F Math 12

4.2 Introducing Permutations and Factorial Notation p. 238

Name _____

Date _____

Goal: Use factorial notation to solve simple permutation problems.

1. **permutation**: An arrangement of distinguishable objects in a definite order. For example, the objects *a* and *b* have two permutations, _____ and _____.
2. **factorial notation**: A concise representation ofthe product of consecutive _____ natural numbers:

   1! =

   2! =

   3! =

   4! =

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

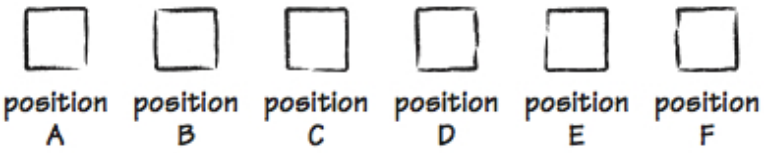
LEARN ABOUT the Math

Naomi volunteers after school at a daycare centre in Whitehorse, Yukon. Each afternoon, around 4 p.m., she lines up her group of children at the fountain to get a drink of water.

How many different arrangements of children can Naomi create for the lineup for the water fountain if there are six children in her group?

Example 1: Solving a counting problem where order matters (p. 238)

Determine the number of arrangements that six children can form while lining up to drink.



Example 2: Evaluating numerical expressions involving factorial notation (p. 240)

Evaluate the following:

a) $10!$

$$\frac{12!}{9!3!}$$

- $0!$ is defined to be equal to _____
- Restrictions on n if $n!$ is defined:

  For example: State the values of n for which each expression is defined, where $n \in I$

  a) $(n-3)!$ b) $\frac{n!}{(n-2)!}$

Example 3: Simplifying an algebraic expression involving factorial notation (p. 241)

Simplify where $n \in N$.

a) $(n+3)(n+2)!$ b) $\frac{(n+1)!}{(n-1)!}$

Example 4: Solving an equation involving factorial notation (p.242)

Solve $\frac{n!}{(n-2)!} = 90$, where $n \in I$

In Summary

Key Ideas

- A permutation is an arrangement of objects in a definite order, where each object appears only once in each arrangement. For example, the set of three objects a, b, and c can be listed in six different ordered arrangements or permutations:

	Position 1	Position 2	Position 3
Permutation 1	a	b	c
Permutation 2	a	c	b
Permutation 3	b	a	c
Permutation 4	b	c	a
Permutation 5	c	a	b
Permutation 6	c	b	a

- The expression $n!$ is called n factorial and represents the number of permutations of a set of n different objects and is calculated as

$$n! = n(n - 1)(n - 2)...(3)(2)(1)$$

Need to Know

- In the expression $n!$, the variable n is defined only for values that belong to the set of natural numbers; that is, $n \in \{1, 2, 3,...\}$.

HW: 4.2 p. 243-243 #2, 3, 5, 6, 9, 12, 14 & 15