TEST 3 **MA 125-2 (Form A)** **November 4, 2016**

Name: _____ **Signature:** _____

SHOW ALL YOUR WORK!

1. (10 points each) Consider $f(x) = x^4(13 - x)^3$
   a) Find $f'(x)$ and factor your answer completely.
   b) Find all critical points of $f(x)$. Use the first derivative test to determine local maxima and minima.

2. (15 points) Find the global maximum and minimum for the function on the closed interval
   $f(x) = xe^{-x^2/2}, -3 \leq x \leq 4$

3. Given $e^{\cos(\pi y)} = x^3 \arctan y$,

   a) (10 points) Find $\dfrac{dy}{dx}$.

   b) (5 points) Find local linearization of function $y = f(x)$ at $y = 1$.

4. Given that $f^{-1}(0) = 4$ and $f'(4) = 10$,
   a)(10 points) find the equation of the tangent line of f^{-1} at $x = 0$.
   b)(5 points) find $g'(0)$ where $g(x) = \sinh x \ f^{-1}(x)$.

5. (10 points each) Let the one parameter family of functions $g(x) = ax - 3x\ln(x)$, where $x > 0$.
   a) Find the x-coordinates of the critical points of g.
   b) Use the second derivative test to classify the critical points.

6. (15 points) Find the **dimensions** of the box with largest possible volume made from 54 m^2 of material. The box has square base and a top.

7. (Bonus- 3 points) Is the following statement **True** or **False**? **Justify** or **give a counterexample**:
Let f be continuous on $(a, b]$ and differentiable on (a, b) with $f(a) = f(b)$, then there exists $c \in (a, b)$ such that $f'(c) = 0$.