

Title: Summer Vacation Combinations

Brief Overview:

Students will explore the concept of making combinations. They will develop their understanding of combinations by utilizing the following four strategies; creating a list, a drawing, a table, or a tree diagram. Throughout the lessons, students will incorporate personal information in order to construct their combinations using the four different strategies. Finally, students will demonstrate their understanding of the strategies by completing the summative assessment.

NCTM Content Standard/National Science Education Standard:

Data Analysis and Probability
Select and use appropriate statistical methods to analyze data

Grade/Level: 4-5

Duration/Length:

3-4 days for 50-60 minutes daily

Student Outcomes:

Students will:

- Identify the possible combinations of a scenario by making a list, creating a drawing, and composing a number sentence. (Lesson 1)
- Identify the possible combinations of a scenario by creating a table and composing a number sentence. (Lesson 2)
- Identify the possible combinations of a scenario by creating a tree diagram and composing a number sentence. (Lesson 3)

Materials and Resources:

Lesson 1

- Overhead transparency of Summer Vacation Combinations (Teacher Resource Sheet 1)
- Cathy Combo's Packing Problem (Student Resource Sheet 1) (1 per student)
- Cathy Combo's Packing Problem (Teacher Resource Sheet 2)
- Pack Your Suitcase (Student Resource Sheet 2) (1 per student)
- Construction paper for reteaching exercises

Lesson 2

- Overhead transparency of Lunch Tables (Student Resource Sheet 3)

- Lunch Tables (Student Resource Sheet 3) (1 per student)
- Overhead transparency of Cruising Casey (Student Resource Sheet 4)
- Cruising Casey (Student Resource Sheet 4) (1 per student)
- Your Dream Car (Student Resource Sheet 5) (1 per student)
- Graph paper for reteaching exercises

Lesson 3

- Overhead transparency of Catie’s Ice Cream Creation (Student Resource Sheet 6)
- Catie’s Ice Cream Creation (Student Resource Sheet 6) (1 per student)
- Sundae Surprise (Student Resource Sheet 7) (1 per student)
- Base ten blocks for reteaching exercises

Advanced Preparation for the reteaching in Lesson 1:

Since students may need another visual to reinforce the concept of the list or drawing strategies, cut-outs will need to be made. Use colored construction paper to make shirts and shorts. These manipulatives will be used in order to provide a hands-on visual for students in a small group.

Development/Procedures:

Lesson 1

Pre-Assessment –

- Write the following journal prompt on the chalkboard or overhead projector:

Today’s school lunch choices were _____ , _____ , and _____ . You can also choose milk, chocolate milk, or juice. Make a list of all of the possible combinations you could have for lunch today.

- Instruct students to write their answers in their journals. Survey the students to observe their level of understanding by noting their number of combinations.
- Ask students to show on their hands how many possible combinations they have found after about 5 minutes. Use this informal inventory to provide a baseline for instruction.
- Record the possible combinations on the chalkboard and discuss.

<i>Choice 1 & Milk</i>	<i>Choice 1 & Chocolate Milk</i>	<i>Choice 1 & Juice</i>
<i>Choice 2 & Milk</i>	<i>Choice 2 & Chocolate Milk</i>	<i>Choice 2 & Juice</i>
<i>Choice 3 & Milk</i>	<i>Choice 3 & Chocolate Milk</i>	<i>Choice 3 & Juice</i>

Launch –

- Display a transparency of Teacher Resource Sheet 1 on the overhead projector and read as a class. Discuss the 3 different problems the family faces as they plan their vacation.
- Introduce the concept of combinations to the students to help solve the family's problems.
- Ask, "What base word do you see in the word combinations?" Lead a discussion about what it means to combine things.

Teacher Facilitation –

- Read the lesson 1 objective as a class.
- Ask, "Why is Cathy Combo's over packing a problem for the family?" Lead students into discussing various ways the family can solve the problem.
- Inform students that there are 4 different strategies to use when calculating combinations. Refer back to the pre-assessment on the chalkboard.
- Ask, "How did we determine the different lunch combinations?"
- Introduce the first strategy to determine multiple combinations by creating a **list**.
- Ask, "What are some other ways we could have determined the lunch combinations?"
- Model how to use a **drawing** to determine the different lunch combinations on the chalkboard or overhead projector.

