1. For each of the following series, determine whether the series converges or diverges.

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

(c) $\displaystyle\sum_{n=1}^{\infty} (-1)^{n+1} e^{\frac{1}{n}}$

(b) $\displaystyle\sum_{n=1}^{\infty} (-1)^{n} \frac{n}{2n-5}$

(d) $\displaystyle\sum_{n=1}^{\infty} (-1)^{n+1} \left(\frac{\ln n}{n}\right)$

2. Estimate the sum of the following series to within two decimal places of accuracy

(a) $\displaystyle\sum_{n=1}^{\infty} (-1)^{n} \frac{n^2}{10^n}$

(b) $\displaystyle\sum_{n=1}^{\infty} (-1)^{n+1} \frac{7}{n^5}$

3. Determine how many terms you would need in order to estimate the following sums to within .0001 (you do **not** need to find an estimate)

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

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

4. Determine whether each of the following series are absolutely convergent, conditionally convergent, or divergent:

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

   (c) $\displaystyle\sum_{n=1}^{\infty} (-1)^{n+1} \frac{\sqrt{n}}{n+1}$

   (b) $\displaystyle\sum_{n=1}^{\infty} (-1)^{n+1} \frac{3n}{500n+1}$

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

(e) $\displaystyle\sum_{n=1}^{\infty} \frac{\cos(n\pi)}{n}$

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

5. The following is a proof that 2=1. Consider the alternating harmonic series $\displaystyle\sum_{n=1}^{\infty} \frac{(-1)^{n+1}}{n}$. We know that this series converges conditionally. Assume the sum of the series is S.

   (a) Write out the first 14 terms of this series. We've done the first 3.

   $S = 1 - \frac{1}{2} + \frac{1}{3} -$

   (b) Multiply what you have in part (a) by 2 and simplify your fractions:

   $2S =$

   (c) Collect terms with the same denominator in part (b):

   $2S =$

   (d) Rearrange what you have in part (c) so that you have the series you began with:

   $2S = 1 - \frac{1}{2} +$

   (e) Thus:

   $2S = S$ and dividing by S we get $2 = 1$.

   (f) We know that $2 \neq 1$. What does your work above tell you about conditionally convergent series?