1. (10 points) Use a double integral to find the volume of the solid that is bounded above by the plane \( z = 4 - x - y \) and below by the rectangle \( R = \{(x, y) : 0 \leq x \leq 1, 0 \leq y \leq 2\} \). You may choose whichever order of integration you prefer.
2. Consider the double integral \[ \int_R x y^2 \, dA \] where \( R \) is the region bounded by 
\[ y = 1, y = 2, x = 0, \text{ and } y = x. \]

a. (10 points) Set this up as an iterated integral (or integrals), where \( dA = dy \, dx. \)
\[ \textbf{DO NOT EVALUATE THE INTEGRAL(S).} \]

b. (10 points) Set this up as an iterated integral (or integrals), where \( dA = dx \, dy. \)
\[ \textbf{DO NOT EVALUATE THE INTEGRAL(S).} \]
3. (15 points) Evaluate the integral by first reversing the order of integration.

$$\int_{0}^{1} \int_{y/2}^{1} e^{x^2} \, dx \, dy$$
4. a. (10 points) Find an equation of the tangent plane to the surface 

\[ xz + 2yz^2 - z^3 = 7 \]

at the point \((2,3,1)\).

b. (10 points) Find parametric equations for the tangent line to the curve of intersection of 

\[ xz + 2yz^2 - z^3 = 7 \text{ and } -x + y - z = 0 \]

at \((2,3,1)\).
5. (15 points) Identify all the critical points of the given function. Then classify each critical point as a relative maximum, relative minimum, or saddle point.

\[ f(x, y) = xy - x^3 - y^2 \]
6. (20 points) Find the absolute maximum and minimum values of

\[ f(x, y) = xy - x - y \]

on the closed triangular region \( R \) with vertices

\((0, 0), (4, 0)\) and \((0, 4)\).
7. (Bonus 5 points) **DON'T, DON'T, DON'T** spend time on the bonus problem unless you feel **VERY, VERY, VERY** confident with your answers on the rest of the test.

Consider the two surfaces described in problem 4:

\[ xz + 2yz^2 - z^3 = 7 \quad \text{and} \quad -x + y - z = 0 \]

(a) (3 points) The curve of intersection of these two surfaces can be parameterized in terms of the variable \( z \). Find this parameterization in terms of \( z \).

(b) (2 points) Find the tangent vector to the curve of part (a), evaluated at the value \( z = 1 \). (The resulting vector should be a scalar multiple of the direction vector you found in problem (4b).