

King Saud University, Department of Mathematics
First Midterm Exam, S2, 2024/25
M-205

All questions carry equal Marks (5 Marks)

Marks: 25, Time: 90 minutes

1. Determine whether the sequences

$$\left\{ \left(\frac{n+4}{n+2} \right)^{n^2} \right\}_{n=1}^{\infty}$$

converges or not. If it converges, find its limit.

2. Test the convergence or divergence of the series

$$\sum_{n=1}^{\infty} \left(\frac{e^{n+2}}{\pi^n} + \frac{2}{n(n+1)} \right)$$

and find its sum if it converges.

3. Determine whether the following series

$$\sum_{n=1}^{\infty} \frac{\left(-\frac{1}{2}\right)^n}{\sqrt{n^2 + n}}$$

is absolutely convergent, conditionally convergent, or divergent.

4. Find the radius and the interval of convergence of the power series

$$\sum_{n=2}^{\infty} (-8)^n \frac{x^{3n}}{\ln n}$$

5. Using the first three non-zero terms of the power series to approximate the value of the integral

$$\int_{-1}^1 \frac{\sin x}{x} dx$$