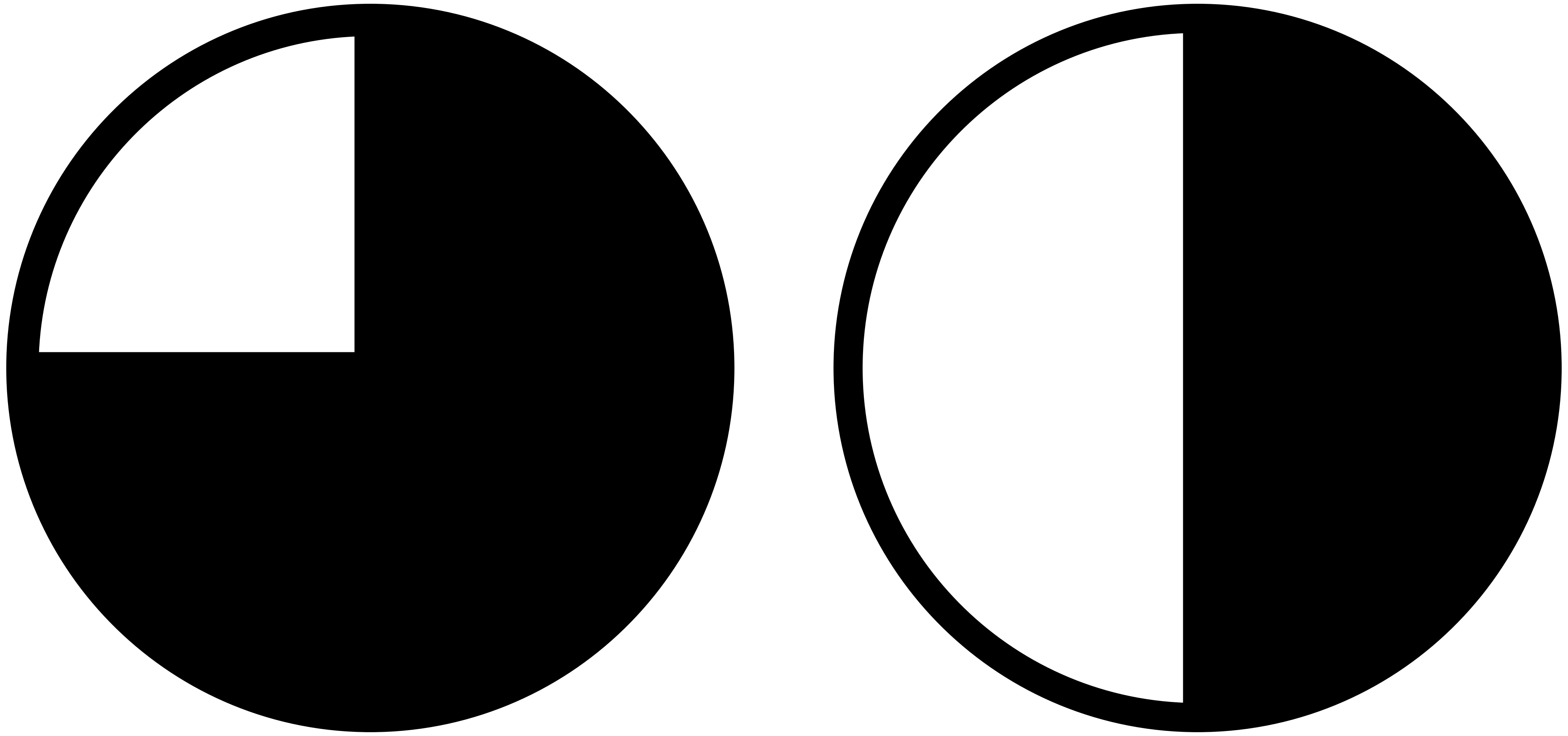
Multiplying & Dividing

GEOMETRY BOARD GAME



Fractions

Which is bigger, 1/2 or 1/4?

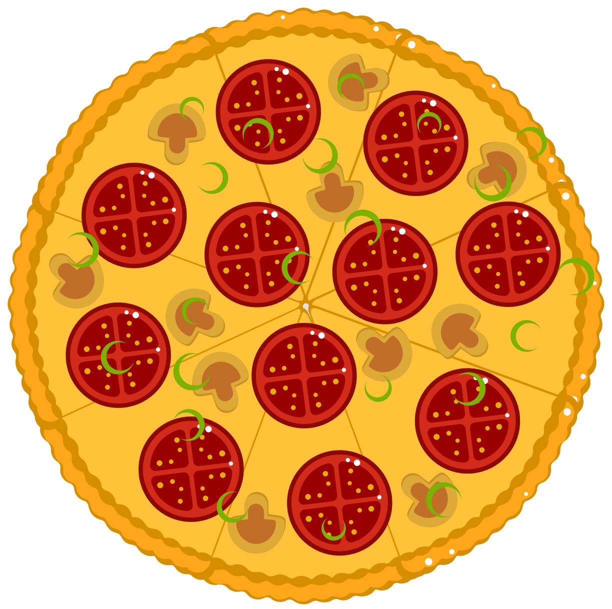


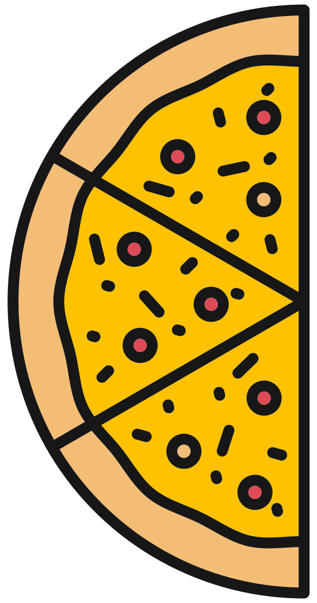
Fractions

When the student believes 1/4 is larger,
he knows the number 4 is larger than 2 so therefore 1/4 is larger. He does not see the visual representation of fractions.

