A permutation of 'n' elements taken 'n' at a time ($_nP_n$ or $n!$) is affected if one or more elements in the set are IDENTICAL.

For example,

   If a set of 3 marbles consists of 2 identical green marbles and 1 blue marble, the set {G1, G2, B} is identical to {G2, G1, B}. This configuration is counted as two different arrangements instead of one.

   Therefore, it must be removed from the total count by dividing out repetitions ($\dfrac{3!}{2!}$)

In general,

   The number of permutations of 'n' objects containing 'a' identical objects of one kind and 'b' identical objects of another kind and so on is: $\dfrac{n!}{a!b!...}$

   Dividing n! by a! and b! eliminates arrangements that are the same and that would otherwise be counted multiple times.

Example 1:

   If there are 9 different cookies (4 chocolate chip, 3 oatmeal and 2 raisin), in how many different orders can you eat all of them if you eat one at a time?

$\longrightarrow$

Example 2:

How many different ways can you arrange the letters in the word MATHEMATICS?

Example 3: (ex. 2, p. 101)

How many ways can the letters in CANADA be arranged, if the first letter must be N and the last letter must be C?
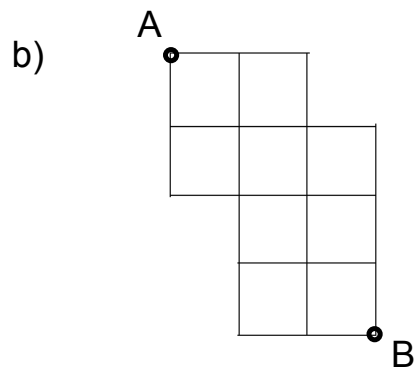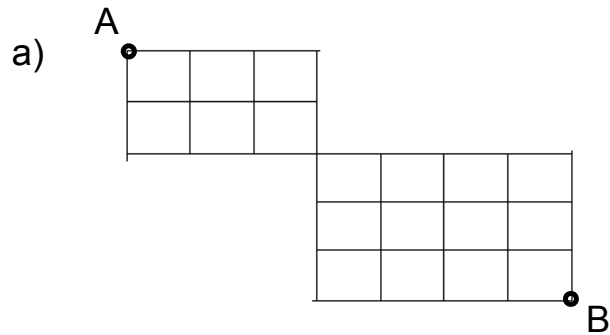
Example 4: (ex. 3, p. 102)

Julie's home is three blocks north and five blocks west of her school. How many routes can Julie take from home to school if she always travels either south or east?
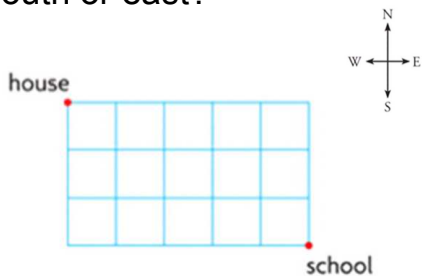
Example 5:

Determine the number of routes there are to get from point A to point B, if you travel only south or east?

a)

A

B

b)

A

B

Practice Questions:

p.104-107, #4,5,6bd,7ab,9a,10,(11ab),12,15ab,16,17ab