

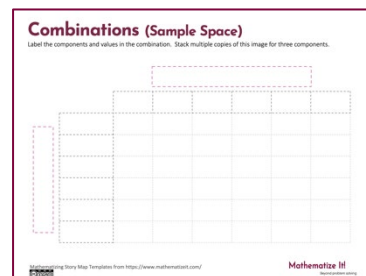
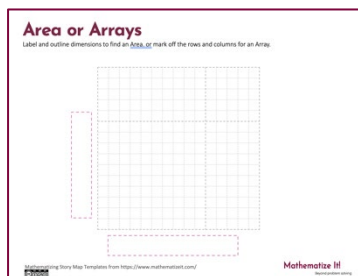
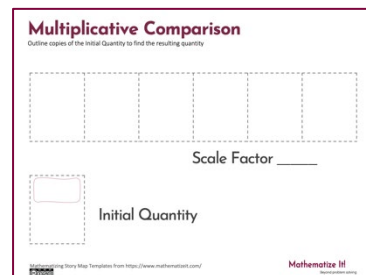
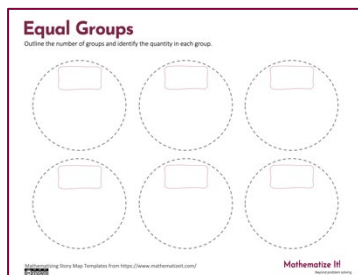
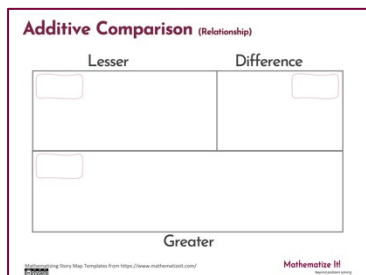
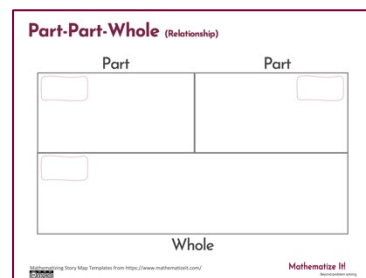
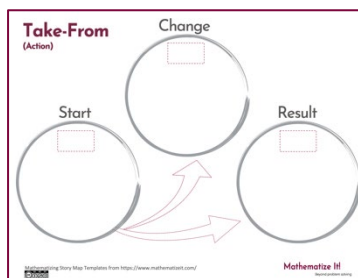
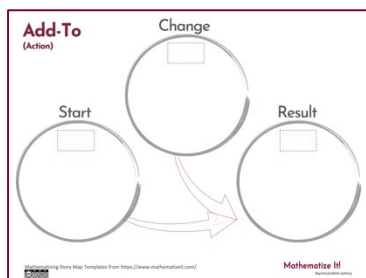
#24 Priya Prepares a Pizza Puzzle

Combinatorics Both Factors Unknown



Making sense of word problems with mathematical comprehension & operation sense.

Mathematizing Story Maps



Mathematize It!

