7. Approximate sum of the series $\sum_{n=1}^{\infty} \frac{(-1)^{n+1}}{n^4}$ with an error of at most $\frac{1}{100}$.

The Alternating Series Test applies because this is an alternating series and the terms $\frac{1}{2^k} > \frac{1}{3^k} > \cdots$ decrease to 0. So the series converges and

$$\left| \text{The total} - \sum_{n=1}^{N} \frac{(-1)^{n+1}}{n^4} \right| < \frac{1}{(N+1)^4}$$

So

$$\left| \text{The total} - \left( \frac{1}{1} - \frac{1}{2^4} + \frac{1}{3^4} \right) \right| < \frac{1}{4^4} < \frac{1}{100}$$

So the sum of the series is within $\frac{1}{100}$ of

$$1 - \frac{1}{2^4} + \frac{1}{3^4}$$

8. A ball is dropped from the height of 10 feet. Each time it hits the floor it rebounds to $\frac{3}{5}$ its previous height. Find the total distance it travels.

\[
\begin{align*}
\text{Distance} & = 10 + \frac{2}{5}(20) + \frac{2^2}{5^2}(20) + \frac{2^3}{5^3}(20) + \cdots \\
& = 10 + \frac{\frac{2}{3}(20)}{1 - \frac{2}{5}} \\
& = \frac{2}{5} \cdot \frac{2}{3} \\
& = \frac{2}{5} \cdot \frac{2}{3}
\end{align*}
\]

**Geometric Series**

**Summary**

$A = \frac{2}{3}(20)$

$\rho = \frac{2}{5}$