The Alternating Series Remainder Estimate

1. If you use the 10^{th} partial sum to estimate $\displaystyle\sum_{i=1}^{\infty}(-1)^i\frac{1}{i}$, what is the maximum error (remainder) of this estimate?

2. For each of the following series, can the alternating series remainder estimate be used to find the maximum error of a partial sum estimate of the series? State why or why not.

   (a) $\displaystyle\sum_{n=3}^{\infty}(-1)^{n-1}\frac{1}{n-2}$

   (b) $\displaystyle\sum_{n=1}^{\infty}\frac{3n^2-2}{4n}$

   (c) $\displaystyle\sum_{n=0}^{\infty}(-1)^n\frac{\cos(n)}{2^n}$

   (d) $\displaystyle\sum_{n=0}^{\infty}7\pi\left(-\frac{3}{10}\right)^n$

3. For each of the following series, check that the conditions to use the alternating series remainder estimate are met. Then find the fewest number of terms necessary so that the error is no more than the given bound.

   (a) $\displaystyle\sum_{n=3}^{\infty}(-1)^n\frac{1}{n-2}$, $|R_n| \leq 0.1$

   (b) $\displaystyle\sum_{n=0}^{\infty}\frac{(-1)^{n+1}}{(3n+1)^3}$, $|R_n| < 0.000001 = \dfrac{1}{10^6}$

   (c) $\displaystyle\sum_{n=0}^{\infty}10\left(\frac{1}{2}\right)^n$, $|R_n| \leq 0.5$

   (d) $\displaystyle\sum_{n=1}^{\infty}(-1)^{n-1}ne^{-n}$, $|R_n| < 0.001$ (Hint: Use Desmos or Wolfram Alpha to graph.)