Answer each of the following questions. Show all work, as partial credit may be given.

1. (12 pts.) Find all critical points of the function \( f(x, y) = 2x^2 + 8xy + y^4 \). (Hint: There are three.)

2. (12 pts.) Given that the function \( f(x, y) = 3x^2y + y^3 - 3x^2 - 3y^2 + 2 \) has critical points \((0, 0), (0, 2), (1, 1)\) and \((-1, 1)\), identify each as a local maximum, local minimum, or saddle point.

3. (15 pts. each) Evaluate the following iterated integrals.
   
   (a) \( \int_0^1 \int_x^{3-x} (x + y)^2 \, dy \, dx \)
   
   (b) \( \int_0^1 \int_y^{2y} \int_0^{2y-z} z \, dx \, dz \, dy \)

4. (12 pts.) Evaluate the integral \( \iint_D x \, dA \) where \( D \) is the region in the first quadrant bounded by the circle \( x^2 + y^2 = 4 \) after changing the integral into polar coordinates.

5. (12 pts.) Change the order of integration in the integral \( \int_0^2 \int_0^{4-2x} xy \, dy \, dx \). DO NOT EVALUATE.

6. (12 pts.) Write \( \iiint_E xyz \, dV \) as an iterated triple integral in the order \( dx \, dy \, dz \) where \( E \) is bounded by the coordinate planes and the plane \( 2x + y + z = 4 \). DO NOT EVALUATE.

7. (12 pts.) Find the center of mass of the region in the first quadrant bounded by the lines \( y = 0, x = 2, \) and the curve \( y = x^2 \) when the density is given by \( \delta(x, y) = xy \). (Hint: The “total mass” of the region is \( 16/3 \)).