1. Consider the geometric series $\sum_{n=1}^{\infty} ar^{n-1}$. For what values of r does the series converge?

2. For each of the following series determine if they converge to a finite number. If they do converge determine the number.

   (a) $\sum_{n=1}^{\infty} 3^n$

   > **Solution:** Series is divergent

   (b) $\sum_{n=1}^{\infty} \left(\frac{1}{3}\right)^n$

   > **Solution:** Converges to .5

   (c) $\sum_{n=1}^{\infty} 5\left(\frac{1}{5}\right)^{n-1}$

   > **Solution:** Converges to $\frac{25}{4}$

   (d) $\sum_{n=1}^{\infty} (-1)^n$

   > **Solution:** Series is divergent

3. Determine the value of
$$\sum_{n=1}^{\infty} \left(2^{n+1} - 1\right) \left(\frac{1}{9}\right)^n$$

   > **Solution:** $\frac{25}{56}$

4. Determine the value of

$$\sum_{n=1}^{\infty} 63^{n-1} \left(\frac{1}{8}\right)^{2n}$$

Solution: 1

5. Determine the value of

$$\sum_{n=1}^{\infty} \left(\frac{1}{2}\right)^{n} \left(\frac{5}{4}\right)^{2n}$$

Solution: $\frac{25}{7}$

6. Determine the the value of

$$\sum_{n=1}^{\infty} \left(3^{n+1} - 1\right) \left(\frac{1}{8}\right)^{n}$$

Solution: $\frac{58}{35}$

7. Determine values of x so that the following series converges

$$\sum_{n=1}^{\infty} \frac{2^n}{2^x}$$

Solution: $|x| > 2$

8. ★ Show that the series $\displaystyle\sum_{n=1}^{\infty} \frac{1}{n}$ is divergent.