MAKEUP EXAM

1. Find the volume of the parallelepiped determined by the vectors \( \vec{u} = \langle 2, 1, 0 \rangle, \vec{v} = \langle 1, -3, 1 \rangle, \vec{w} = \langle 4, 0, 1 \rangle \).

2. Find the equation of the plane containing the parallel lines
\( L_1: \ x = -2 + t, y = 3 + 2t, z = 4 - t \) and
\( L_2: \ x = 3 - t, y = 4 - 2t, z = t \).

3. Find the equation of the tangent line to the curve
\( \vec{r}(t) = \langle e^{-2t}, \cos t, 3 \sin t \rangle \) at the point where \( t = 0 \).

4. Find the point of intersection of the line \( x = y = z \) and the plane \( 3x - 2y + z = 4 \). Find the acute angle which the line makes with the plane.

5. Find all second-order partial derivatives of
\( f(x, y) = 2x^2y^3 + y^2 + 2x \).

6. Find the local linear approximation of \( f(x, y) = \sin(xy) \) at \( \left( \frac{1}{3}, \pi \right) \).

7. Sketch the level curve of \( f(x, y) = y/x^2 \) that passes through \( P(-2, 2) \). Draw the gradient vector at \( P \).

8. Determine the dimensions of a rectangular box, open at the top, having a volume of 32 cubic feet, and requiring the least amount of material for its construction.