Beyond problem solving

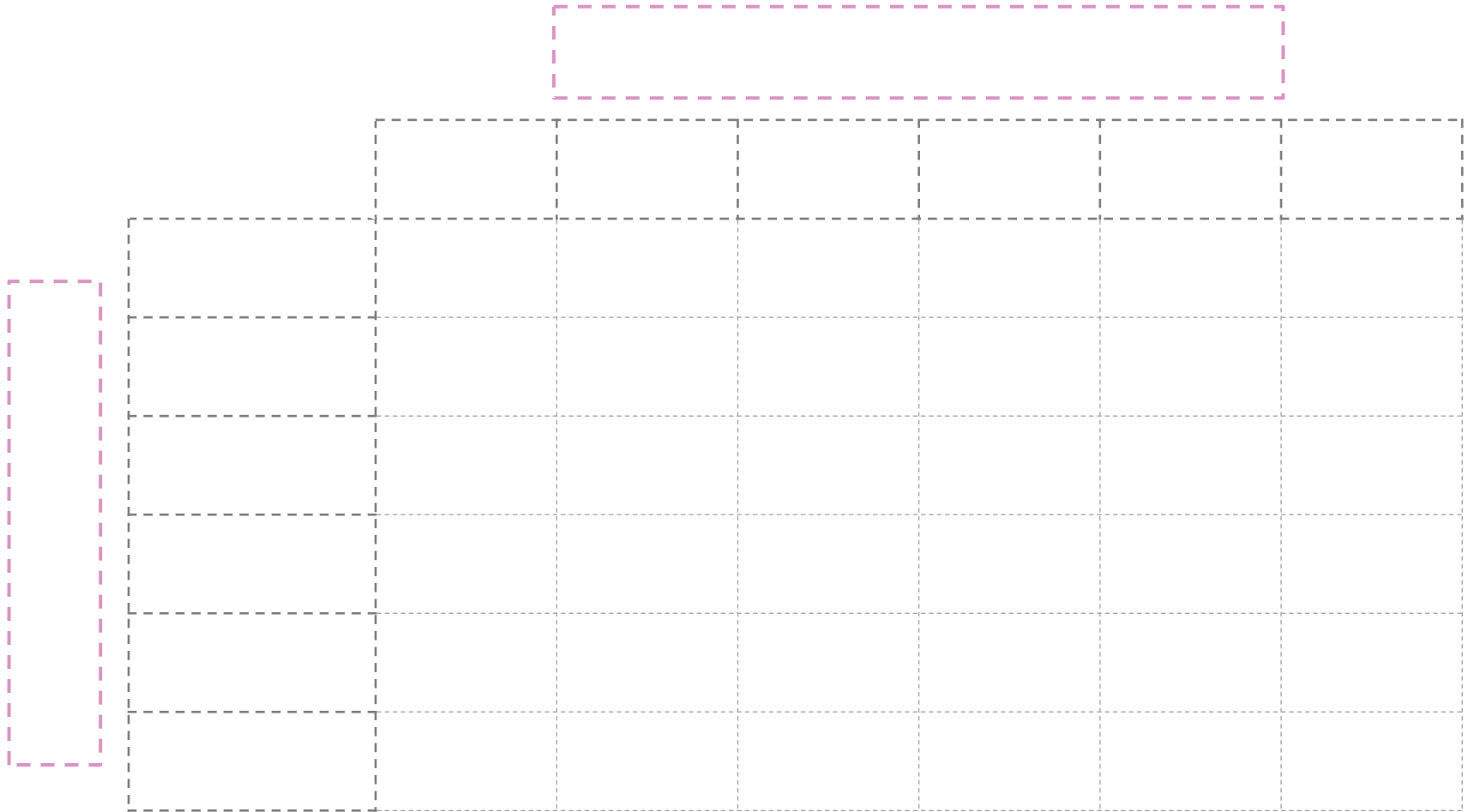


Sara Delano Moore and Kimberly Morrow-Leong

Mathematizing Story Map Templates from <https://www.mathematizeit.com/>

Combinations (Sample Space)

Label the components and values in the combination. Stack multiple copies of this image for three components.



... Mathematizing Story Maps ...

How do your students approach word problems?

Key words don't always help. What are we supposed to underline in **CUBES** anyway?

Sometimes it feels like students just pick an operation and they don't know why!

