

Permutations and Combinations

How many **distinct** lines could be formed from a group of 8 people? 5 people? 5 people from a group of 8?

*Review factorials

$$\textcircled{1} 8 \times 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1 = 8! = \underline{40320}$$

$$\textcircled{2} 5! = \underline{120}$$

$$\textcircled{3} 8 \times 7 \times 6 \times 5 \times 4 = \underline{6720} \quad \frac{8!}{3!}$$

Permutations

- An arrangement of things, objects, or events in a ...

"Definite Order"

Read as...
"n permute r"

${}^n P_r$

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

where... n - # of items possible
 r - # of items you are choosing

Example #1: Determine the following...

a) ${}_6 P_3$ b) ${}_5 P_4 \times {}_7 P_2$

120 120×42
5040

SOLUTION

SOLUTION

Example #2:



At a 100 m race, 8 runners have qualified for the final. How many ways can gold, silver and bronze be awarded?



1 ${}_8 P_3 = \underline{\underline{336}}$

SOLUTION

Example #3:

How many ways can a 3 digit number be arranged using the digits #1 - 9 and no digit is repeated?

$9 \times 8 \times 7 = \underline{\underline{504}}$ or ${}_9 P_3 = 504$

SOLUTION

Repetitions are taken care of by DIVIDING the permutation by the number of objects that are **(identical)**! ← factorial

Example #1:

How many different 5-letter words can be made from A-P-P-L-E P P L

$$\frac{5P_5}{4! 2!}$$

$$\frac{5!}{2!} = 60$$

Example #2:

How many different six digit numbers can be written using all of the following six digits...?

4, 4, 5, 5, 5, 7

2! 3!

$$\frac{6P_6}{2! 3!} = \underline{\underline{60}}$$

Combinations

- An arrangement of things, objects, or events where ...

"Order IS NOT Important"

Read as...
"n choose r"

$$C(n, r) = {}^nC_r = {}_nC_r = \binom{n}{r} = \frac{n!}{r!(n-r)!}$$

where n - # of items possible
 r - # of items you are choosing

Example #1: Determine the following...

a) ${}_5C_2$ b) ${}_6C_4 \times {}_3C_1 = \underline{\underline{45}}$
=

SOLUTION

10

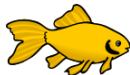
SOLUTION

Example #2:

We have 4 swimmers and we need a team of 3 for a relay. How many different combinations are possible?



Freddy



Goldy



Dolly



Wally

$${}_4C_3 = \underline{\underline{4}}$$

SOLUTION

Example #3:

As a promotion, a record store placed 12 CD's and 10 DVD's into a box. If Angus was the millionth customer and was allowed to select 4 CD's and 4 DVD's, then how many selections can Angus make?

$${}_{12}C_4 \times {}_{10}C_4 = \underline{\underline{103950}}$$

SOLUTION

Permutation or Combination...you decide!!!

1. How many three-card poker hands can be made from a regular deck of 52 playing cards? ${}_{52}C_3$
2. Seven people are lined up as a tug-of-war team. How many ways can this team be lined up for the contest? ${}_7P_7$
3. Suppose 15 people are entered in the 100m dash at the Olympics. How many different ways are there to hand out the gold, silver and bronze medals? ${}_{15}P_3$
4. Out of a class of 18 students, 10 are randomly selected to participate in a survey. How many different selections are possible for the survey group? ${}_{18}C_{10}$

Page 524

#1, 2, 3, 4, 5,

Page 534

#2, 3, 4, 6, 8

