## Math 2144Q - Advanced Calculus IV Practice Midterm

Instructions:

- You may not refer to any notes or your textbook. No calculators, cellphones, or other electronic devices are permitted.
- You have from 12:30pm until 1:45pm to complete the test.
- In every question you must justify your answers.

[10 points] 1. Let S be the sphere radius 1 around the origin oriented outward. Compute

$$\iint_{S} \left( 2yz + z^{3} - x \right) dy \wedge dz + \left( x^{2} + y - 2z \right) dz \wedge dx + \left( z + x^{2}y + \cos x \right) dx \wedge dy$$

[10 points] 2. One eigenvalue of the matrix A below is 5. Find all eigenvalues and eigenvectors and determine whether there is a matrix C such that  $C^{-1}AC$  is diagonal. If there is no such C, explain why not.

$$A = \begin{pmatrix} 1 & 3 & 1 \\ 3 & 2 & 0 \\ 1 & 0 & 4 \end{pmatrix}$$

[10 points] 3. Compute the surface area of the part of the cone  $x^2 + y^2 = z^2$  that lies between z = 0 and x = 3 - 2z.