HOMEWORK

Sultan Qaboos University College of Science

Department of Mathematics and Statistics

Calculus III **Fall 2014**

Important Instructions: Please read and follow the instructions. The homework will be collected in Week 12 (Monday, Tutorial Time), and at least one question will be graded. Also, a quiz out of the homework (exactly out of the homework) will be given on Dec. 8th (Monday, Tutorial Time). This quiz is called "Homework-Quiz." Certainly, good understanding of the homework and good practice in writing the solution will improve your performance in the "Homework-Quiz." So, students are required to solve and practice writing the complete, mathematically correct and neatly written solution for each question.

---

1. Find an equation of the plane containing the two lines

$$\begin{array}{lllll} L_1: & x = t, & y = 4t, & z = -2t \\ L_2: & x = 1 + t, & y = 1 + 4t, & z = 3 - 2t \end{array}$$

2. Find an equation of a sphere for which the line segment

$$x = 4 + 2t, \quad y = 7 + 3t, \quad z = 8 + 6t, \quad -1 \leq t \leq 0$$

is a diameter.

3. Find parametric equations for the tangent line to the curve described by

$$r(t) =< -3t^2, \quad 4\sqrt{t+1}, \quad t - 2 >$$

at the point $(0, 4, -2)$.

4. Use a computer algebra system such as Maple to graph the vector function

$$r(t) =< (10 + \sin 20t)\cos t, \quad (10 + \sin 20t)\sin t, \quad \cos 2t >$$

for $0 \leq t \leq 2\pi$.

5. Use a computer algebra system such as Maple to graph the following surfaces and identify each of them:

$$\begin{array}{llll} (a) & x^2 + 4y^2 = 16 & (b) & y + 2x^2 + 4z^2 = 0 \\ (c) & x^2 + y^2 + z^2 = 10z & (d) & 9z - x^2 + y^2 = 0 \end{array}$$

6. Let $P_0(x_0, y_0, z_0)$ be a point on the plane $ax+by+cz+d = 0$. Show that if $P_1(x_1, y_1, z_1)$ is any point not on the plane then the distance d from P_1 to the plane is given by

$$D = \frac{|ax_1 + by_1 + cz_1 + d|}{\sqrt{a^2 + b^2 + c^2}}$$

7. Find the points on the surface $x^2 + 4x + y^2 + z^2 - 2z = 11$ at which the tangent plane is horizontal.

8. Determine whether the function f defined by

$$f(x,y) = \begin{cases} \dfrac{6x^2y^3}{(x^2+y^2)^2} & \text{if} \quad (x,y) \neq (0,0) \\ 0 & \text{if} \quad (x,y) = (0,0) \end{cases}$$

is continuous at $(0,0)$.

9. The function $f(x,y) = \sin(xy)$ is continuous on the closed rectangular region R defined by $0 \leq x \leq \pi, \quad 0 \leq y \leq 1$

   (a) Find the critical points in the region R.

   (b) Find the points where f has an absolute extremum.

   (c) Use a computer algebra system to graph the function on the rectangular region R.

End of Homework