Student Application –

- Distribute Student Resource Sheet 1. Read together as a class. Have students work in pairs to solve problem #1. Share and discuss answers. Have students work in pairs to complete problem #2. Share and discuss answers. (Teacher Resource Sheet 2)
- Ask students to brainstorm to solve problem #3 with their partner. Discuss ways to solve the problem.

For example: $3 + 3 + 3 = 9$ $3 \times 3 = 9$

- Guide students to use the multiplication sentence to determine the total number of combinations.

Embedded Assessment –

- Distribute Student Resource Sheet 2 in order to determine mastery of the list and drawing strategies. Have students work independently to demonstrate their understanding. (Answers will vary)

Reteaching –

- Observe students closely as they are completing the assessment. If students do not understand the concept, work with them in a small group while other students work independently. Use pre-made cutouts of clothes to provide a visual and further reinforce the concept.

Extension –

- Students who understand the concept can further demonstrate their understanding by adding another variable to the problem.

For example: You will also have a choice of wearing 2 different pairs of shoes.
Create a list, drawing, and number sentence to create your new combinations.

- Write the extension on the chalkboard. Once students have completed their assessments, they will complete the enrichment activity on the back of their worksheets.

Lesson 2

Pre-Assessment –

- Distribute Student Resource Sheet 3. After filling in today’s lunches in the prompt, instruct students to fill in today’s lunch choices in the appropriate boxes in the table. Model this on an overhead transparency.
- Instruct students to record their answers for today’s lunches in the table. Survey the students to observe their level of understanding by noting their completion of the table.
- Ask students to show on their hands how many possible combinations they have found after about 5 minutes. Use this informal inventory to provide a baseline for instruction.
- Record the possible combinations on an overhead transparency of Student Resource Sheet 1 and discuss.

	<i>Choice 1</i>	<i>Choice 2</i>	<i>Choice 3</i>
<i>Milk</i>	<i>Choice 1 Milk</i>	<i>Choice 2 Milk</i>	<i>Choice 3 Milk</i>
<i>Chocolate Milk</i>	<i>Choice 1 Chocolate Milk</i>	<i>Choice 2 Chocolate Milk</i>	<i>Choice 3 Chocolate Milk</i>
<i>Juice</i>	<i>Choice 1 Juice</i>	<i>Choice 2 Juice</i>	<i>Choice 3 Juice</i>

Number Sentence $3 \times 3 = 9$ combinations

Launch –

- Refer back to the transparency of Teacher Resource Sheet 1 on the overhead projector and read again as a class. Identify the next problem the family faces as they plan their vacation. Highlight or underline Casey’s situation.

Teacher Facilitation –

- Read the objective of lesson 2 as a class.

- Ask, "How could we use a table to help Casey decide what type of car and color his family should rent?"
- Refer back to the transparency of Student Resource Sheet 3 from the pre-assessment. Ask, "How was the table arranged?" *It was arranged in columns and rows. "How many columns and rows does the table have?" It has 4 columns and 4 rows. "Why?" We need 4 columns because there are 3 lunch choices and the other column is a label. We need 4 rows because there are 3 drink choices and the other row is a label.*
- Model how to create a **table** with the appropriate number of columns and rows. Model how to label the columns and rows appropriately using the information from the pre-assessment. (Use this only as a model showing how to organize a table. You do not have to complete the table.)

Student Application –

- Distribute Student Resource Sheet 4. Read together as a class. Give students about 10-15 minutes to create a table and complete the different combinations. After students have completed their tables, go over the table on the overhead transparency as a class.
- Allow students time to complete problem #2 and go over as a class.

	<i>Red</i>	<i>Silver</i>	<i>Blue</i>	<i>Black</i>
<i>Convertible</i>	<i>Red Convertible</i>	<i>Silver Convertible</i>	<i>Blue Convertible</i>	<i>Black Convertible</i>
<i>Sunroof</i>	<i>Red Sunroof</i>	<i>Silver Sunroof</i>	<i>Blue Sunroof</i>	<i>Black Sunroof</i>
<i>Hardtop</i>	<i>Red Hardtop</i>	<i>Silver Hardtop</i>	<i>Blue Hardtop</i>	<i>Black Hardtop</i>

Number Sentence $4 \times 3 = 12$ or $3 \times 4 = 12$ combinations

Embedded Assessment –

- Distribute Student Resource Sheet 5 in order to determine mastery of the table strategy. Have students work independently to demonstrate their understanding. (Answers will vary).

Reteaching –

- Observe students closely as they are completing the assessment. If a student does not understand the concept, work with them in a small group while other students work independently. Use graph paper to help create the table.

