Name

1. (a) Find polar coordinates for the point whose Cartesian coordinates are (2, 2).
   (b) Find Cartesian coordinates for the point whose polar coordinates are (2, 2).

2. The curve on the right shows the graph of \( r \) as a function of \( \theta \) in the \( \theta - r \) plane. Use it to sketch the corresponding polar curve in the \( x - y \) plane.

3. (a) Sketch the curves in the same Cartesian x-y plane whose polar equations are \( r = 3 \sin(\theta) \) and \( r = 1 + \sin(\theta) \).
   (b) Find the area inside \( r = 1 + \sin(\theta) \) and outside \( r = 3 \sin(\theta) \).

4. a) Find the limit of the infinite sequence defined by \( a_n = \frac{n + 1}{5n - 1} \).
   b) Does the infinite series \( \sum_{n=1}^{\infty} \frac{n + 1}{5n - 1} \) converge to a sum? Why?

5. A ball bounces back half as high each time it falls. If it first falls from a height of 10 ft, find the total distance it travels.

6. If \( \sum_{n=1}^{\infty} a_n = 2 \), then \( \sum_{n=1}^{\infty} \frac{3^n + a_n}{6^n} \) equals
   a) 2  b) 3  c) 5  d) 6  e) \( \infty \)

7. Tell whether each of the following series converges or diverges and justify:
   a) \( \sum_{n=1}^{\infty} \frac{n}{n + 1} \)  b) \( \sum_{n=1}^{\infty} \frac{n}{2^n} \)  c) \( \sum_{n=1}^{\infty} \frac{n!}{2^n} \)  d) \( \sum_{n=1}^{\infty} \frac{(-1)^n}{2n + 1} \)

8. Why is the series \( \sum_{n=1}^{\infty} \frac{(-1)^{n+1}}{n^5} \) convergent? Approximate the sum accurate to within .001.
9. If \( \sum_{n=0}^{\infty} c_n x^n \) converges for \( x = 5 \) and diverges for \( x = -7 \), what can be said about the following series?
   a) \( \sum_{n=0}^{\infty} c_n \) 
   b) \( \sum_{n=0}^{\infty} c_n 4^n \) 
   c) \( \sum_{n=0}^{\infty} (-1)^n c_n 3^n \) 
   d) \( \sum_{n=0}^{\infty} c_n 8^n \)

10. Find the radius of convergence for each of the following series:
   a) \( \sum_{n=1}^{\infty} \frac{n(x-2)^n}{3^n} \) 
   b) \( \sum_{n=0}^{\infty} \frac{(-1)^n x^{2n}}{(2n)!} \)

11. a) The geometric series \( 1 + x + x^2 + x^3 + x^4 + \ldots = \frac{1}{1-x} \) for what values of \( x \)?
   What is the radius of convergence for this series?
   b) Use part a) to find a series centered at 0 for \( \frac{1}{1+x} \). What is the radius of convergence?
   c) Use the information in b) to find a series centered at 0 for \( f(x) = \ln(1+x) \).
   d) Find \( \int_{0}^{.5} \frac{\ln(1+x)}{x} \, dx \) accurate to within .01.

12. Sketch a function whose Taylor series centered at \( a = 1 \) could be given by \( 1 + 1(x-1) - 1(x-1)^2 + \ldots \).

13. Let \( f(x) = x^2 + 3x - 4 \). a) Write the Maclaurin series for \( f(x) \). b) Write the Taylor series for \( f(x) \) centered at \( a = 2 \).

14. Use the Maclaurin series for \( e^x \) to find the Maclaurin series for \( f(x) = e^{-x^2} \).