Answer the problems on separate paper. You do not need to rewrite the problem statements on your answer sheets. Do your own work. Show all relevant steps which lead to your solutions. Attach this question sheet to the front of your answer sheets.

1. (18 pts) For each of the following geometric series, determine:
   i. Does the series converge?
   ii. If the series is convergent, then find its sum.

   a. \( \sum_{n=1}^{\infty} \frac{4^n}{3^{n+1}} = \frac{4}{9} + \frac{16}{27} + \frac{64}{81} + \cdots \)
   b. \( \sum_{n=1}^{\infty} \frac{2^{n+1}}{5^n} = \frac{12}{5} + \frac{24}{25} + \frac{48}{125} + \cdots \)

2. (30 pts) Determine whether the following series converge or diverge. Clearly identify which method you are employing, how you are applying your method and what your conclusions are.

   a. \( \sum_{n=1}^{\infty} \frac{1}{n^3 + 2n} \)
   b. \( \sum_{n=1}^{\infty} \frac{3^n}{n!} \)
   c. \( \sum_{n=1}^{\infty} 3n \left(\frac{4}{5}\right)^n \)

3. (12 pts) Find the first 3 non-zero terms of the MacLaurin series for \( f(x) = \sqrt{1+x} \).

4. (24 pts) Find the first 4 non-zero terms of the MacLaurin series for:

   a. \( f(x) = \cosh x = \frac{e^x + e^{-x}}{2} \)
   b. \( f(x) = \frac{1-\cos x}{x} \)

5. (18 pts) Using a MacLaurin series expansion for \( \sin x \),
   a. approximate the value of \( \sin 0.3 \) by using the first 3 terms of the expansion
   b. find the maximum error which ensues by approximating the value of \( \sin 0.3 \) by the value obtained in a.
   c. from the maximum error in b., determine the accuracy of the approximation in a., i.e., determine how many decimal places are correct