

## TOPIC: FACTORIALS

### Factorials

- ◆ **Factorials** are just another operation, where you multiply all \_\_\_\_\_ numbers from a **specific number** down to 1.
  - ▶ Sequences, series, combinatorics, & probability all use factorials, represented with \_\_\_\_\_

$$4! = 4 \cdot \underline{\hspace{1cm}} \cdot \underline{\hspace{1cm}} \cdot 1$$

### EXAMPLE

Calculate the factorials in the table below.

Factorials	
Number	Factorial
0	$0! = \underline{\hspace{2cm}} \rightarrow \underline{\hspace{1cm}}$
1	$1! = \underline{\hspace{2cm}} \rightarrow \underline{\hspace{1cm}}$
2	$2! = \underline{\hspace{2cm}} \rightarrow \underline{\hspace{1cm}} \cdot \underline{\hspace{1cm}} = \underline{\hspace{1cm}}$
3	$3! = \underline{\hspace{2cm}} \rightarrow \underline{\hspace{1cm}} \cdot \underline{\hspace{1cm}} \cdot \underline{\hspace{1cm}} = \underline{\hspace{1cm}}$
4	$4! = \underline{\hspace{2cm}} \rightarrow \underline{\hspace{1cm}} \cdot 3 \cdot 2 \cdot 1 = \underline{\hspace{1cm}}$
5	$5! = \underline{\hspace{2cm}} \cdot 4 \cdot 3 \cdot 2 \cdot 1 = \underline{\hspace{1cm}}$
6	$6! = \underline{\hspace{2cm}} \cdot \underline{\hspace{2cm}} \cdot \underline{\hspace{2cm}} = \underline{\hspace{1cm}}$

- ◆ Each factorial = \_\_\_\_\_ factorial multiplied by new number:  $n! = n \cdot (\underline{\hspace{1cm}})!$

- ▶ This can be used to easily simplify factorial expressions.

### EXAMPLE

Evaluate the expression. Hint: Use the formula above.

(A)  $4 \cdot 3!$

(B)  $\frac{100!}{99!}$

(C)  $(1 - 1)!$

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### PRACTICE

Evaluate each expression.

$$(A) \frac{12}{4!}$$

$$(B) \frac{9!}{7!}$$

$$(C) \frac{16!}{12! \cdot 4!}$$

### EXAMPLE

List the first five terms of the sequence with the given general term below.

$$a_n = \frac{n!}{2}$$