

Permutations & Combinations

ID: 12601

 Time required
 15 minutes

Activity Overview

Students will explore permutations and combinations by arranging letters when order does and does not make a difference. Students will also answer several questions to make sure that they understand the difference between permutations and combinations. As an extension, students will explore the handshake problem.

Topic: Combinations & Permutations

- *Use factorial notation to express the number of permutations and combinations of n elements taken r at a time.*

Teacher Preparation and Notes

- *To use Combination and Permutation notation, students can either use the Catalog or the Probability menu (**Math > PRB**) to find the commands. the value of n should be entered before the combination or permutation command, followed by the value of r .*
- *To download the student worksheet, go to education.ti.com/exchange and enter "12601" in the keyword search box.*

Associated Materials

- *PermutationsCombinations_Student.doc*

Suggested Related Activities

To download any activity listed, go to education.ti.com/exchange and enter the number in the keyword search box.

- *Combinations (TI-Nspire technology) — 8433*
- *Bewildered Babies (TI-84 Plus family) — 9975*
- *What's Your Combination (TI-84 Plus family) — 10126*
- *Permutations (TI-84 Plus family) — 10076*
- *Too Many Choices! (TI-84 Plus family) — 11762*

Problem 1 – Arranging Letters

Students begin by exploring permutations. They will create permutations by selecting three of the four letters and rearranging them in as many ways as possible, such that order of the letters matters (ABC is different than BCA).

After exploring all the possible outcomes, the students use the calculator two ways to determine the exact number of permutations.

$4! / (4-3)!$	24
$4 \text{ nPr } 3$	24

If using Mathprint OS:

Students can display the formula as a fraction as shown on the worksheet.

Press **[ALPHA]** **[F1]** and select **n/d**. This will set up the fraction. In the top, enter **4** **[MATH]** and select **!** from the PRB menu. Press **⏏** to move to the bottom. Then enter **(4-3)** **[MATH]** and select **!**. Press **[ENTER]** to get the answer.

$\frac{4!}{(4-3)!}$	24
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Discussion Questions

- How do you know you have all the possibilities?
- How do you know you have all the possibilities beginning with A (B, C, D)?

Students should find that there are 24 different permutations of the letters (ABC, ACB, BAC, BCA, CAB, CBD, ABD, ADB, BAD, BDA, DAB, DBA, ACD, ADC, CAD, CDA, DAC, DCS, BCD, BDC, CBD, CDB, DBC and DCB.)

Problem 2 – Arranging Letters in a Different Way

Next, students explore combinations. They will create combinations by selecting three of the four letters and rearranging them in as many ways as possible such that order of the letters does not matter (ABC is the same as BCA).

$4! / (3! * (4-3)!) = 4$	4
$4 \text{ nCr } 3 = 4$	4

If using Mathprint OS:

When finding the answer using the formula:

Press **[ALPHA]** **[F1]** and select **n/d**. This will set up the fraction. In the top, enter **4** **[MATH]** and select **!**. Press **⏏** to move to the bottom. Then enter **3!(4-3)!** (no outside parentheses are needed). Press **[ENTER]** to get the answer.

$\frac{4!}{3!(4-3)!}$	4
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Discussion Questions

- Why are there fewer possibilities when the order does not matter?
- How do you know you have all the possibilities?

Students should find that there are 4 different combinations of the letters (ABC, ABD, ACD and BCD.)

Problem 3 – Permutations versus Combinations

Students answer several questions to test their understanding of when to use permutations and when to use combinations.

Student Solutions

- True
- False
- ${}_5P_3$
- For a permutation, the order matters. In a combination, ABC is the same BCA so there are fewer arrangements.

Extension – Handshake Problem

Students will simulate the handshake problem by connecting points with segments. By completing the simulation, students should be able to determine that this situation represents combinations because the order people are picked does not matter.

# of People	2	3	4	5	6	...	n
# of Handshakes	1	3	6	10	15	...	$\frac{n(n-1)}{2}$
	${}_2C_2$	${}_3C_2$	${}_4C_2$	${}_5C_2$	${}_6C_2$...	${}_nC_2$

Note: ${}_nC_2 = \frac{n!}{2!(n-2)!} = \frac{n(n-1)(n-2)!}{2(n-2)!} = \frac{n(n-1)}{2}$