Math 142 Midterm 1

Name: _____

1. Evaluate $\dfrac{d}{dx}\left(\ln(\sin x)+\sin(\ln x)+\dfrac{e^x}{1+e^x}+\dfrac{1}{x}+\displaystyle\int_1^{\ln x}\dfrac{1}{t^4+1}\,dt\right)$.

2. Why does the function $f(x) = x^5 + \ln x$ for $x > 0$ have an inverse? If $g(x)$ is this inverse, find the equation of the tangent line to $g(x)$ at $x = 1$.

3. An upright cylindrical tank (in the shape and orientation of a soda can) has a height of $1m$ and a radius of $1/2m$. It is half full of water (which has density $1000kg/m^3$). How much work does it take to pump the water out the top?

4. Find the volume of the solid created by rotating the area underneath the graph of $\frac{\ln x}{x^2}$ on the interval from 1 to 2 around the y-axis.

5. Find all of the inflection points (where the second derivative is 0) for the function $e^{-\pi x^2}$.

6 (Bonus). Write down a positive integer. The student who writes down the lowest unique integer wins.