

What you NEED to know about COUNTING:

Permutations = when the order matters

Total number
of choices = (ways to choose) × (ways to choose) × (ways to choose) × ... × (ways to choose)
1st item 2nd item 3rd item last item

Combinations = when the order doesn't matter

Number of
combinations = (total number of choices, figured as above) ÷ (how many ways to arrange each set)

Think of it as a fraction:

$$\text{Number of combinations} = \frac{\text{(total number of choices, figured as above)}}{\text{(how many ways to arrange each set)}}$$

How many ways can you arrange a set?

Let n = the number of items in the set,
Then the ways to arrange them are: $(n) \times (n - 1) \times (n - 2) \times \dots \times 3 \times 2 \times 1 = n!$

What you NEED to know about PROBABILITY:

$$\text{Probability}(\text{event happens}) = \frac{\text{(how many ways the event can happen)}}{\text{(total number of possible things that could happen)}}$$

The “AND” probability, when several things must ALL happen together:

$$\text{Prob}(\text{this AND that AND that all happen}) = \text{Prob}(\text{this}) \times \text{Prob}(\text{that}) \times \text{Prob}(\text{the 3rd thing}) \times \dots$$

Example: What is the probability of throwing double sixes when rolling two dice?

The “EITHER/OR” probability, when only one of several things can happen:

$$\text{Prob}(\text{this OR that OR that happens}) = \text{Prob}(\text{this}) + \text{Prob}(\text{that}) + \text{Prob}(\text{the 3rd thing}) + \dots$$

Example: What is the probability of rolling an even number (2 or 4 or 6) with a 6-sided die?

$$\text{The “odds” for something to happen} = \frac{\text{Prob}(\text{event happens})}{\text{Prob}(\text{event doesn't happen})} = \frac{\text{(how many ways it can happen)}}{\text{(how many ways it won't happen)}}$$

Note: Math Counts generally uses the above definition of odds. But in everyday common usage, the “odds” usually means the “odds *against*” something = $\frac{\text{Prob}(\text{event doesn't happen})}{\text{Prob}(\text{event happens})}$

In normal conversation (odds against), odds of 100-to-1 means the event is not likely to happen.