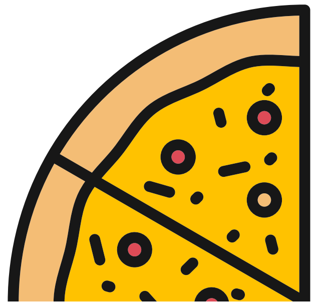
Fractions

When do you get a larger piece of pizza? When you share it with 1 friend or when you share it with 3 friends?





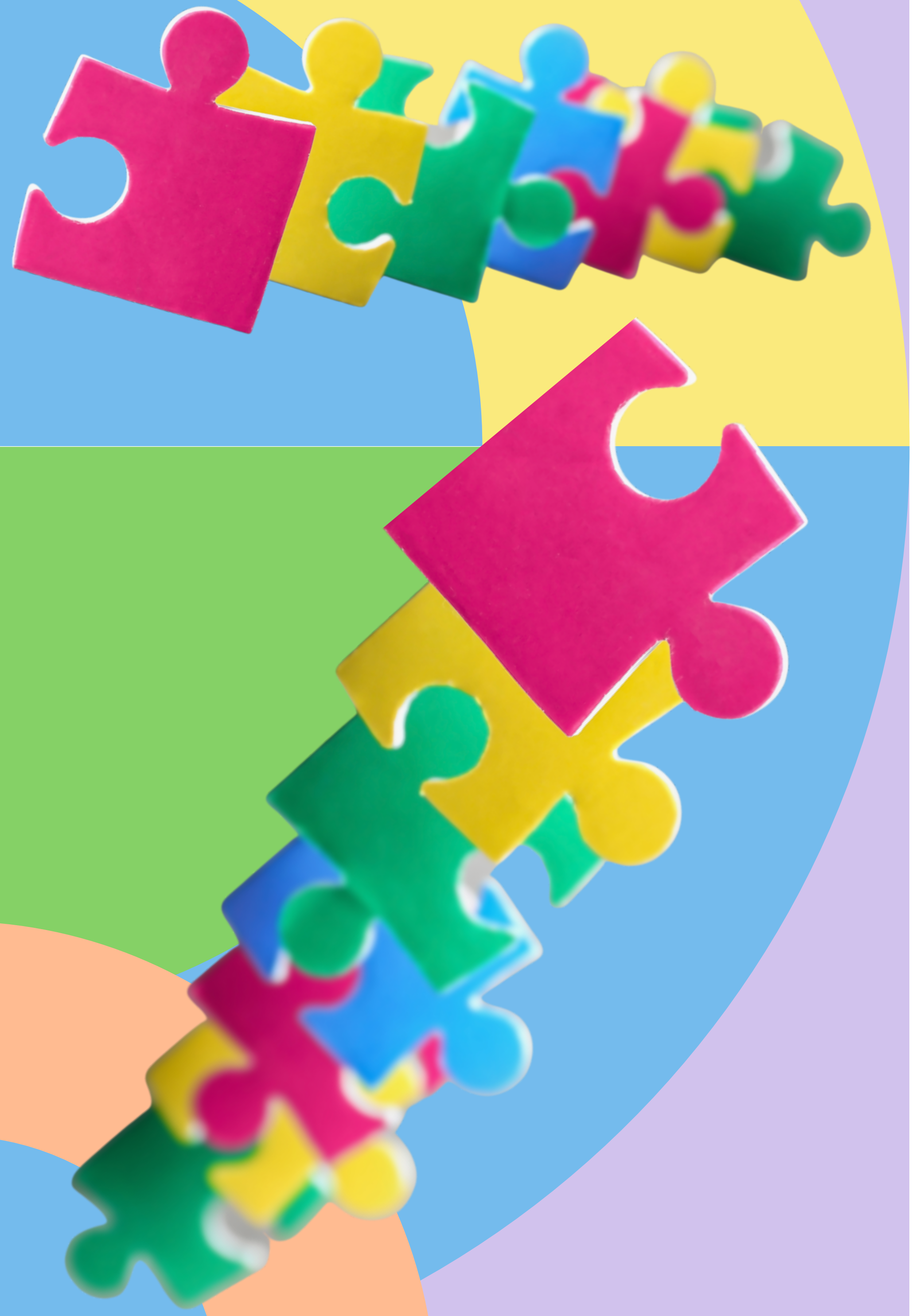
SHARE WITH 1 FRIEND



SHARE WITH 3 FRIENDS

Activities That Develop Math Skills

PUZZLES



Activities That Develop Math Skills

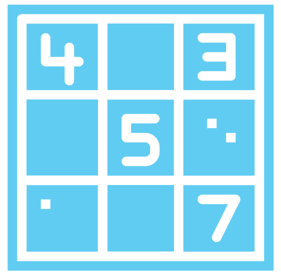
PARQUETRY BLOCKS

Activities That Develop Math Skills

ATTRIBUTE BLOCKS

More Activities That Develop Math Skills

Math Stars



Sudoku

Tangoes

Yahtzee

Chess

Thanks for being here!

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