MATH 120 Section 7.4 Permutations & Combinations

Factorial: $n! = n \cdot (n-1) \cdot (n-2) \cdot \cdots \cdot 2 \cdot 1$ Note: By definition, 0! = 1

Examples Compute the following Factorials

1) $5! = 120$ 2) $4! = 24$ 3) $3! = 6$ 4) $2! = 2$ 5) $1! = 1$ 6) $0! = 1$ 7) $\frac{7!}{6!} = 7$ 8) $\frac{8!}{5!} = 8 \cdot 7 \cdot 6 \cdot 5! = 336$

9) $\frac{52!}{5!47!} = 2598960$ 10) $\frac{12!}{4!(12-4)!} = 495$

A permutation is an arrangement of objects in a specific order. [Order Matters]
Example: Awarding 1st place, 2nd place and 3rd to a group of 10 students in a spelling contest. 10 nPr 3 = 720

A combination is an arrangement of objects in any order. [Order Doesn't Matter]
Example: Choosing 3 students from a group of 10 students to participate on a team. 10 nCr 3 = 120

Examples Permutation or Combination?

11) Suppose that 7 people enter a swim meet. Assuming that there are no ties, in how many ways could the gold, silver, and bronze medals be awarded? 7 nPr 3 = 210

12) In a horse race, how many different finishes among the first three places are possible if 22 horses are running? 22 nPr 3 = 9240

13) John bought a machine to make fresh juice. He has five different fruits: strawberries, oranges, apples, pineapples, and lemons. If he only uses two fruits, how many different juice drinks can John make? 5 nCr 2 = 10

14) How many different committees of 3 people can be chosen to work on a special project from a group of 9 people? 9 nCr 3 = 84

15) From a committee of 10 people, how many ways can we choose a chair, a vice-chair and a secretary? 10 nPr 3 = 720

16) From a committee of 10 people, how many ways can we choose a subcommittee of 3 people? 10 nCr 3 = 120

Calculating Permutations & Combinations

Permutation: The number of permutations of n objects taken r at a time (no repetition):	**Combination:** The number of combinations of n objects taken r at a time (no repetition):
$P_{n,r} = \frac{n!}{(n-r)!}$	$C_{n,r} = \frac{n!}{r!(n-r)!}$

Examples

16. Calculate the following. a) $P_{9,2}$ b) $C_{8,3}$

17. Calculate the above problems 11 - 16

$P_{9,2} = 9nPr\,2 = 72$

$C_{8,3} = 8nCr\,3 = 56$