

Magnet Precalculus D Combinatorics

Devin D. Droddy

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Chapter 1

Intro to Combinatorics

1.1 Counting

If decision M can be made in x number of ways and decision N can be made in y number of ways, then the number of ways to make both decisions is $x \cdot y$.

Example 1.1.1 (Counting)

The ice cream shop offers a choice of a 3 cone sizes, 15 flavors, and 8 toppings. How many cones are possible if you can only choose one flavor and one topping?

$$3 \cdot 15 \cdot 8 = 360$$

There are 360 cones possible.

1.2 Factorials

Definition 1.2.1: Factorial

A factorial of some number n , denoted as $n!$, is the product of all natural numbers from 1 to n . For example, $5! = 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1 = 120$.

1.3 Permutations

Definition 1.3.1: Permutation

A permutation of objects, denoted as ${}_nP_r$, is an arrangement of r objects chosen from a set of n objects. The number of possible permutations of size r is denoted as ${}_nP_r = \frac{n!}{(n-r)!}$.

Note:-

$0! = 1$. This means that if $n = r$, then ${}_nP_r = n!$, since $n - r = 0$, so $\frac{n!}{(n-r)!} = \frac{n!}{0!} = n!$.

Example 1.3.1 (Permutation)

There are 16 players on the baseball team. How many ways can the coach make a 9-player batting order?

$$n = 16, r = 9, {}_nP_r = {}_{16}P_9 = \frac{16!}{(16-9)!} = \frac{16!}{7!} = \frac{16!}{5040} = \frac{20922789888000}{5040} = 4151347200$$

There are 4,151,347,200 ways to make a 9-player batting order.