University of Connecticut
Department of Mathematics

MATH 2110Q PRACTICE EXAM 1 FALL 2016

NAME: _____

DISCUSSION SECTION: _____

Read This First!

- Read the questions and instructions carefully.
- The available points for each problem are given in brackets.
- You must **show your work** to obtain full credit (and to possibly receive partial credit). Correct answers with no justification will not receive credit.
- Make sure your answers are clearly indicated, and cross out any work you do not want graded.
- Do not leave any blanks! Even if you do not arrive at an answer, show as much progress towards a solution as you can, and explain your reasoning.
- Calculators are allowed, but models that can do symbolic computations (TI-89 and above, including TI-NSpire) are not allowed.

Grading - For Administrative Use Only

Page:	1	2	3	4	5	Total
Points:	11	11	9	10	9	50
Score:						

1. Assume that $\vec{a}$ and $\vec{b}$ are orthogonal, nonzero vectors. In what direction does $\vec{a} \times (\vec{a} \times \vec{b})$ point? Explain your answer. [5]

2. If the angle between two planes is defined as the angle between their normal vectors, find the angle between the planes $x + y = 2$ and $x + y + \sqrt{2}z = \sqrt{6}$. [6]

3. Find an equation for the line containing the point $(-3, 4, 2)$ that is parallel to the line $\vec{r}(t) = \langle 1 - t, 2 + 3t, 5t \rangle$. [5]

4. The total resistance R produced by three conductors with resistances R_1, R_2, and R_3 connected in a parallel electric circuit is given by the formula [6]

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}.$$

Find $\partial R/\partial R_1$.

5. Describe the shape of the traces $z = k$ for the surface $x^2 + y^2 - z^2 = 1$. Sketch a graph of a trace for at least one value each with $k < 0$, $k = 0$, and $k > 0$. [9]

6. Consider the function $f(x, y) = x^2(y^3 + 1)^2 + 3x$.

   (a) Compute $\vec{\nabla} f$. [5]

   (b) Find an equation of the tangent plane at the point $(1, 1, 7)$. [5]

7. Determine a function $f(x, y)$ that has partial derivatives $f_x = x + 4y$ and $f_y = 3x - y$. If no such function exists, explain why not. [5]

8. If $f(x, y) = 2x^2 - 3y$, find $D_{\vec{u}} f(1, 1)$ if $\vec{u}$ is the unit vector $\left\langle \frac{1}{\sqrt{2}}, \frac{1}{\sqrt{2}} \right\rangle$. [4]