



**Aim: To review permutations, combinations and probability.**

HW: pg 676 # 26,27  
pg 685 25,31,45  
GB Test 1 17-27

**Do Now:**

- 1) The Math Club has 20 members:
- a) How many ways are there of selecting a president, vice president and secretary?
  - b) How many committees of 3 members can be selected?

Ans: 1)a)  ${}^{20}P_3 = 20 \cdot 19 \cdot 18 = 6840$

This is a **permutation**. We use this here because we are looking to arrange our selection of 3 members into some named order. We say  $nPr$  is a permutation of  $n$  things taken  $r$  at a time. A permutation is an arrangement with order.

To calculate  $nPr$  we start with  $n!$  and stop after  $r$  factors.

$$1)b) \quad {}^{20}C_3 = \frac{{}^{20}P_3}{3!} = \frac{20 \cdot 19 \cdot 18}{3 \cdot 2 \cdot 1} = 20 \cdot 19 \cdot 3 = 1140$$

This is a **combination**. We use this here because we are selecting a committee. With a committee there is no order implied. A combination is an arrangement without order.

We call  $nCr$  a combination of  $n$  things taken  $r$  at a time.

To calculate  $nCr$  we divide  $nPr$  by  $n!$

We also often use the notation  $\binom{n}{r}$  as well

$r$   
and this is read “ $n$  choose  $r$ .”

Note: In both  $nPr$  and  $nCr$   $n \geq r$ .

## Permutations with Repeaters

We can also find how many permutations we have when a set of elements has **repeaters**.

ex: 2) How many different “words” can be made from the word COMMITTEE ?

How many letters?

What letters repeat?

How many times

Here we have 9 letters total but 3 letters occur twice each.  
The answer:  $\frac{9!}{2! 2! 2!} = \frac{9 * 8 * 7 * 6 * 5 * 4 * 3 * 2 * 1}{2 * 1 * 2 * 1 * 2 * 1} = 45360$

A combination is an arrangement that the order does **not** matter.

$nC_r$  is a Combination of **n** things taken **r** at a time.

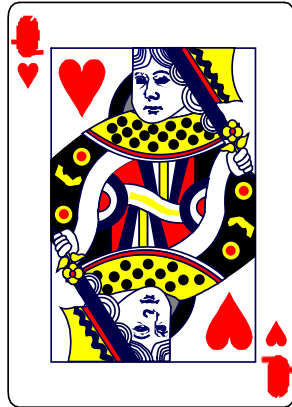
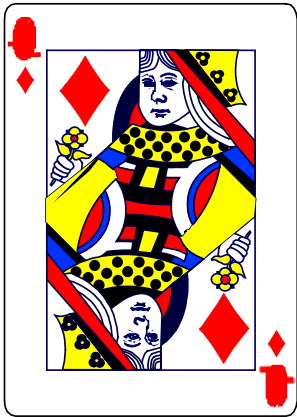
$$\binom{n}{r}$$

A local convenient store hires three students to work. Next month, there are 20 days on which they will work. Alex will work 8 days, Rosa will work 6 days and Carla will work 6 days. In how many ways can their schedule for the month be arranged?

$${}_{20}C_8 \cdot {}_{12}C_6 \cdot {}_6C_6 = 116,396,280$$

3) What is the **probability** of drawing a red queen from a deck of 52 cards?

How many red queens are there?



4) If two cards are drawn from a deck of 52 cards without replacement what is the probability that both cards will be red?

Probability with "AND" "OR"

