



CYBER COMBOS

Math Topic: Combinations

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ABOUT THE AUTHOR

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CYBER COMBOS

MATH TOPIC: Combinations

GRADE LEVEL: 3-5

TIME ALLOTMENT: One or two 45-minute class periods

OVERVIEW: Students will learn that when they are overwhelmed with choices, they can use lists, tables and tree diagrams to help them master the combinations. Using crazy costume props (such as fun T-shirts and outlandish sunglasses), groups will explore the costume combination possibilities and then hold a wacky fashion show. They will develop strategies for keeping track of combinations and learn how to predict the number of combinations using multiplication. Video clips from the CYBERCHASE episode “A Day at the Spa” will help students focus on ideas for dealing with combinations.

SUBJECT MATTER: Mathematics

LEARNING OBJECTIVES: Students will be able to:

- Use lists, tables, and tree-diagrams to represent total combinations;
- Select the appropriate method for representing total combinations;
- Predict the number of combinations using multiplication.

STANDARDS: From the National Council of Teachers of Mathematics grades K-12, available online at <http://www.nctm.org/standards/standards.htm>

- Understand numbers, ways of representing numbers, relationships among numbers, and number systems. (Number and Operations)
- Solve problems that arise in mathematics and in other contexts. (Problem Solving)
- Communicate their mathematical thinking coherently and clearly to peers, teachers, and others. (Communication)
- Recognize and apply mathematics in contexts outside of mathematics. (Connections)
- Select, apply, and translate among mathematical representations to solve problems. (Representation)

MEDIA COMPONENTS:

Video

CYBERCHASE Episode #111: “A Day at the Spa”

Web Sites

CYBERCHASE Web Game: “Disguise Combos”

<http://pbskids.org/cyberchase/games/combinations/combinations.html>

Students are challenged to create as many disguises as possible for the CyberSquad.

MATERIALS:

For each group of three or four students

- At least three different T-shirts and two different pairs of sunglasses (provided by students)
- 2 different costume accessories of the same type (boas, costume jewelry, scarves, hats, wigs, etc.) per group. Vary the categories among the groups.

PREP FOR TEACHERS:

- Divide the class into groups of three or four. Ask each student to bring in a funny T-shirt and a crazy pair of sunglasses.
- Bookmark all the Web sites used in the lesson, and **CUE** the video to the starting point, which is when you see Inez and Digit in the spa dressing room.
- When using media, provide students with a **FOCUS FOR MEDIA INTERACTION, a specific task to complete and/or information to identify during or after viewing of video segments, Web sites, or other multimedia elements.**
- To read about what kids know and don't know about this lesson's math topic, please turn to the last page of this lesson.

INTRODUCTORY ACTIVITY:

1. Several days before the lesson, assign students to groups of three or four. Ask every student to bring in a fun T-shirt and a crazy pair of sunglasses.
2. On the day of the lesson, have each group select the three coolest T-shirts and the two craziest pairs of sunglasses to work with. Tell students to be sure that the T-shirts and sunglasses they pick are all different. Ask students how many 'outfits'—an outfit being one T-shirt and one pair of sunglasses—they can make from their pile of three T-shirts and two sunglasses. (*Six outfits*) Give students plenty of time to discuss and manipulate the items.
3. Ask groups if there might be easier way to predict how many outfits are possible using the number of each set of objects: T-shirts and sunglasses. (*Guide students to the realization that by multiplying the number of T-shirts by the number of sunglasses, you can get the total number of possible combinations.*)
4. Say: **Let's see if our observation is true.** Distribute two hats, or two boas, or two other identical costume accessories to each group. Each group can receive different items, but each group must have two of the same accessory. Ask groups to predict the number of outfits possible with the new objects. (*3 T-shirts x 2 sunglasses x 2 accessories = 12 possible outfits*) Instruct groups to list the outfits to verify their predictions. Tell groups to save their outfits and lists because they will be used later.

LEARNING ACTIVITIES:

Tell students that they will now view a few video clips from the CYBERCHASE episode "A Day at the Spa." The CYBERCHASE team must get the Krystal of Kalamoor out of the hands of Hacker. Along the way, the team must deal with situations that call for figuring out combinations of different sets of objects.

