



ex: 12 swimmers, how many ways can they finish 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup>?

$$\underline{12} \quad \underline{11} \quad \underline{10} = \boxed{1320 \text{ ways}}$$

OR  ${}_{12}P_3 = 1320$  (in calc: 12, math, prb, #2, 3)

ex:  ${}_{10}P_6 = \underline{10} \underline{9} \underline{8} \underline{7} \underline{6} \underline{5}$   
 $= \boxed{151,200}$

OR (in calc: 10, math, prb, #2, 6)  
 $= 151,200$

\* Combinations: where order is NOT important.

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

ex: choosing a group of 5 students out of a class of 20.

← Doesn't matter if you are picked 1<sup>st</sup> or last.

In the calc:

20, Math, Prb, #3, 5

$${}_{20}C_5 = 15,504 \text{ ways}$$

$$\downarrow \text{OR}$$
$$\frac{20!}{5!(15!)} = 15,504$$

ex:  ${}_{10}C_6 = \boxed{210}$

$$\frac{10!}{6!4!} = 210 \text{ or "10, Math, Prb, #3, 6" in calc.}$$

ex: 30 students, committee of 3

$${}_{30}C_3 = \boxed{4060}$$

OR  $\frac{30!}{3!(17!)}$

\* Determining between a permutation & a combination:  
Decide if order matters!

↑ order important

↑ order not important.

ex: 7 movies to watch.  
only time to watch 2 of them.  
How many ways can you select two to watch?

\* Order not important:  ${}_7C_2 = \boxed{21 \text{ ways}}$

ex: Math team: 12 member  
How many teams of 4 are possible?

\* Order not important:  ${}_{12}C_4 = \boxed{495 \text{ ways}}$

\* You can use permutations & combinations to solve probability problems.

ex: Pool Balls numbered 1-15.

Probability of choosing 5, 7, 9?

$$P(\text{choosing } 5, 7, 9) = \frac{\# \text{ of ways to choose } 5, 7, 9}{\# \text{ of ways to choose } 3 \text{ balls}} \rightarrow \begin{array}{c} 3 \\ \underline{\quad} \\ 2 \\ \underline{\quad} \\ 1 \end{array} \begin{array}{l} \text{choices} \\ \rightarrow \text{a combination:} \\ 15C_3 = 455 \end{array}$$

$$= \frac{6}{455}$$

ex: cards numbered 1-8

Find the prob. of selecting 5 & 6.

$$P(5 \& 6) = \frac{2 \cdot 1}{8C_2} = \frac{2}{28} = \frac{1}{14}$$

ex: lottery: #1-50, choose 6 numbers.  
# can not repeat. Find the prob. that your ticket is correct.

$$\text{Prob} = \frac{1 \cdot 1 \cdot 1 \cdot 1 \cdot 1 \cdot 1}{50C_6} = \frac{50!}{44!}$$
$$= \frac{1}{15890700}$$