Topic/Skill	Definition/Tips	Example
1. Combination	A collection of things, where the **order does not matter**.	How many combinations of two ingredients can you make with apple, banana and cherry? Apple, Banana Apple, Cherry Banana, Cherry 3 combinations
2. Permutation	A collection of things, where the **order does matter**.	You want to visit the homes of three friends, Alex (A), Betty (B) and Chandra (C) but haven't decided the order. What choices do you have? ABC ACB BAC BCA CAB CBA
3. Permutations with Repetition	When something has n different types, there are **n choices each time**. Choosing r of something that has n different types, the permutations are: $$n \times n \times \dots (r\ times) = \boldsymbol{n^r}$$	How many permutations are there for a three-number combination lock? 10 numbers to choose from $\{1, 2, \dots .10\}$ and we choose 3 of them $\rightarrow$ $10 \times 10 \times 10 = 10^3 = 1000$ permutations.
4. Permutations without Repetition	We have to **reduce the number of available choices each time**. One you have chosen something, you cannot choose it again.	How many ways can you order 4 numbered balls? $$4 \times 3 \times 2 \times 1 = 24$$
5. Factorial	The factorial symbol '!' means to multiply a series of descending integers to 1. Note: $0! = 1$	$$4! = 4 \times 3 \times 2 \times 1 = 24$$
6. Product Rule for Counting	If there are **$\boldsymbol{x}$ ways of doing something** and **$\boldsymbol{y}$ ways of doing something else**, then there are **$\boldsymbol{xy}$ ways of performing both**.	To choose one of $\{A, B, C\}$ and one of $\{X, Y\}$ means to choose one of $\{AX, AY, BX, BY, CX, CY\}$ The rule says that there are $3 \times 2 = 6$ choices.