Extension –

- Students who understand the concept can further demonstrate their understanding by creating their own scenario that would require drawing a table to determine the possible combinations. Responses should include the

prompt, the table, and the number sentence representing the number of possible combinations.

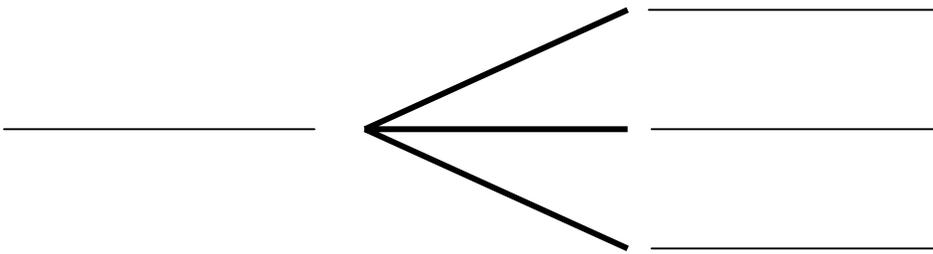
For example: After school, I could join one club activity and one sports team.

- Write the extension on the chalkboard. Once students have completed their assessment, they will complete the enrichment activity on the back of their worksheet.

Lesson 3

Pre-Assessment –

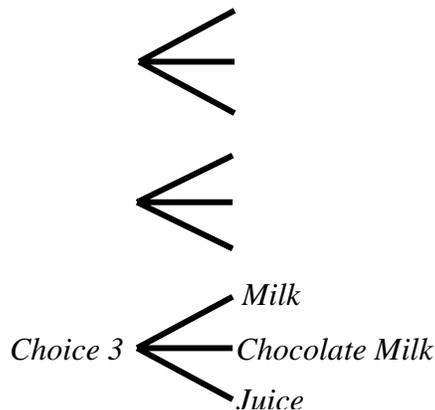
- Draw a blank tree diagram on the board that shows 3 categories with 3 different choices. (Draw 3 of the following)



- Write the following prompt on the board

Today's school lunch choices were _____, _____, and _____. You can also choose milk, chocolate milk, or juice. Make a list of all of the possible combinations you could have for lunch today.

- Instruct students to copy the blank tree diagram in their journals and arrange the choices to show all of the different combinations. Survey the students to observe their level of understanding by noting their tree diagrams.
- Give students approximately 5-10 minutes to complete the tree diagram. Go over and discuss as a class



Launch –

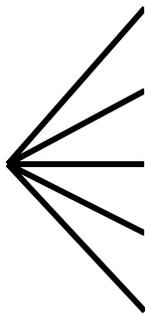
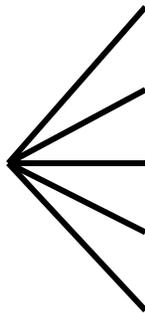
- Refer back to the transparency of Teacher Resource Sheet 1 on the overhead projector and read again as a class. Identify the next problem the family faces as they plan their vacation. Highlight or underline Catie’s situation.

Teacher Facilitation –

- Read the objective of lesson 3 as a class.
- Ask, “How could we use a tree diagram to help Catie decide what kind of ice cream and topping she should get on their trip?”
- Refer back to the tree diagram on the chalkboard from the pre-assessment. Ask, “How was the tree diagram arranged?” *It was arranged in lunch choices with lines showing the drink choices.* Instruct that tree diagrams are arranged in larger branches with smaller branches showing all of the choices. “How many branches does the tree diagram have?” *It has 3 larger branches and 3 smaller branches.* “Why?” *We need 3 larger branches because there are 3 lunch choices. We need 3 smaller branches because there are 3 drink choices.*
- Model how to create a **tree diagram** with the appropriate number of branches. Model how to label the larger and smaller branches appropriately using the information from the pre-assessment. (Use this only as a model showing how to organize a tree diagram. You do not have to complete the tree diagram.)

Student Application –

- Distribute Student Resource Sheet 6. Read together as a class. Give students about 10-15 minutes to create a tree diagram and complete the different combinations. After students have completed their tree diagrams, go over the table on the overhead transparency as a class.



- Allow students time to complete problem #2 and go over as a class.

Embedded Assessment –

- Distribute Student Resource Sheet 7 in order to determine mastery of the tree diagram strategy. Have students work independently to demonstrate their understanding. (Answers will vary).

