Math 221 Review Questions for Test 2
March 27, 2006
Calculus II

Marks
This is a closed book exam. No notes are permitted.

4 1. Find the 2nd derivative, \( \frac{d^2y}{dx^2} \), if \( y = 4e^{5x} \).

16 2. Evaluate the following integrals:
   
   (a) \( \int \frac{\arcsin x}{\sqrt{1 - x^2}} \, dx \)
   
   (b) \( \int e^{\ln(6t)} \, dt \)
   
   (c) \( \int \frac{dx}{x^2 + 6x + 73} \)
   
   (d) \( \int_{0}^{\ln100} x e^{x^2} \, dx \)

4 3. Find \( y \) if \( \frac{dy}{dx} = 6y \).

10 4. The fish population in a lake is attacked by a disease at time \( t = 0 \), with the result that the size \( P(t) \) of the population at time \( t \geq 0 \) satisfies \( \frac{dP}{dt} = -k \sqrt{P} \), where \( k \) is a positive constant. If there were initially 40,000 fish in the lake, and 10,000 were left after 4 weeks, when will the fish population be reduced to 1,600?

8 5. Find the following limits:
   
   (a) \( \lim_{x \to e} \frac{1 - \ln x}{x - e} \)
   
   (b) \( \lim_{x \to \infty} \frac{x^3}{2^x} \)

8 6. Find the area of the region enclosed by the graphs of \( f(x) = 3 - 2x \) and \( g(x) = \frac{1}{x} \).