Each problem is worth one point for a total of ten. The worksheet is due Thursday, December 6. **You must show your work to receive full credit;** partial credit will be awarded where appropriate.

1. Let $x = t - \ln t$ and $y = t + \ln t$.
   
   a. Find $\frac{dy}{dx}$

   b. For what values of $t$ does the curve have horizontal tangent lines? vertical tangent lines?

   c. Find $\frac{d^2y}{dx^2}$

   d. For what values of $t$ is the curve concave up? concave down?

2. Describe the motion of a particle with position $(x, y)$, where $x = \sec \theta$, $y = \tan \theta$ and $-\frac{\pi}{2} < \theta < \frac{\pi}{2}$. 
3. Find the slope of the tangent line to the polar curve \( r = \cos \theta \) at \( \theta = \pi/3 \).

4. Find the area enclosed by the loop of the strophoid \( r = 3 \cos \theta - \sec \theta \).

5. Find the length of the curve \( x = \ln(\sec t + \tan t) - \sin t, \ y = \cos t \) over the interval \( 0 \leq t \leq \pi/3 \).

6. Find the length of the curve \( r = e^{\theta}/\sqrt{2} \) on the interval \( 0 \leq \theta \leq 2 \).

7. Find the area of region enclosed by the circle \( r = a(\sin \theta + \cos \theta) \).