Reteaching –

- Observe students closely as they are completing the assessment. If a student does not understand the concept, work with them in a small group while other students work independently. Use base ten blocks to serve as branches to provide a visual.

Extension –

- Students who understand the concept can further demonstrate their understanding by adding another variable to the problem.

For example: You will also have a choice of 3 different kinds of cones (cake cone, sugar cone, pretzel cone, etc). Create a tree diagram using the information from your Sundae Surprise (Student Resource Sheet 7) and your new information. Also include a number sentence to show the total number of new combinations.

- Write the extension on the chalkboard. Once students have completed their assessment, they will complete the enrichment activity on the back of their worksheet.

Summative Assessment:

Students will demonstrate an understanding of combinations as the possibilities of combining 2 or more things by creating several diagrams and completing a brief constructed response (Student Resource Sheet 8). They will need to interpret information and use appropriate mathematical reasoning and vocabulary to justify their thinking. The Answer Key is Teacher Resource Sheet 3.

Additional Activities:

- The following website provides practice using the drawing strategy to determine possible combinations.
<http://pbskids.org/cyberchase/games/combinations/combinations.html> (Lesson 1)

- The following website provides practice using the tree diagram strategy to determine possible combinations. <http://regentsprep.org/Regents/math/math-topic.cfm?TopicCode=tree> (Lesson 3)

Authors:

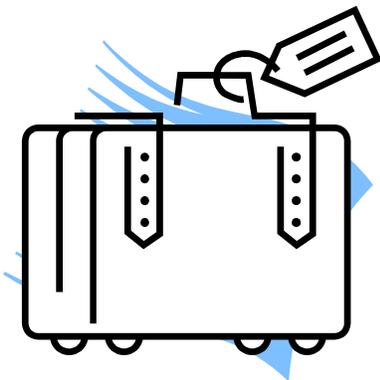
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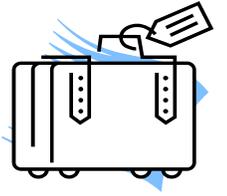
Summer Vacation Combinations

Every summer the Combo Family vacations in South Carolina. Mr. and Mrs. Combo love the beach. Their teenage daughter, Cathy, always packs way too many clothes. The Combo's son, Casey, just got his driver's license and has been researching different rental cars. Little Catie Combo can't wait for their yearly visit to Ren & Terry's Ice Cream Shop. Help the Combo family plan a perfect summer vacation!



Name _____ Date _____

Cathy Combo's Packing Problem



Cathy Combo needs to pack for her trip. She has three shirts that are red, green, and orange. Cathy also has three pairs of shorts that are tan, blue, and white. Use the strategies below to determine the number of combinations that students should wear.

1. Make a list of all of Cathy's outfit combinations.

2. Use the space below to draw all of the outfit combinations.

3. Write a number sentence to show the total number of combinations for Cathy.

Cathy Combo's Packing Problem

Cathy Combo needs to pack for her trip. She has a red, green, and orange shirt. Cathy also has a pair of tan, blue and white shorts. Use the strategies below to determine the number of combinations that students should wear.

1. Make a list of all of Cathy's outfit combinations.

*red shirt and tan shorts,
red shirt and blue shorts,
red shirt and white shorts,
green shirt and tan shorts,
green shirt and blue shorts,
green shirt and white shorts,
orange shirt and tan shorts,
orange shirt and blue shorts,
orange shirt and white shorts*

2. Use the space below to draw all of the outfit combinations.

Pictures should reflect the above combinations.

3. Write a number sentence to show the total number of combinations for Cathy.

$$3 \times 3 = 9 \text{ combinations}$$

Name _____ Date _____

Pack Your Suitcase

You are going to _____ (choose a destination that you would like to visit) this summer.

Packing List: Fill in the boxes with your choices

<u>Shirts</u>	<u>Shorts</u>

- How many outfit combinations will you be packing?
Use the space below to list your combinations.

- Use the space below to draw your outfit combinations.



- Write a number sentence representing the total number of combinations.

Name _____ Date _____

Lunch Tables

Today's school lunch choices are _____,
 _____, and _____. You also
 have the choice of milk, chocolate milk, or juice.

