

Math 4a. Classwork 25.

In the last class two week ago we were solving permutation problems about number of ways to fix a dinner, or choose a team. Now let us take another look at some of them.

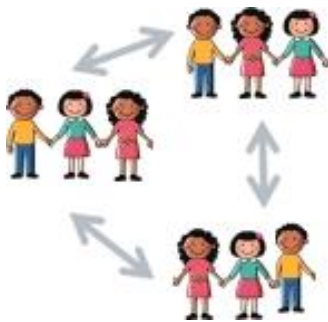
- 1) How many different ways can be 3 first places awarded to the math Olympiad command of 8 students?
- 2) How many different ways are there to choose a team of 3 students out of 8 to participate in the math Olympiad.

What are the similarities in these two problems?

Can you see the difference between them?



In both cases, we have 8 possible ways to choose the first student, 7 possible ways to choose the second student, and 6 different ways to choose the third one. So, there are $8 \cdot 7 \cdot 6$ different way to choose three first places and teams of 3 students out of 8. Or not?



Is there any difference for Maria, Mike and Jessika who is first, second and third? Yes.

If we chose Mike, Maria, and Jessika, a team of 3 students for the math Olympiad, it doesn't matter in which order we wrote their names.

In the first case, we have $8 \cdot 7 \cdot 6$ ways award three first places. In the second case for each group of 3 kids we will count 6 times ($3!$ – number of ways to put 3 kids in line) more possible choices than there really are.

$$\frac{8 \cdot (8 - 1) \cdot (8 - 2)}{3!}$$

In the school cafeteria, there is only limited space to form the line, so only 25 students can be inside simultaneously and form the line. How many ways are there to this line to be formed in the cafeteria, if there are 100 students in school in total?

How many different ways are there to form a Science Olympiad team of 25 students in this school? In which case do you think, order is very important and in which case it is not?

1. There are 10 books on the library shelf. 8 of them are authored by different authors and 2 are from the same author. How many different ways are there to place all these books on a shelf so that 2 books of one author will be next to each other?
2. Mother has 2 apples and 3 pears. Each day she gives one fruit to her kid for lunch. How many different orders are there to give these fruits?
3. In a restaurant customers can order a cheese platter for \$15 or \$20. For \$15 platter, you can choose 3 different kind of cheese out of 15 and for \$20 platter you can choose 5 different kind of cheese. How many different ways are there to create these two cheese platters?
4. I have 15 new books to read during my 5 days' vacation. I want to read 1 book every day. How many different ways are there for me to read these 5 books? How many ways would be there if I would have only a 3 days' long weekend to read them?
5. a) The weight of dried apples is 25% of the weight of fresh apples. What is the weight of dried apples made of 200kg of fresh apples?
b) Grapes lose 65% of its weight during drying process. What is the weight of raisins made from 400 kg of grapes?
6. An old man had 12 horses. He divided the horses among his 3 sons, in a ratio 3:2:1. How many horses did he give to each of his sons?

