To receive credit for your answers you must SHOW ALL YOUR WORK, EXPLAIN YOUR REASONING carefully and clearly, and include all steps necessary to completely justify each answer. Any variables you use must be clearly identified. Box in your answers when it is possible. Good luck!

**Problem 1.** Find the value of the integral \( \int_0^1 \int_0^x 4x^2 \, dy \, dx \)

**Problem 2.** Find \( \iint_D 2xy \, dA \) where \( D \) is the region bounded by \( y = x^2 \) and \( y = x^3 \).
Problem 3. Find $\iint_D e^{xy} \, dA$ where $D$ is the triangle with vertices $(0, 0)$, $(0, 1)$ and $(1, 1)$.

Problem 4. Compute the volume of the solid bounded by the surfaces $z = x^2 + y^2$ and $z = 8 - x^2 - y^2$. 
Problem 5. Use an appropriate change of variable (transformation) to evaluate \( \iint_{R} (y - 2x) \, dA \) where \( R \) is the region bounded by \( y = 2x - 1 \), \( y = 2x + 1 \), \( y = 2 - 2x \) and \( y = 4 - 2x \).
Problem 6. Use Lagrange Multipliers to find the maximum and minimum of the function $f(x, y) = x + 2y$ subject to the constraint $x^2 + y^2 = 5$. 

\(^7\)Enjoy the break!