(1) Do either (a) or (b): (a) Prove that \( \sum_{n=0}^{\infty} \frac{x^{3n}}{n!} \) converges for all real \( x \). Find a simple formula for the sum \( \sum_{n=0}^{\infty} \frac{x^{3n}}{n!} \). (b) Prove that \( \sum_{n=0}^{\infty} \frac{(-1)^n x^{6n}}{(2n)!} \) converges for all real \( x \). Find a simple formula for the sum \( \sum_{n=0}^{\infty} \frac{(-1)^n x^{6n}}{(2n)!} \).

(2) Let \( f(x) \) be a continuous function defined on the interval \([1, 9]\) such that \( f(1) = 4, f(2) = -2, f(3) = 2, f(4) = 3, f(5) = -2, f(6) = 1, f(7) = -3, f(8) = 3, f(9) = -4 \). Find the approximations \( T_4, M_4 \) and \( S_4 \) to \( \int_1^9 f(x) \, dx \). Recall that \( T \) stands for Trapezoidal, \( M \) stands for Midpoint and \( S \) stands for Simpson. Now assume that \( f(x) \) has a continuous second derivative and the additional property \(-30 < f''(x) < 20\) for all \( x \) in the interval \([1, 9]\). What estimates can we make for the errors associated with \( T_4 \) and \( M_4 \)?

(3) Determine whether \( \sum_{n=2}^{\infty} \frac{2^n}{3^n - 5} \) converges or diverges.

(4) A surface is formed by rotating the curve \( y = (x+2)^3 \), \( 0 \leq x \leq 1 \) about the \( x \)-axis. Find the area of this surface. Hint: Evaluate the integral using an appropriate substitution.

(5) Determine whether \( \sum_{n=1}^{\infty} \tan(1/n) \) converges or diverges. Hint: One way to do this is to start with the evaluation of \( \lim_{n \to \infty} \frac{\tan(1/n)}{1/n} \). Is there another way?

(6) Find \( \sum_{n=1}^{\infty} \frac{1}{32^n + 1} \). Your answer must be a simple number.

(7) Find the interval of convergence of \( \sum_{n=1}^{\infty} \frac{(x-2)^n}{\sqrt{n}} \). In this particular example, there is one and only one value of \( x \) such that the given power series converges conditionally at \( x \). Find that value of \( x \).

(8) Determine whether \( \sum_{n=2}^{\infty} \frac{1}{n!(\ln n)^{3/2}} \) converges or diverges.

(9) Determine whether \( \sum_{n=1}^{\infty} \left( \frac{n}{2n+1} \right)^n \) converges or diverges. Try to do this problem in two different ways.

(10) Determine whether \( \sum_{n=1}^{\infty} \frac{(2n)!(2n)!}{n!(3n)!} \) converges or diverges.