The problems on this worksheet are for in-class practice during tutorial. You are free to collaborate and to ask for help. They don't count for course credit, but it's a good idea to make sure you know how to do everything before you leave tutorial – similar problems may show up on a test or assignment.

1. Calculate $\lim_{n\to\infty} a_n$ to show that the series $\sum a_n$ diverges:

   (a) $\displaystyle\sum_{n=1}^{\infty} \frac{3n^2}{n(n+2)}$ (b) $\displaystyle\sum_{n=1}^{\infty} \frac{n!}{10^n}$ (c) $\displaystyle\sum_{n=0}^{\infty} \frac{2^n}{2^{n+1}+1}$

2. Determine if the series diverges or converges. (Each series is a p-series, or geometric, or there is an argument involving basic properties of series. See Key Idea 17 on page 126 of the textbook for additional guidance.)

   (a) $\displaystyle\sum_{n=1}^{\infty} \frac{1}{n^5}$ (c) $\displaystyle\sum_{n=1}^{\infty} \frac{3^n}{5^n}$ (e) $\displaystyle\sum_{n=1}^{\infty} \frac{10}{n!}$

   (b) $\displaystyle\sum_{n=1}^{\infty} \frac{\sqrt{n}+1}{n^2}$ (d) $\displaystyle\sum_{n=1}^{\infty} \frac{7^n}{6^n}$ (f) $\displaystyle\sum_{n=1}^{\infty} \left(\frac{1}{n!}+\frac{1}{n}\right)$

3. Determine if each series converges or diverges. If it converges, determine the value it converges to.

   (a) $\displaystyle\sum_{n=0}^{\infty} \frac{1}{4^n}$. (Geometric) (c) $\displaystyle\sum_{n=1}^{\infty} \frac{1}{n(n+1)}$ (Telescoping)

   (b) $\displaystyle\sum_{n=1}^{\infty} e^{-n}$. (Geometric?) (d) $\displaystyle\sum_{n=1}^{\infty} \ln\left(\frac{n}{n+1}\right)$ (Telescoping?)

4. Use the integral test to determine if the series converges:

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

5. Use direct comparison to determine if the series converges:

   (a) $\displaystyle\sum_{n=1}^{\infty} \frac{1}{4^n+n^2-n}$ (b) $\displaystyle\sum_{n=1}^{\infty} \frac{1}{\sqrt{n}-2}$ (c) $\displaystyle\sum_{n=1}^{\infty} \frac{1}{n^2\ln n}$

6. Use the Limit Comparison Test to determine if the series converges. (Be sure to state what series you're using for comparison.)

   (a) $\displaystyle\sum_{n=1}^{\infty} \frac{1}{4^n-n^2}$ (b) $\displaystyle\sum_{n=1}^{\infty} \frac{1}{\sqrt{n^2+n}}$ (c) $\displaystyle\sum_{n=1}^{\infty} \frac{n+5}{n^3-5}$