1. **CUE** the tape to where you see Inez and Digit in the Spa dressing room. Provide students with a **FOCUS FOR MEDIA INTERACTION by asking students to determine how Inez and Digit list all of Digit's disguises?** **PLAY** the tape. **STOP** when Digit says, "I sure hope this works." Ask: **How did Inez and Digit list all of Digit's disguises?** (*Inez took pictures of each.*) **Why?** (*So Digit could keep track of which disguises were already used*) **What did Digit use for his disguises?** (*Three wigs, two sunglasses*) **How many combinations of wigs and sunglasses did Digit make?** (*Six*) **Could you tell Digit and Inez an easy way of counting all the disguises possible?** (*Multiply the number in each set of objects: 3 wigs X 2 sunglasses = 6 disguise combinations.*)

2. **FAST-FORWARD** to the scene where Jackie and Matt are in the Grim Wrecker dungeon trying to escape by pushing against the door. Provide students with a **FOCUS FOR MEDIA INTERACTION** asking how Jackie and Matt kept track of the combinations of doorknobs and keys. **PLAY** the tape. **STOP** when you hear Matt say “Yes” and they both open the dungeon door to leave. Check for comprehension. Ask: **How did they keep track of the combinations of doorknobs and keys?** (*They created a table using the square tiles on the dungeon floor.*) **How many doorknobs and keys did they have?** (*Three of each*) **How many combinations of one doorknob and one key were possible?** (*Nine*) **In our costume activity, how many T-shirt and sunglasses combinations were possible?** (*Six*) **Ask students if a table such as the one Jackie and Matt used could be applied to keep track of our T-shirt and sunglass costumes?** (*Yes*) Have groups attempt to draw a table showing all combinations of T-shirts and sunglasses. Remind groups that each received a third costume accessory. **How many costume combinations of T-shirt, sunglasses, and third item were possible?** (*Twelve*) **Could a table be drawn to keep track of all our costume combinations using three items?** (*Not easily*) **Why?** (*Tables can only represent two objects clearly.*) **Let’s see how the CYBERCHASE team handles a situation with more than two sets of objects.**

3. **FAST-FORWARD** until you see the control board being used to protect the Krystal of Kalamoor with a force field. Provide your students with a **FOCUS FOR MEDIA INTERACTION** asking students to determine the number and type of controls on the control board. **PAUSE** when Inez says “but there are so many possibilities.” Ask: **What are the types of controls, and how many of each are there?** (*Two switches, two levers and three buttons*) **How many of each must be used to cancel the force field?** (*One of each*) **How many combinations of one switch, one lever, and one button are possible?** ($2 \times 2 \times 3 = 12$) Elicit how the CYBERCHASE team can keep track of all possible combinations of switches, levers and buttons. (*Answers will vary.*)

4. Provide your students with a **FOCUS FOR MEDIA INTERACTION** asking students to determine what the team used to keep track of the 12 combinations of switches, levers and buttons. **START** the tape. **PAUSE** when you hear Matt say, “Every path is closed off.” Ask: **What did the team use to keep track of the 12 combinations?** (*A tree diagram.*) Create the tree diagram on the blackboard. Show how it works by listing all the various combinations. Ask each group to draw a tree diagram using the three sets of accessories used in creating our 12 costumes. Invite groups to draw their tree diagrams on the blackboard.

5. Ask: **Was the team successful in canceling the force field.** (*No.*) **Why?** (*Something was missing.*) Provide a **FOCUS FOR MEDIA INTERACTION**, asking students to determine what was missing from the combinations of switches, levers and buttons. **START** the tape and **STOP** when you hear Jackie say, “Let’s get out of here.” Ask: **What was missing from the combinations of switches, levers and buttons?** (*There was a hidden button.*) **How does the hidden button change the number of combinations?** ($2 \times 2 \times 4 = 16$ combinations. *Emphasize that by adding just one more object, the number of combinations increased from 12 to 16.*) **Did the team have to start testing all the combinations again?** (*No, they only had four combinations to test.*) **How did the tree diagram change?** (*Four branches were added to the top.*) Add the four branches to the tree diagram already on the blackboard.

