Ex. An ice cream store offers 3 types of cones and 31 flavors. How many different single-scoop ice-cream cones is it possible to buy at this store?

item 1 item 2.

Cone 1 — 31 flavors

Cone 2 — 31 flavors

Cone 3 — 31 flavors

$31 \times 3 = \boxed{93}$.

Fund. Counting Principle.

Suppose that two events occur in order. If the first can occur in m ways and the second in n ways, then the two events can occur in $m \times n$ ways.

ex, In a certain state, automobile license plates display 3 letters followed by 3 digits. How many such plates are possible,

a) repetitions allowed

26	26	26	10	10	10

$\Rightarrow 26^3 10^3$

$= 17,576,000$

b) repetitions not allowed.

26	25	24	10	9	8

$= 11,232,000$

$= \frac{26!}{23!} \cdot \frac{10!}{7!}$

ex. In how many different ways can a race with 6 runners be completed? Assume no tie-

$= 6! = 720$

11.2 Permutations & Combinations

Permutations — Ordering of the objects of a particular set.

ex. A club has nine members. In how many ways can a president, vice president, and secretary be chosen from the members of this club?

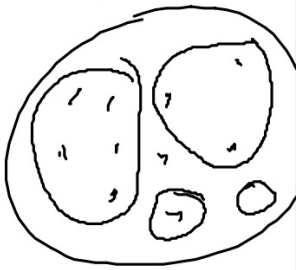
$$P(n,r) = \frac{n!}{(n-r)!}$$

n = total # of people
r = # of people chosen

$$P(9,3) = \frac{9!}{(9-3)!} = \frac{9!}{6!}$$

$$= 9 \times 8 \times 7 = \boxed{504}$$

Combination – Any subset of r elements from the set.



Ex. Consider a set of four letters, namely, A, B, C, D. Combination of taking 3 letters at a time.

ABC, ACD, BCD, ABD,

MQM',

$$Comb = C(n,r) = \frac{n!}{r!(n-r)!}$$