1. Use a test or a *combination* of tests from 11.2-11.6 to decide if the series is absolutely convergent (AC), conditionally convergent (CC), or divergent (D).

   Your options are: geometric series test, p-series test, divergence test, integral test, direct comparison test, limit comparison test, ratio test, root test, alternating series test.

   (a) $\displaystyle\sum_{k=1}^{\infty} \frac{\ln k}{k}$

   (b) $\displaystyle\sum_{k=1}^{\infty} \frac{k^2}{(k^2+3)^{5/2}}$

   (c) $\displaystyle\sum_{k=2}^{\infty} \frac{1}{k \ln^2 k}$

   (d) $\displaystyle\sum_{k=1}^{\infty} (-1)^k 2^{1/k}$

   (e) $\displaystyle\sum_{k=2}^{\infty} \frac{k}{(k-1)!}$

   (f) $\displaystyle\sum_{k=1}^{\infty} \frac{(-1)^k \sin(k)}{k^6+1}$

2. Now we will consider an infinite series of *functions* instead of numbers:

$$\sum_{k=1}^{\infty} \frac{(-1)^k x^k}{k 2^k}$$

Think of it as an infinite-degree polynomial. The problem is that the series might converge for some x values and diverge for other x values!

(a) Plug in $x = 1$ to get a series just of numbers. Use the ratio test to show this series converges.

(b) Show that your reasoning applies whenever $|x| < 2$.

(c) Plug in $x = 4$ to get a series just of numbers. Use the ratio test to show this series diverges.

(d) Show that your reasoning applies whenever $|x| > 2$.

(e) Plug in $x = 2$. The ratio test fails, so use another test to decide convergence.

(f) Do the same for $x = -2$? What test did you use?

(g) Summarize your work: write the set of x values for which the series is convergent.