

COUNTING FORMULAS

Fundamental Principle of Counting

If one thing can be done in r ways, a second thing in s ways, a third thing in t ways, etc., then the total number of ways all things can be done together is

$$r \times s \times t \times \dots$$

Example: Barb has 5 shirts, 6 pants, and 3 pairs of shoes. How many ways can she get dressed?

$$5 \times 6 \times 3 = 90 \text{ ways}$$

Permutations

n things can be lined up in $n!$ ways.

Example: How many ways can 6 books be lined up on a shelf?

$$6 \times 5 \times 4 \times 3 \times 2 \times 1 = 720 \text{ ways}$$

Permutations with Repeats

n things, of which r are alike, s are alike (etc.) can be lined up in $\frac{n!}{r!s!}$ ways.

Example: How many ways can five blue flags, three red flags, and two green flags be lined up?

$$\frac{10!}{5!3!2!} = 2520 \text{ ways}$$

Combinations

r things can be chosen out of n things in $\frac{n!}{r!(n-r)!} = \binom{n}{r}$ ways.

Example How many committees of three people can be chosen from 7 people?

$$\binom{7}{3} = \frac{7!}{3!4!} = 35 \text{ different committees}$$

Partial Permutations

Example How many ways can 5 books from 8 books be lined up on a shelf?

$$8 \times 7 \times 6 \times 5 \times 4 = 6720 \text{ ways}$$

BUT: How many ways can 5 books be chosen from 8 books?

$$\frac{8!}{5!3!} = 56 \text{ ways}$$