Instructions. Write your name clearly at the top of each sheet of paper, and start each problem on a fresh side of a page, in order. If you skip a problem, leave the corresponding side of a sheet blank so you can come back to it. No books or notes are allowed. All work must be shown to receive credit. Number each problem clearly at the upper left.

1. Find all local extrema and saddle points \((x,y)\) for \(f(x,y) = \frac{1}{3}x^3 + \frac{1}{3}y^3 - \frac{3}{2}x^2 - 4y\).
   \[
   \begin{align*}
   \text{Loc.Max.at} : \\
   \text{Loc.Min.at} : \\
   \text{Sad.Pts.at} : 
   \end{align*}
   \]

2. Evaluate:
   (a) \(\int_0^1 \int_y^2 xy^2 \, dx \, dy\)
   (b) \(\int_0^1 \int_z^2 \int_0^y xyz \, dx \, dy \, dz\)
   (c) \(\int_0^{\sqrt{\pi}} \int_x^{\sqrt{\pi}} \cos(y^2) \, dy \, dx\)

3. Use polar coordinates to find the volume of the solid below \(z = (x^2 + y^2)^{\frac{3}{2}}\) and above the region in the first quadrant of the xy-plane bounded by the circle \(x^2 + y^2 = a^2\).

4. Find the volume of the solid below \(z = y^3\) and above the region in the xy-plane bounded by \(x = 0, y = 1,\) and \(y = x^3\).

5. Use spherical coordinates to find the volume of the ice-cream cone bounded above by the sphere \(\rho = a\) and below by the cone \(\phi = \pi/6\).

6. Let \(R\) be the flat plate bounded by \(x = 0, y = 0,\) and \(x + y = 1,\) with density \(\delta(x,y) = xy\). In (a) and (b), Set Up, but Do Not Evaluate, integrals for:
   (a) the mass \(M\) of \(R\).
   (b) the moment \(M_x\) of \(R\) about the \(x\) axis.
   (c) Write a formula expressing one of the 2 coordinates \((\overline{x}, \overline{y})\) of the centroid of \(R\) in terms of \(M\) and \(M_x\).

7. Set Up, but Do Not Evaluate an integral in Cylindrical Coordinates to find the mass of the solid above the xy-plane and below \(z = 9 - x^2 - y^2\), if the density \(\delta(x,y,z) = z\).