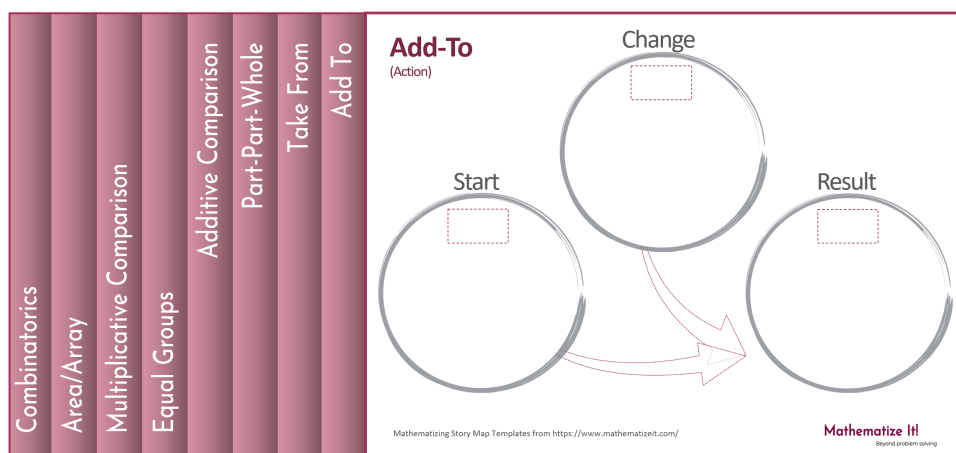
These strategies don't prepare students to formulate and solve **problems that matter** to them.

...
Prepare students to DO math!
...

Teacher Background

Mathematizing Story Maps encourage students to **model** with mathematics and find the math in their everyday lives. Opening stories are written to engage students first in thinking about the **story** and then about the mathematics.

Mathematizing Story Maps help students understand what the four familiar operations (+ - × ÷) can do. The more students know about how we use subtraction or when we use division, the more skills they will have to match a strategy to a problem.



Mathematizing Story Maps by Sara Delano Moore & Kimberly Morrow-Leong

Find more at [mathematizeit.com](https://www.mathematizeit.com)



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Beyond problem solving

How to teach the Mathematizing Story Maps

1. **Read the story**
 - a. Think about how your students might respond. What's familiar? What's not?
 - b. What mathematics is seen in the story? How might students **represent their thinking**?
2. **Choose tools you have and that students know.**
 - a. What **manipulatives** might your students use to represent the mathematics in the story? Consider counters, base ten materials, fraction tools, or more!
 - b. What **visual representations** might your students know (ten frames, number tracks, number lines, grid paper, etc.)
3. **Choose a Mathematizing Story Map**

We share a mathematizing story map for each of 8 categories of problem situations.



Mathematizing Story Maps help students act out or represent what is happening in a problem and make sense of it.



What will students do?

Most word problems (story problems) students encounter support their calculation skills. We need to build their understanding of **how to use math** to solve real problems.

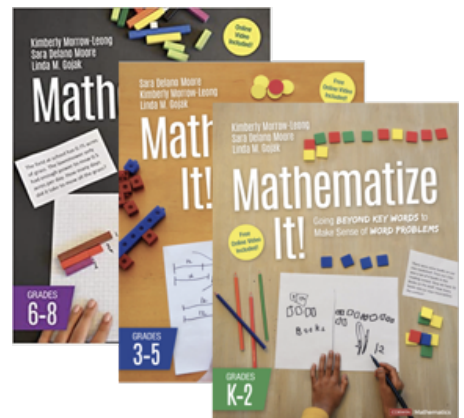
- Find the story behind every mathematical problem situation
- Use one of 8 Mathematizing Story Maps to act it out or show
- Represent the story and choose an operation (+ – × ÷) that matches the story.
- **Resist answer-getting.** We pay attention to the process of solving problems

What's included?

Each mathematizing story map lesson includes:

- Teaching notes on 8 categories of problem situations.
- Teaching notes for the Mathematizing Story Maps
- A set of questions to pose that focus students on the mathematizing story.

To read more about problem situations and the four operations, check out the [Mathematize It!](#) book series.



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Teacher Notes

Mathematizing Story Maps

Priya Prepares a Pizza Puzzle



Problem Type

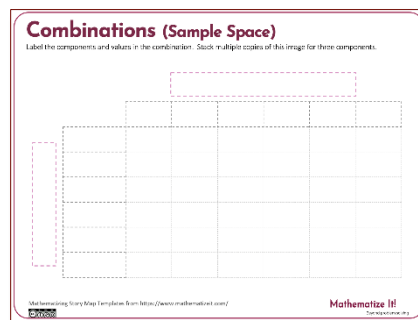
This story supports developing mathematical ideas around the Combinatorics job of multiplication. These problem situations represent finding the total number of possible outcomes given a specific set of inputs. For example, tops and pants combine to create outfits. In this situation, each factor does the same job of representing one component of each possible outcome, also known as the Sample Space.

