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 $r = \lim_{n\to\infty} \frac{a_{n+1}}{a_n}$.

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

TASK 3a.

- Research shows that trying to solve a problem (and possibly making errors in the attempt)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 $r = \lim_{n\to\infty} \frac{a_{n+1}}{a_n}$ 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).