Midterm 1

Last Name: __________________________________________

First Name: __________________________________________

Student ID: __________________________________________

Signature: ____________________________________________

Section:        Tuesday:   Thursday:

3A            3B        TA: Ioannis Lagkas-Nikolos
3C            3D        TA: Fei Xie
3E            3F        TA: Sangchul Lee

Instructions: Do not open this exam until instructed to do so. You will have 50 minutes
to complete the exam. Please print your name and student ID number above, and circle the
number of your discussion section. You may not use calculators, books, notes, or any
other material to help you. Please make sure your phone is silenced and stowed where
you cannot see it. You may use any available space on the exam for scratch work. If you
need more scratch paper, please ask one of the proctors. You must show your work to
receive credit. Please circle or box your final answers.

Please do not write below this line.

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1. (10 pts) Compute the double integral

\[ \int_{-2}^{2} \int_{1-\sqrt{2+y}}^{1+\sqrt{2+y}} x \, dx \, dy. \]

(Hint: First change the order of integration.)
2. (10 pts) Find the average distance from the origin of all points inside the sphere

\[ x^2 + y^2 + (z - 3)^2 = 9. \]
3. (10 pts) Let $\mathcal{D}$ be the region in the first quadrant bounded by $y = x^2$, $y = 32x^2$, and $y = \frac{1}{\sqrt{x}}$. Use the change of variables $x = uv^2$, $y = \frac{u^2}{v}$ to compute the integral

$$\int \int_{\mathcal{D}} ye^{xy^2} dA.$$ 

(Hint: What part of the picture corresponds to $u = 0$?)
4. (10 pts, 7 for just setup) Find the total mass within the region described by $z \leq 4 - x^2 - y^2$, $z \geq 4 - 4y$, $y \geq 2$, if the density of the material in that region is given by

$$\rho(x, y, z) = \frac{1}{x^2 + y^2}.$$