1. (14 points) Find the area of the region inside the graph of $r = 3 + 2\sin\theta$ and outside the graph of $r = 4$. 
2. (12 points) Find the interval of convergence of the series:

\[ \sum_{k=0}^{\infty} (-1)^k \frac{4^{2k}}{\sqrt{k + 1}} x^k \]
3. (10 points) Consider the parametric equations:

\[ x = t - 2 \sin t \]
\[ y = 1 - 2 \cos t \]

Find the slope of the tangent line to the graph of the parametric equations at \( t = 2\pi/3 \).

4. (14 points) Find a Taylor series for \( f(x) = \ln(2 + x) \) about \( c = 0 \).
5. (8 points each) Consider the function $f(x) = \ln(\cos x)$.

   (a) Find the Taylor polynomial of degree 2 about $c = \pi/6$ for $f(x)$.

   (b) Find the second Taylor remainder for $f(x)$ about $c = \pi/6$. 
6. (8 points) Find an equation in rectangular coordinates that has the same graph as the polar coordinate equation 
\[ r = 2 \cos \theta + 3 \sin \theta. \]

7. (12 points) Consider the function \( f(x) = \ln(1 + \sin x) \). Suppose the third Taylor remainder for \( f(x) \) about \( c = 0 \) is 
\[ R_3(x) = \frac{-2 + \sin z}{24(\cos(z/2) + \sin(z/2))} x^4, \]
where \( z \) lies between \( x \) and 0. What is the maximum error in using \( P_3(x) \) to approximate \( f(\pi/2) \)?
8. (14 points) Consider the parametric equations:

\[
\begin{align*}
x &= \cos^3 t \\
y &= \sin^3 t
\end{align*}
\]

Find the exact arclength (no approximations) of the graph of the parametric equations for \(0 \leq t \leq \pi/2\).