Missing Element

In this story, the factors are unknown. Students know the total number of possible outcomes. They must identify two or more possible missing factors and the number of values each has.

The Mathematizing Story Map

The Mathematical Story Map provided supports the Combinatorics job of multiplication by showing the possible combinations of two components. Story maps can be stacked to represent three components.



Multiplication & Division Problem Situations				
Asymmetric Situations	Equal Groups (Ratio/Rate)	Product Unknown	Number of Groups (Multiplier) Unknown	Group Size (Measure) Unknown
	Multiplicative Comparison	Resulting Value Unknown	Scale Factor Unknown	Original Value Unknown
Symmetric Situations	Area/Array	Product Unknown	One-Dimension Unknown	Both Dimensions Unknown
	Combinatorics	Sample Space (Total Outcomes) Unknown	One Factor Unknown	Both Factors Unknown

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Mathematize It!

Beyond problem solving

Day 1

Read the story at least once with your class. Talk about the story and support your students as they make sense of the events in the story as you would for any narrative.

Then encourage students to find the mathematics in the story with questions like these:

- What items are being combined in this situation? (e.g., tops/pants or meat/cheese)
- What does each possible combination represent? (e.g., an outfit or a sandwich)
- How can you organize to find all the possible combinations?

If students start calculating numbers right away, particularly if they are “number-plucking” or randomly doing calculations, refocus their attention on the relationship in the story.

Encourage students to use manipulatives as they work on the Mathematizing Story Map to show the relationship that is in the story. Label the quantities and their units. Before ending for the day, give students the opportunity to record their thinking on paper.

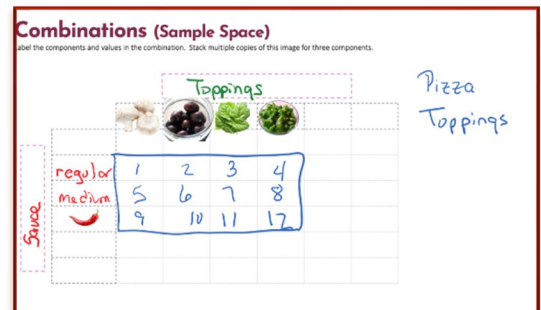
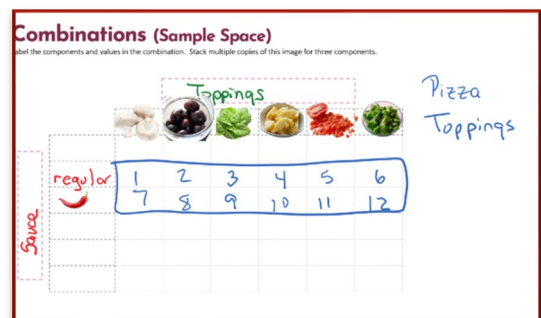
Encourage students to use manipulatives and visuals to show their thinking about the math in the story. Students should translate their work from manipulatives and sketches to the mathematical story map.

Day 2

Reread the story and use the Mathematizing Story Map to retell it and act it out. Ask your students to translate their actions on the Mathematizing Story Map into an equation. Each student should be able to connect the elements of the story map to the narrative. Discuss the **quantities** in the story and what strategies students might use to find an answer to the question they have asked. Ask students to consider other mathematical stories (or variations on the current story) they can see in this narrative.

You may wish to use the [Three Reads Strategy](#) (p.15) to support student understanding of the text itself.

To focus on the story, create a [numberless word problem](#). Remove the numbers from the story as the class discusses it.



Day 3

Use the mathematizing story map to support solving the word problems provided. Take time for reading comprehension (does the story make sense?) before mathematical comprehension (what is happening in the story?) These questions can help students develop mathematical comprehension.

