Permutations and Combinations on the ClassPad

GETTING READY

A) Open the Main Application (J).

B) Select **Edit** and then **Clear All.**

C) Select **OK** when prompted with the **Clear All** menu.

PERMUTATIONS (rearrangements of the same items are ***different***)

Rule #1: This permutation rule is for when there are *n* ***different*** items available.

$$_nP_r = \frac{n!}{(n-r)!}$$

(n is the number of items and r is the number of items selected)

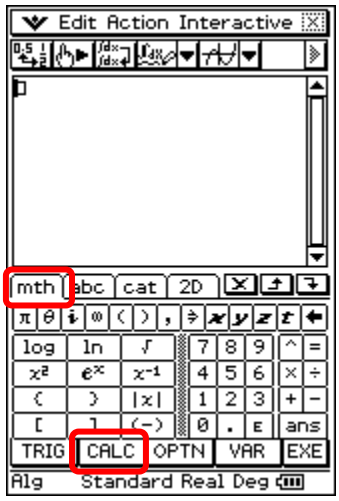
Problem #1: You are going on a sightseeing trip and have 3 different places you would like to go. Unfortunately, you only have enough money and time to visit 2 of them. What is the total number of different routes that would be possible?

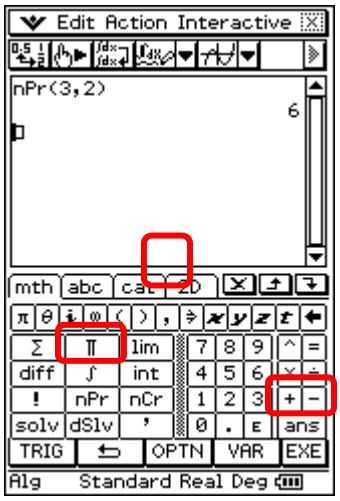
1) Open your k and go to the 9 tab. Then click on the tab at the bottom.

2) Enter the information you see in the second screen capture to the right using the appropriate buttons.

3) When finished press **EXE**.

4) So we can see that there are 6 different possible routes!





Let's check! Imagine that the 3 shapes below are the places you would like to go. How many different ways can we go to two out of the three destinations? Make sure to think about the order in which you visit each place as well. Sometimes it helps to make a chart to organize your data.

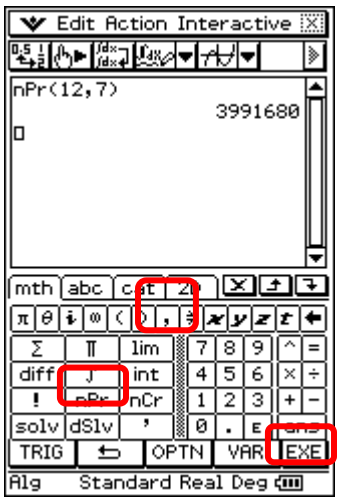
Route #	First Location	Second Location

1	Circle	Rectangle
2	Rectangle	Circle
3	Circle	Triangle
4	Triangle	Circle
5	Rectangle	Triangle
6	Triangle	Rectangle

There are no other possible routes so we see that there are 6 choices - the calculation was correct!

Now let's try a problem with a few more destination choices. The calculation process is the same!

Problem #2: You are going on a sightseeing trip and have 12 different places you would like to go. Unfortunately, you only have enough money and time to visit 7 of them. What is the total number of different routes that would be possible?



1) Open your k and go to the 9 tab. Then click on the tab at the bottom.

2) Enter the information you see in the screen capture to the right using the appropriate buttons.

3) When finished press **EXE**.

4) So we can see that there are 3,991,680 different possible routes!

5) If we were to make a chart like the one above, we would end up with 3,991,680 entries!

On Your Own:

You are in a museum and have 20 different exhibits you would like to see. Unfortunately, you only have enough time to visit 14 of them. What is the total number of different routes through the museum that would make this possible?

Rule #2: This permutation rule is for when there are *n* items available and ***some are identical*** to others.

$$\frac{n!}{n_1!*n_2!*\cdots*n_k!}$$

(n is the total number of items and n_1 through n_k represent the total number of identical items in each group)

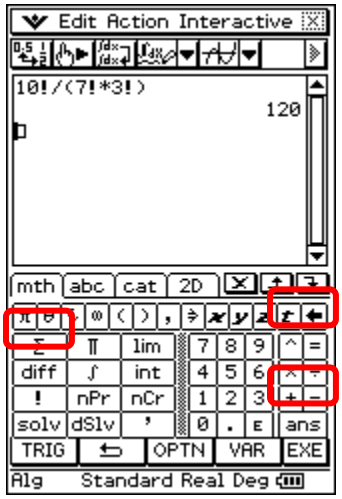
Problem #1: You will be arranging 7 girls and 3 boys in sequence. How many ways can you do this? In this example, *n* represents the total number of children (10), n_1 represents the number of girls (7) and n_2 represents the number of boys (3).

