1. (10 points) Determine whether the following series converges absolutely, converges only conditionally, or diverges. *Name any test you use.*

$$\sum_{n=1}^{\infty}(-1)^n \frac{\sin(n)n^{3/2}}{n^5+10}$$

2. (10 points) Determine whether the following series converges absolutely, converges only conditionally, or diverges. *Name any test you use.*

$$\sum_{n=1}^{\infty}(-1)^n \left(\frac{n}{n+1}\right)^{n^2}$$

3. (20 points) Find the radius and interval of convergence of the following power series.

(a)

$$\sum_{n=1}^{\infty} \frac{(-5)^n (x-3)^n}{n4^n}.$$

4. (20 points) Consider the function $f(x) = \cos(3x)$.

(a) Find a power series expansion of $f(x)$ about $x = -\frac{\pi}{2}$.

(b) Use the ratio test to find the radius and interval of convergence of the series you found in (a). *No credit will be given for solutions not using the ratio test.*

5. (20 points)

(a) Find the Maclaurin series expansion of the function

$$f(x) = \frac{x^2 - \arctan(x^2)}{2x^4},$$

write out the first four nonzero terms, and express the series in sigma notation.

(b) What is the value of $f^{(11)}(0)$?

(c) What is the value of $f^{(12)}(0)$?

(d) What is the value of $\lim_{x \to 0} f(x)$?

6. (10 points) Write out the first three terms and then find the sum of each of the following series. *Your table of Maclaurin series expansions might be helpful.*

(a) $\displaystyle\sum_{n=0}^{\infty} \frac{3}{n!}\left(\frac{-1}{2}\right)^n =$

(b) $\displaystyle\sum_{n=0}^{\infty} \frac{(-1)^{n-1}}{(2n+1)!}2^{2n+1} =$

(c) $\displaystyle\sum_{n=1}^{\infty} \frac{(-1)^n}{n6^n} =$

7. (10 points) Consider the parametric equations for a curve $C(\theta)$ defined by

$$x = 3\tan(\theta), \qquad y = 6\sec(\theta), \qquad -\frac{\pi}{2} < \theta < \frac{\pi}{2}.$$

Eliminate the parameter, and write the resulting Cartesian equation in the form given below. *No credit will be given for solutions not showing any work.*

$$\frac{y^2}{36} =$$