Math 31, Spring 2011
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WU # 5

Name: ________________________________

In order to determine if the series converges or diverges, we can use the comparison test. Find a (comparison) series which will help us determine convergence.

$$\sum_{k=1}^{\infty} \frac{\ln k}{k^2}$$

Solution:
Note that neither (a) $\sum_{k=1}^{\infty} \frac{1}{k^2}$ or (b) $\sum_{k=1}^{\infty} \frac{1}{k}$ will work. (a) doesn't work because $\frac{1}{k^2}$ is *smaller* than the terms in our original series, so it doesn't help to compare. (b) doesn't work because the series *diverges* (and is greater than our original series) and ours doesn't.

$$\begin{aligned} \sqrt{k} &> \ln(k) \qquad \text{for all } k \\ \sqrt{k}/k^2 &> \ln(k)/k^2 \\ \frac{1}{k^{3/2}} &> \frac{\ln(k)}{k^2} \end{aligned}$$

Because the power is greater than 1, we know $\sum_{k=1}^{\infty} \frac{1}{k^{3/2}}$ converges. By using the comparison test, we can see that our series also converges.