Closed book. You may use a calculator and one 8 ½ × 11" sheet of handwritten notes (both sides). You must show your work to receive full credit. Unless specifically instructed, you may use any correct technique to solve the problems. Simplify your answers if possible.

Pledge:
On my honor, as a student, I have neither given nor received unauthorized aid on this examination: ____________________________  ___________

  (signature)  (date)
1. Differentiate \( \ln \left( \frac{x^2}{x^4 + 1} \right) \)
2. Suppose \( f(x) = x^2 - 4x + 3 \) and \( g(x) \) is the branch of \( f^{-1}(x) \) with \( g(1) = 0 \). Find \( g'(1) \).
3. Evaluate \( \int_0^{\pi/2} e^{\cos(2x)} \sin(2x) \, dx \).
4. Suppose $\frac{dy}{dx} = 2xe^{-y}$ with $y(0) = 0$. What is $y(1)$?
5. A brick is heated to 250°, and then placed to cool in a 20° environment. You find the brick some time later, when the temperature has dropped to 180°. Five minutes after that, the brick has cooled to 120°. How long after the brick was placed to cool did you make the first measurement?
6. Evaluate $\int 3^x \, dx$. 
7. Evaluate \[ \int \frac{dx}{x^2 + 4x + 6} \]
8. Let \( f(x) = \text{asin}(\cos(x)) \). Evaluate \( f'(\frac{\pi}{6}) \) and \( f'(-\frac{\pi}{6}) \). What is the range of possible values for \( f'(x) \)?