MTH 234 Quiz 3 June 9, 2016 Name _____

(20 points total)

1. (4 points) Find and ${\bf classify}$ all of the critical points of

$$f(x,y) = xye^{y-x}$$

Given

$$f_{xx} = y(x-2)e^{y-x}$$
 $f_{xy} = (1-x)(1+y)e^{y-x}$ $f_{yy} = x(y+2)e^{y-x}$

2. (4 points) Find the minimum and maximum value of $f(x,y) = 4 - x^2 - y^2$ subject to $g(x,y) = x^2 + 2y^2 = 1$ using the method of Lagrange multipliers.

Hint: when you solve the equation $\nabla f = \lambda \nabla g$, break the result down into cases:

Case 1: either x = ? or $\lambda = ?$.

Case 2: either y = ? or $\lambda = ?$.

Then analyze these cases to finish the problem.

3. (4 points) Evaluate

$$\iint_D y \sin x \, \mathrm{d}A$$

where D is the region enclosed by the curves $x = -\pi/2, y = 0, x = y^2$, and $y = \sqrt{\pi/6}$.

(Hint: you can either do a type I or a type II integral. One method requires fewer steps than the other.)

4. (4 points) Find the volume of the solid beneath the surface z = xy and above the triangle in the xy-plane with vertices (0, 1), (3, 1) and (0, 2).

5. (4 points) Find the volume of the solid beneath the surface $z = x^2 + y^2 + 1$ and above the region bounded by the unit circle $x^2 + y^2 = 1$ in the *xy*-plane. (Hint: This problem is easier to solve using polar coordinates, but you do not need to.)