What's Your Combination?

ID: 10126

Time required
30 minutes

Activity Overview

In this activity, students are first introduced to the counting principle and the factorial symbol. Then, they will calculate combinations and permutations using these formulas and the ${}_nC_r$, n!, and ${}_nP_r$ commands on the graphing calculator.

Topic: Permutations, Combinations & Probability

- *Use the Fundamental Counting Principle to calculate the number of outcomes in a sample space.*
- *Use factorial notation to express the number of permutations and combinations of n elements taken r at a time.*
- *Use factorial notation to express the number of outcomes in a sample space.*
- *Evaluate expressions involving factorials to compute the number of outcomes in a sample space.*

Teacher Preparation and Notes

- *This activity is intended to be **teacher-led** with students in **small groups**. You should seat your students in pairs so they can work cooperatively. You may use the following pages to present the material to the class and encourage discussion. Students will follow along using their calculators. Be sure to cover all the material necessary for students' total comprehension.*
- *Students should already be familiar with the concept of probability and generating a total list of outcomes for an event occurring (i.e., flipping a coin three times).*
- *Depending on time constraints, there are two ways you can proceed with the introductory part of the activity on the counting principle: writing the arrangements on paper, or by using a set of index cards with the letters M, A, T, and H written on them.*
- *The student worksheet is intended as an investigation through the main ideas of the activity. It also serves as a place for students to record their answers. Alternatively, you may wish to have the class record their answers on separate sheets of paper, or just use the questions posed to engage a class discussion.*
- ***To download the student worksheet, go to education.ti.com/exchange and enter "10126" in the keyword search box.***

Associated Materials

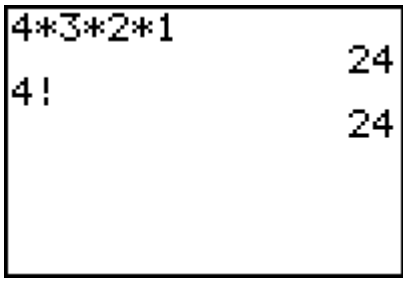
- *WhatCombination_Student.doc*

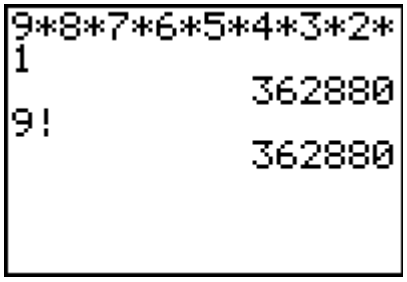
Problem 1 – The Counting Principle

Students are to rearrange the letters in the word MATH to determine all the possible arrangements. This can also be accomplished using index cards with each letter written on a different index card.

After they come up with all the arrangements, draw a tree diagram on the board to show the students why $4 \times 3 \times 2 \times 1 = 24$. Discuss with students the counting principle. Students can confirm their answer using the counting principle and factorial symbol.

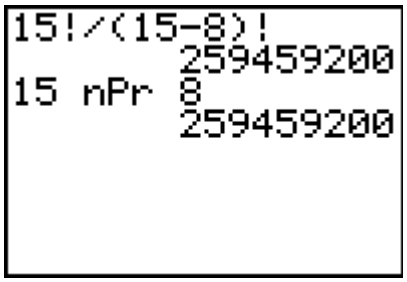
Then students should use the counting principle to find the number of different batting orders for the baseball team. Notice that they can also use the factorial symbol.





Problem 2 – Permutations and Combinations

Discuss with students that a permutation is an ordered group of objects. Students should use the formula for a permutation to answer the school tryout question. Be sure to explain that this situation is a *permutation* because the roles in the musical are different, so the order of the students matters.

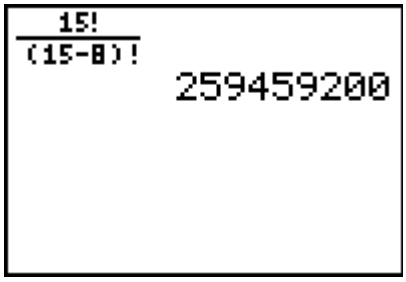


When computing $\frac{15!}{7!}$ by hand, be sure that students do the canceling in the numerator and denominator to reinforce the formula.

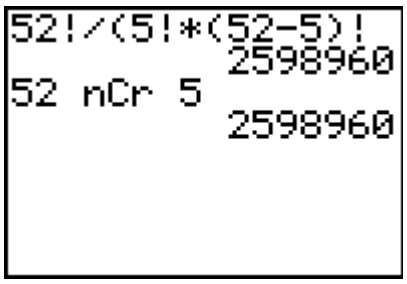
Students can check their work by using the **nPr** command.

If using Mathprint OS:

Students can display and calculate the formula as a fraction. To do this, press [ALPHA] [F1] and select **n/d**. Then enter the value of the numerator, press [▼] to move to the bottom of the fraction, enter the value of the denominator, and press [ENTER].



Discuss with students that a combination is an *unordered* set of objects. Students should use the formula for a combination to answer the deck of cards question. Before doing this problem, make sure your students are somewhat familiar with playing cards and their properties (four suits, 52 cards, etc.).



Explain to students that this situation is a combination since the order of the cards in a hand does not matter—just that they are ***in*** the hand.

Students can check their answers using the **nCr** command.

Exercises

Have students read each situation and decide whether to use the counting principle or the formula for a permutation or combination, and then answer the question.

Solutions

1. This is a combination because the order does not matter: ${}_{40}C_3 = 9{,}880$.
2. Since repetition is allowed: $4 \times 4 \times 4 = 64$.
3. This is a combination because the order does not matter: ${}_{52}C_{13} = 635{,}013{,}559{,}600$.
4. This is simply: $10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 \times 10 = 1{,}000{,}000{,}000$.
5. The question must be split into two parts that will be multiplied together—one for the first five numbers and another for the powerball: ${}_{55}C_5 \cdot 42 = 146{,}107{,}962$.