UP SCHOOL OF STATISTICS STUDENT COUNCIL

Education and Research

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EDUCATION AND RESEARCH

M54-LE3-005

Mathematics 54 — Elementary Analysis II

Third Long Exam — First Semester, AY 2014 -2015

I. Write TRUE if the statement is always true. Otherwise, write FALSE. **1 point each**

1. The trace of the cone $x^2 + y^2 - 4z^2 = 0$ on the xz-plane is a point.
2. The quadric generated by $3x^2 - y^2 - z^2 = 3$ is a hyperboloid of one sheet.
3. The dot productof two unit vectors is 1 or -1.
4. Consider the vector $\vec{V} =< x, y, z >$. The sum of the squares of its direction cosines is 1.
5. The intersection of a line and a plane is a point (if any).

II. Do as indicated.

1. Find an equation of the surface generated by revolving about the y-axis the parabola $x = y^2 + 1$ on the xy-plane. Sketch the surface and show the traces. **5 points**
2. Determine the equation of the line passing through the center of the sphere $x^2 + y^2 + z^2 + x + y - 2z = 2$ and parallel to the line $L : x = 3 + 2t$, $y = -2t$, $z = 3t - 1$. **5 points**
3. Consider the planes $\pi_1 : 2x - y - z = 10$ and $\pi_2 : x - 3y + z = 2$.
   a. Determine a symmetric equation of the line of intersection of π_1 and π_2. **4 points**
   b. Give the equation of the plane perpendicular to the line of intersection on (a) and containing the point $(1, 1, 1)$. **1 point**
4. The plane π contains the point $(0, 0, 0)$ and $(1, 1, -1)$. If π is perpendicular to $\bar{\pi} : -4x + y = 5$, find the equation of π. **5 points**
5. Consider the intersecting lines:

$$\begin{array}{llll} L_1 : & x = 7 - t, & y = \frac{1}{2}t, & z = -5 + 2t \\ L_2 : & x = 1 + 2t, & y = 3 - t, & z = 3 \end{array}$$

   a. Determine the point of intersection of the lines. **3 points**
   b. Determine the acute angle formed by L_1 and L_2. **2 points**
6. Let $\vec{A} =< 2, 3 >$ and $\vec{B} =< -3, 1 >$. Find the vector projection of $\vec{A}$ onto $\vec{A} + \vec{B}$. **3 points**
7. Find the distance between the plane $-6x + 6y + 3z = 2$ and the point $(1/3, 1/2, -1)$. **2 points**

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