1. Use the table below to make the possible combinations.

Lunch Tables

Milk			
Chocolate Milk			
Juice			

2. Write a number sentence representing the total number of combinations.



Name _____ Date _____

Your Dream Car

1. Let's pretend that you are in charge of the vehicle rental for your family's vacation this summer. In the spaces below, choose 3 vehicle colors, and 4 types of vehicles (for example: Explorer, Caviler, etc)

<u>Vehicle Colors</u>	<u>Type of Vehicles</u>

2. In the space below, create a table organizing your combinations.



3. Write a number sentence representing the total number of combinations.

Summer Vacation Combinations

Summative Assessment

*** Use the following to complete numbers 1 and 2.**

Megan’s breakfast choices are pancakes, scrambled eggs, bagel, or cereal. She can have orange juice, milk, or water to drink.

1. The strategy being used is a _____.
2. Organize the information below to represent the possible combinations.

3. Brian loves to play sports, but he is only allowed to be on one team per season. In the fall, Brian can play soccer or football. In the spring, Brian can play baseball or basketball. For each sport, Brian earns a patch. Draw the combinations of patches that Brian may have on his jacket in one year.

4. One beautiful spring afternoon Denise wants to do something outdoors. She can run, hike, or ride a bike down the trails. At the local park, the names of the trails are Dogwood, Cherry Blossom, and Red Maple.

Step A:

What is the total number of possible combinations of activities and trails?

Step B:

Using what you know about combination strategies explain how you found your answer. Use words, numbers and/or symbols to justify your answer in your explanation.

5. Mike is a bird watcher. He needs to observe a bird feeder to see what species come to the feeder and which seeds they prefer. This is the list that Mike made:

Cardinal eating sunflower seeds, cardinal eating poppy seeds, cardinal eating sesame seeds, blue jay eating sunflower seeds, blue jay eating poppy seeds, blue jay eating sesame seeds, finch eating sunflower seeds, finch eating poppy seeds, finch eating sesame seeds, robin eating sunflower seeds, robin eating poppy seeds, robin eating sesame seeds.

Mike is getting confused when he reads the list. In the space below, organize the information into a tree diagram.

Summer Vacation Combinations

Summative Assessment

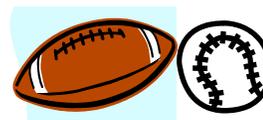
* Use the following to complete numbers 1 and 2.

Megan's breakfast choices are pancakes, scrambled eggs, bagel, or cereal. She can have orange juice, milk, or water to drink.

1. The strategy being used here is a table.
2. Organize the information below to represent the possible combinations.

	<i>pancakes</i>	<i>scrambled eggs</i>	<i>bagel</i>	<i>cereal</i>
<i>orange juice</i>	<i>pancakes orange juice</i>	<i>scrambled eggs orange juice</i>	<i>bagel orange juice</i>	<i>cereal orange juice</i>
<i>milk</i>	<i>pancakes milk</i>	<i>scrambled eggs milk</i>	<i>bagel milk</i>	<i>cereal milk</i>
<i>water</i>	<i>pancakes water</i>	<i>scrambled eggs water</i>	<i>bagel water</i>	<i>cereal water</i>

3. Brian loves to play sports, but he is only allowed to be on one team per season. In the fall, Brian can play soccer or football. In the spring, Brian can play baseball or basketball. For each sport, Brian earns a patch. Draw the combinations of patches that Brian may have on his jacket in one year.



4. One beautiful spring afternoon Denise wants to do something outdoors. She can run, hike, or ride a bike down the trails. At the local park, the names of the trails are Dogwood, Cherry Blossom, and Red Maple.

Step A:

What is the total number of possible combinations of activities and trails?

9 total combinations

Step B:

Using what you know about combination strategies explain how you found your answer. Use words, numbers and/or symbols to justify your answer in your explanation.

2-point response – Student response shows a full understanding of the combination strategy used. Response refers back to the problem.

1-point response – Student response shows a limited understanding of the combination strategy used. Response loosely refers back to the problem.

0 point response – Student response is incomplete or incorrect.

5. Mike is a bird watcher. He needs to observe a bird feeder to see what species come to the feeder and which seeds they prefer. This is the list that Mike made:

Cardinal eating sunflower seeds, cardinal eating poppy seeds, cardinal eating sesame seeds, blue jay eating sunflower seeds, blue jay eating poppy seeds, blue jay eating sesame seeds, finch eating sunflower seeds, finch eating poppy seeds, finch eating sesame seeds, robin eating sunflower seeds, robin eating poppy seeds, robin eating sesame seeds.

Mike is getting confused when he reads the list. In the space below, organize the information into a tree diagram.

