

**Definition Factorial**

The **factorial** of a positive integer  $n$ , denoted by  $n!$ , is the **product** of all positive integers less than or equal to  $n$ .

**TASK 1. Fill in the blank.**

- Simplify  $4! =$  \_\_\_\_\_.
- $0! =$  \_\_\_\_\_.
- Simplify  $\frac{(n+1)!}{n!} =$  \_\_\_\_\_.

**Theorem The Ratio Test**

**TASK 2.** Go to pg 739. Fill in (i) – (iii) by copying the boxed theorem (top of the page). Replace ‘absolutely convergent’ with ‘convergent’.

Suppose  $\sum_{n=1}^{\infty} a_n$  is an infinite series with positive terms. Consider  $r = \lim_{n \rightarrow \infty} \frac{a_{n+1}}{a_n}$ .

- (i) If  $0 \leq r < 1$ , \_\_\_\_\_.
- (ii) If  $r > 1$ , \_\_\_\_\_.
- (iii)  $r = 1$ , \_\_\_\_\_.

**TASK 3a.**

- Research shows that attempting to solve a problem before being taught the solution leads to better learning.
- Attempt the following question for at least a couple minutes before flipping to the next page for a step-by-step explanation.

Example: Use the **Ratio Test** to determine whether the series  $\sum_{k=1}^{\infty} \frac{10^k}{k!}$  converge.

**TASK 3b.** Complete the solution.

Step 1: Simplify  $(10^{n+1} / (n+1)! ) / (10^n / n! )$

Step 2: Compute  $r = \lim_{n \rightarrow \infty} \frac{a_{n+1}}{a_n}$  using your computation from step 1.

Step 3: Your result from step 2 should be  $r = 0$ . Using the ratio test theorem you copied down on the previous page, conclude that  $\sum_{n=1}^{\infty} a_n$  is convergent / divergent (please circle the correct answer).