6. Let's see a real activity that uses combinations. **FAST-FORWARD** to the scene where Harry is reading the want ads in CYBERCHASE FOR REAL. Provide a **FOCUS FOR MEDIA INTERACTION**, asking students to determine why Harry thinks the menu is boring. **START** the tape and **PAUSE** when Harry says "boring menu." Ask: **Why does Harry think the menu is boring?** *(There are only four sandwiches offered.)* Provide a **FOCUS FOR MEDIA INTERACTION**, asking students to determine how Harry makes the menu more exciting. **START** the tape again and **STOP** when Harry says, "That's the selling point I can use on the flier." Ask: **How did Harry make the menu more exciting?** *(He actually lists all the different combinations of fillings, breads, toppings, and tomatoes.)* **How many of each was available?** *(Four fillings, three breads, five choices of toppings, and two choices of tomatoes)* **How many combinations are possible?** *(120)*

7. Summarize what students have learned. Ask: **How do you determine the number of combinations possible when using different sets of objects?** *(Multiply the number of objects in each set.)* **For example, if you were at an ice cream parlor, and there were four different flavors of ice cream and two different types of cone, how many possible one-scoop cones could you create?** *(There are 8 possible one-scoop cones—four different flavors multiplied by two different types of cones.)* **How can you illustrate the different combination possibilities?** *(Combination possibilities can be shown using lists, tables, and tree diagrams. Tables can show possible combinations using two sets of objects but not more than two. Tree diagrams can also be used to show combinations of two sets of objects but they can be used to show more than two.)* **When might you use combinations?** *(Answers will vary, but possible scenarios include packing for a trip or ordering a pizza with multiple possible toppings.)*

CULMINATING ACTIVITY:

1. Have students log on to the CYBERCHASE Web site and play a game called "Disguise Combos." Provide students with a **FOCUS FOR MEDIA INTERACTION** by asking students to use their knowledge of combinations to create as many disguises as possible for the CYBERCHASE team. Students can play alone or with a partner. Ask groups to list the combinations using tables and tree diagrams.

2. Have a fashion show. Ask groups to retrieve their costume accessories. Group members will each pick a costume and model it for the class.

CROSS-CURRICULAR EXTENSIONS:

- **English/Language Arts.** Have groups make up characters for each costume in the fashion show and write five lines introducing the character.
- **Art and Economics.** Using clippings from catalogs, challenge the class to come up with outfits consisting of one shirt, one pair of pants or skirt, and one pair of shoes, given a budget of only \$100. Have them cut out the pictures and list the price. Make a poster showing the number of possible outfits.

COMMUNITY CONNECTIONS:

Invite the school dietitian to class to explain the thinking process that goes into planning lunch menus and how combinations influence that process.

Math Topic: Combinations

(To go with "Cyber Combos")

What we can assume 8- and 9-year-olds already know about COMBINATIONS:

Kids enjoy creating new combinations of things like different flavors of ice cream with different toppings, or hamburgers with different garnishes. They are fascinated with how many different combinations they can create, and like to be credited with a new 'invention.' They also try combining different colors in the clothes they wear. Some toys, like different Lego pieces, can be combined to make unique things with the same component parts (the same 50 Legos can make an airplane, a building, or a tank!). Anything with different components can be used to make combinations.

Kids also enjoy making number combinations. They enjoy looking for the one undiscovered combination as if they were looking for a lost nickel. But generally, they do not have an organized method for recording combinations, so they find it difficult to check for possibilities that are missed.

What confuses kids about COMBINATIONS:

Organizing combinations can quickly become overwhelming. Kids often believe they can recognize all the possibilities simply by reciting them aloud. When that fails, they may resort to a written list. Some may discover that making a picture of the possibilities is a useful method, but not very efficient. Kids need other organizational tools, such as tree diagrams.

When working with combinations, it is important for kids to start by using real things or pictures so that the representation doesn't become too abstract too soon. They will eventually see that making a chart is an easier, more efficient method for visualizing choices than drawing every possibility. Using symbols on a chart in place of sketches is even faster. Finally, creating a simple tree diagram showing the combinations is very fast.

Students often have trouble reading and interpreting a completed tree diagram. When there are more than two categories, the presentation of the tree diagram needs to be carefully explained. Direct the child to always begin at the point of origin and trace the combinations along the branch until they reach the last component. Follow every path to name each specific combination. The last set of branches will show the total number of combinations. If the tree diagram is carefully organized, kids soon will learn a short cut: Count all of the last branches! Even faster, they can multiply the number of choices in each category to find the total number of combinations.