

Math Objectives

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




About the Lesson

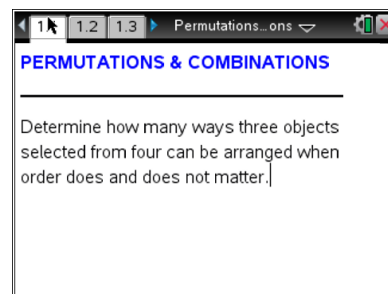
- Students will explore permutations and combinations by arranging letters when order does and does not make a difference. Students will also answer several questions to make sure that they understand the difference between permutations and combinations. As an extension, students will explore the handshake problem.
- Students will be moving text on Graphs & Geometry applications pages. Students should know how to grab and move objects in order to complete the activity.
- To use Combination and Permutation notation, use the Catalog to find the notation. In the Calculator application, the notation is available under **MENU > Probability**.
- In the exploration, students will create line segments using the **Segment** tool (**MENU > Points & Lines > Segment**).
- To download the student and solution TI-Nspire documents (.tns files) and student worksheet, go to education.ti.com/exchange and enter "12602" in the keyword search box.

TI-Nspire™ Navigator™ System

- Send out the *PermutationsandCombinations.tns* file.
- Monitor student progress using Class Capture.
- Use Live Presenter to spotlight student answers.

Activity Materials

- Compatible TI Technologies:  TI-Nspire™ CX Handhelds,  TI-Nspire™ Apps for iPad®,  TI-Nspire™ Software



Tech Tips:

- This activity includes screen captures taken from the TI-Nspire CX handheld. It is also appropriate for use with the TI-Nspire family of products including TI-Nspire software and TI-Nspire App. Slight variations to these directions may be required if using other technologies besides the handheld.
- Watch for additional Tech Tips throughout the activity for the specific technology you are using.
- Access free tutorials at <http://education.ti.com/calculators/pd/US/Online-Learning/Tutorials>

Lesson Files:

Student Activity

- PermutationsandCombinations_Student.doc
- PermutationsandCombinations.tns
- PermutationsandCombinations_Soln.tns

TI-Nspire document

- PermutationsandCombinations.tns



Discussion Points and Possible Answers

Read the instructions on pages 1.1 and 1.2 and move to page 1.3.

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).

1.1	1.2	1.3	Permutations...oln
A	B	C	D
A	C	B	D
B	A	C	D
B	C	A	D
C	A	B	D

On page 1.10, students can evaluate the expression to find the answer to the question. They should move their cursor to the $nPr(4,3)$ expression and select **ENTER**.

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.

1.8	1.9	1.10	*Permutation...ons
How many ways can you select 3 objects from 4 when the order matters?			
Answer: $nPr(4,3) = 24$			
Evaluate this permutation by moving your cursor on it and selecting ENTER .			



TI-Nspire Navigator Opportunity: Quick Poll

See Note 1 at the end of this lesson.



Read the directions on page 2.1 and move to page 2.2.

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).

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.

A B C	D
A B D	C
A C D	B
B C D	A
No more arrangements	ABCD

Move to page 3.1.

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.

2.7 2.8 3.1 *Permutation...oln

Selecting five cards from a standard deck of cards is an example of a combination.

True

False

3.1 3.2 3.3 *Permutation...oln

Which expression has a larger value?

${}_5C_3$

${}_5P_3$

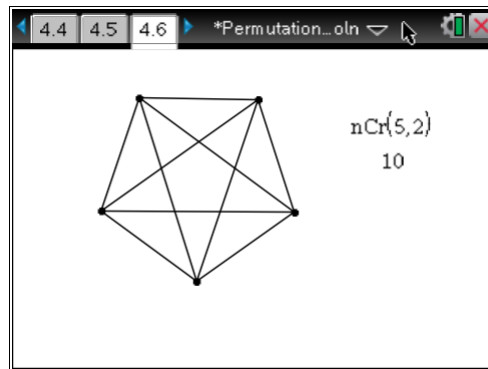


TI-Nspire Navigator Opportunity: *Class Capture*

See Note 2 at the end of this lesson.

Extension – Handshake Problem

Students will simulate the handshake problem by connecting points with segments (**MENU > Points & Lines > Segment**). By completing the simulation, students should be able to determine that this situation represents combinations because the order people are picked does not matter.



Tech Tip: To connect the points, students will need to select **Points & Lines > Segment**. Then, students can simply touch each pair of points they wish to connect with a line segment.



TI-Nspire Navigator Opportunities

Note 1

Problem 1, *Quick Poll*

This would be a good place to do a class capture to verify student understanding. You may choose to have each student list three different permutations with Quick Polls, and give the total number of permutations (24).

Note 2

Problem 3, *Class Capture*

You may choose to use Class capture in this problem or throughout the lesson to verify students are answering the questions correctly.