Math 392 Quiz 4A
June 25, 2019

Name: _____
Instructions: No calculators! Answer <u>all</u> problems in the space provided! Do your rough work on scrap paper.

1. Let S_1 be a surface given by $z = g(x, y)$. Find a formula for a normal vector $\vec{n}_1$ to S_1: $\vec{n}_1 =$ _____

2. Let S_2 be a surface parametrized by $\vec{r}(s, t)$. Find a formula for a normal vector $\vec{n}_2$ to S_2: $\vec{n}_2 =$ _____

3. What is the formula to compute the area of S_1 over a region D. $A =$ _____

4. What is the formula to compute the area of S_2 over a region R. $A =$ _____

5. If $\vec{F} = < P(x, y), Q(x, y) >$, define $div\vec{F} =$ _____

6. Let $\vec{F} = < -y^2, 0, -x \cos y >$.

   (a) Compute $div\ \vec{F} =$ _____

   (b) Does $\vec{F}$ have a vector potential? _____ (Yes/No)

   (c) If your answer above is "No", write "DNE" in the space provided. If "Yes", then find a vector potential $\vec{G}$ for $\vec{F}$. In doing so, you may assume the z-coordinate of $\vec{G}$ is 0, and set arbitrary constants of integration to 0 when convenient/appropriate.

   $\vec{G} =$ _____

7. Set-up integrals, with specific limits, to compute the areas of the following surfaces:

   (a) $\vec{r}(u, v) = < uv, u + v, u - v >, u^2 + v^2 \leq 1$: $A =$ _____

   (b) The part of $y = 4x + z^2$ that lies between the planes $x = 0,\ x = 1, z = 0$, and $z = 1$:

   $A =$ _____

Bonus:

1. For S_1 above, define $\iint_{S_1} f(x, y, z)dS =$ _____

2. For S_2 above, define $\iint_{S_2} f(x, y, z)dS =$ _____

(In this quiz, the less shorthand the better. Use as many variables as possible. For example, when writing a formula for which you need a normal vector $\vec{n}$, don't just write "$\vec{n}$", but rather the formula used to find it.)