- *What items are being combined in this situation? (e.g., tops/pants or meat/cheese)*
- *What does each possible combination represent? (e.g., an outfit or a sandwich)*
- *How can you organize to find all the possible combinations?*

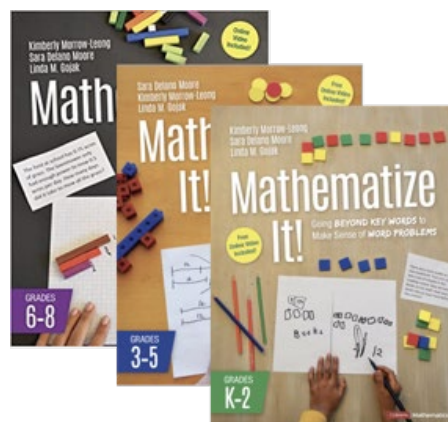
Encourage your students to use manipulatives and visuals to show their thinking about the math happening in each problem. Students should translate their work from manipulatives and sketches to the mathematical story map.

Days 4-5

Choose one or more of these options to continue developing student thinking.

- Continue working on the problems provided, focusing on the story map as a tool to develop mathematical comprehension and operation sense.
- Lead a discussion among students focusing on how the story map fits the narrative and problems provided. Use these questions to focus thinking on the job Combinatorics is doing in these situations:
 - *What are the components (factors) limiting the combinations to be made?*
 - *How do the factors combine to make each specific item?*
 - *How can you be sure you have all the possible combinations?*
 - *What number sentence(s) can you write to show these relationships?*
- Ask students to develop new narratives or problems, either from scratch or as extensions of the current storyline, which can also be told using the same mathematical story map. Encourage students to explain the underlying connections which make the mathematics similar even if the story contexts are not the same.

To read more about problem situations and the four operations, check out the [Mathematize It!](#) book series.



Mathematizing Story Maps by Sara Delano Moore & Kimberly Morrow-Leong

Find more at mathematizeit.com



Mathematize It!

Beyond problem solving

Priya Prepares a Pizza Puzzle Practice Problems

Use objects, pictures, numbers, and words to describe what is happening in each problem. Use a mathematizing story map to record your thinking.

The class won a pizza party and they want to have enough choices that every student can have a different pizza. Each pizza includes a crust, cheese, and one topping. How many choices do they need to have so that there are at least 100 possible pizza combinations?

The middle school basketball team plays 12 games in the season. They want to wear a different uniform (shirt and shorts) for each game. How many different shirts and shorts do they need to have in order to make this happen?

The friends are making diya (lamps) to celebrate Diwali. They would like to make at least 27 different combinations of designs and shapes to sell at the art festival. They have lots of different molds to shape the lamps and many colors of glaze to use. How many different molds and glaze colors do you suggest the friends choose to meet their goal?

Combinatorics Situations, Both Factors Unknown

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Mathematize It!

Beyond problem solving

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Combinations (Sample Space)
Label the components and values in the combination. Stack multiple copies of this image for three components.

12 pizzas before toppings
4 toppings \Rightarrow 48 pizzas
9 toppings

The middle school basketball team plays 12 games in the season. They want to wear a different uniform (shirt and shorts) for each game. How many different shirts and shorts do they need to have in order to make this happen?

Combinations (Sample Space)
Label the components and values in the combination. Stack multiple copies of this image for three components.

2 shorts & 3 shirts \Rightarrow 6 games
4 shirts & 3 shorts \Rightarrow 12 games

The friends are making diya (lamps) to celebrate Diwali. They would like to make at least 27 different combinations of designs and shapes to sell at the art festival. They have lots of different molds to shape the lamps and many colors of glaze to use. How many different molds and glaze colors do you suggest the friends choose to meet their goal?

Combinations (Sample Space)
Label the components and values in the combination. Stack multiple copies of this image for three components.

Molds: 0, 1, 2, 3, 4
7 glazes \Rightarrow 28 designs

Combinatorics Situations, Both Factors Unknown