1) Open your k if it is not already open from the previous problems and go to the 9 tab. Then click on the □tab at the bottom.

2) Enter the information you see in the screen capture to the right using the appropriate buttons.

3) When finished press **EXE**.

4) So we can see that there are 120 different possible arrangements!



On Your Own:

You will be arranging 11 girls and 7 boys in sequence. How many ways can you do this? (Hint: First find the total number of children by adding the number of girls and the number of boys and then follow the example above.)

COMBINATIONS (rearrangements of the same items are ***the same***)

Combination Rule: When there are *n* ***different*** items available and we select *r* of the *n* items, see the combinations formula below.

$$_nC_r = \frac{n!}{(n-r)!*r!}$$

There is a difference between permutations and combinations. With the permutation example above that included shapes, we counted each order as a separate event (i.e. Circle, Triangle was counted separately from Triangle, Circle). In combinations, those two would be counted as one.

Problem #1: You see a group of 3 students. You need to find out how many different combinations of two students you can make. In other words, how many different pairs can you choose from 3 students? Keep in mind that with combinations if you have students A, B, and C, pair AB is the same as BA because each pair contains the same students.

Let's try the table first this time and then check our answer on the ClassPad!

Combination #	Student #1	Student #2
1	A	B
2	A	C
3	B	C

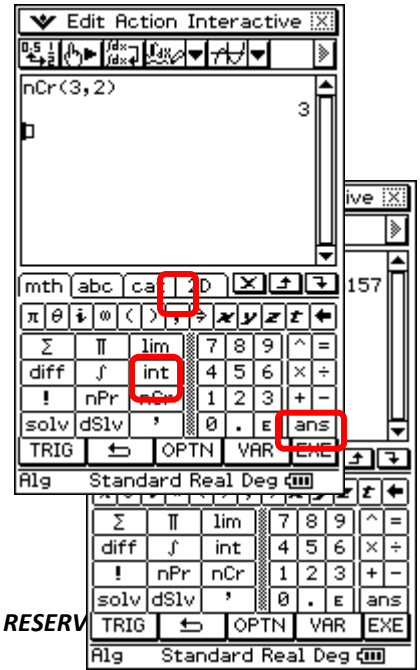
Are there any other combinations? We could try BA, but AB is already in our table and with combinations, those are the same thing. So the result is 3 unique combinations. Now let's check it on the ClassPad.

1) Open your k if it is not already open from the permutations problems and go to the 9 tab. Then click on the □tab at the bottom.

2) Enter the information you see in the screen capture to the right using the appropriate buttons.

3) When finished press **EXE**.

4) So we can see that there are 3 different possible groups!



Problem #2: Your class is doing an activity that calls for volunteers. There are 23 total students in your class, but the activity only requires 7 students.

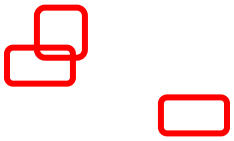
How many different groups of selected students are possible?

1) Open your k if it is not already open from the permutations problems and go to the 9 tab. Then click on the □tab at the bottom.

2) Enter the information you see in the screen capture to the right using the appropriate buttons.

3) When finished press **EXE**.

4) So we can see that there are 245,157 different possible groups!



On Your Own:

Your class is doing an activity that calls for volunteers. There are 27 total students in your class, but the activity only requires 11 students. How many different groups of selected students are possible?

Bringing it Together:

For each scenario, *indicate which method you would use to find the answer*: Permutation Rule #1, Permutation Rule #2, or the Combination Rule. Put an **X** in the correct box of the method you would use to solve each problem.

Situation	**Permutation Rule #1**	**Permutation Rule #2**	**Combination Rule**
You see a group of 5 students. You need to find out how many different combinations of two students you can make. In other words, how many different pairs can you choose from 5 students?			
You are going on a sightseeing trip and have 4 different places you would like to go. Unfortunately, you only have enough money and time to visit 3 of them. What is the total number of different routes that would be possible?			
You will be arranging 12 girls and 3 boys in sequence. How many ways can you do this?			