Exam #2, October 29, Calculus II (109), Fall, 2010, W. Stephen Wilson

I agree to complete this exam without unauthorized assistance from any person, materials or device.

Name: ________________________________ Date: ________________

TA Name and section: ________________________

**NO CALCULATORS, NO PAPERS, SHOW WORK.** (26 points total)

In case you need them: \( \cos(2x) = 2 \cos^2(x) - 1 = 1 - 2 \sin^2(x). \)
1. (2 points) Compute the slope of the graph of the polar coordinate equation $r = 1 - \sin(\theta)$ when it crosses the x-axis, $x > 0$. 
2. (3 points) Compute the polar coordinates and the xy-coordinates for the point where $y$ is maximal ($x > 0$) on the graph of the polar coordinate equation $r = 1 - \sin(\theta)$. 
3. (3 points) Compute the polar coordinates and the xy-coordinates for the point where $x$ is maximal for the graph of the polar coordinate equation $r = 1 - \sin(\theta)$. 
4. (2 points) Compute the area enclosed by the graph of the polar coordinate equation \( r = 1 - \sin(\theta) \) when both \( x \) and \( y \) are greater than or equal to zero \((x, y \geq 0)\).
5. (2 points) Determine if this integral is improper. If it is, determine if it converges or diverges. Explain all. If it converges, compute it. \[ \int_0^3 \frac{dx}{(x-3)^2} \]

6. (2 points) Determine if this integral is improper. If it is, determine if it converges or diverges. Explain all. If it converges, compute it. \[ \int_4^\infty \frac{dx}{(x-3)^2} \]

7. (2 points) Determine if this integral is improper. If it is, determine if it converges or diverges. Explain all. If it converges, compute it. \[ \int_{-3}^0 \frac{dx}{(x-3)^2} \]
8. (2 points) Give a rough sketch of the graph given by the parametric equations: \( x = t^3 - 4t \), and \( y = 4 - t^2 \).
9. (2 points) Give the equation for the tangent line to the graph given by the parametric equations: 
\[ x = t^3 - 4t, \quad \text{and} \quad y = 4 - t^2, \]
when it passes through the origin the first time (i.e. for the smallest value of \( t \)).
10. (2 points) Find the xy-coordinates of the graph for the maximum value of $x$ when $y > 0$ for the curve given by the parametric equations: $x = t^3 - 4t$, and $y = 4 - t^2$. 
11. (2 points) Set up the integral for the length of the curve for the part of the graph above the x-axis for the curve given by the parametric equations: \( x = t^3 - 4t \), and \( y = 4 - t^2 \).
12. (2 points) Find the area enclosed by the graph for the part of the graph above the x-axis for the curve given by the parametric equations: $x = t^3 - 4t$, and $y = 4 - t^2$. 