**Factorial Notation**

For each positive integer $n$, the quantity $n$**factorial** denoted $n!$, is defined to be the product of all the integers from 1 to $n$

$$n! = n(n-1)(n-2)\ldots 3 \cdot 2 \cdot 1$$

**Zero factorial**, denoted 0!, is defined to be 1:

$$0! = 1$$

$$_nP_n = n!$$

For any natural number $n$, $n! = n(n-1)!$

For any natural numbers $k$ and $n$, with $k < n$,

$$n! = \underbrace{n(n-1)(n-2)\cdots[n-(k-1)]}_{k \text{ factors}} \cdot \underbrace{(n-k)!}_{n-k \text{ factors}}$$