St. Joseph's University
Date: April 15, 2026 Professor: Asher Roberts

Calculus II Optional Take-Home Test 3

Number of questions—6

Directions: Solve each of the following problems using separate paper, while clearly indicating each problem number when solving. Irrelevant work will detract from your score, while answers without work shown will be awarded no credit. Answers with partially correct work will receive partial credit. Each problem is worth 16 ⅔ points. You must work alone, but you may use a graphing calculator as a supplement to your own work if you indicate the steps used. You may not use a phone, computer, computational intelligence, AI, or other tools to assist you in solving the problems. You may not have a phone in your possession while taking this test.

1. If the series
$$3 + \frac{15}{6} + \frac{75}{36} + \cdots$$
converges, find its sum.

2. Determine whether $\displaystyle\sum_{k=1}^{\infty} ke^{-k^2}$ converges or diverges.

3. Determine whether $\displaystyle\sum_{n=1}^{\infty}(-1)^n \frac{n}{\sqrt{n^3+2}}$ converges or diverges.

4. How many terms of the series $\displaystyle\sum_{n=1}^{\infty} \frac{(-1)^{n-1}}{n^2 2^n}$ are needed to approximate the sum to an accuracy of 0.0005?

5. Determine whether the series $\displaystyle\sum_{n=1}^{\infty} \frac{(2n)!}{(n!)^2}$ is convergent or divergent. If the series converges, can you state whether it converges conditionally or absolutely?

6. Determine whether $\displaystyle\sum_{n=0}^{\infty}(\arctan n)^n$ converges or diverges. If the series converges, can you state whether it converges conditionally or absolutely?