1. Evaluate the following integrals. You may need to switch the order of integration and/or convert to a different coordinate system.

(a) \[8\] \[\int_{x^2}^{3^2} \int_{0^2}^{x^2} \sqrt{y} \cos y \, dy \, dx\]

(b) \[8\] \[\int_{-2^2}^{2^2} \int_{0^2}^{\sqrt{4-x^2}} e^{-x^2-y^2} \, dy \, dx\]

2. [12] Use polar coordinates to find the centroid of the given region.

\[x^2 + y^2 \leq 4, \quad y \geq 1\]

3. [12] Use spherical coordinates to find the centroid of the given region.

\[x^2 + y^2 + z^2 \leq 1, \quad x, z \leq 0\]

4. Evaluate the following line integrals.

(a) [12] \[\int_C 3xy \, ds\]

\(C\) is the clockwise oriented closed curve consisting of the line segment from (1, 0) to (2, 0), the part of the ellipse \(\frac{x^2}{4} + y^2 = 1\) in the first quadrant, and the part of the circle \(x^2 + y^2 = 1\) in the first quadrant.

(b) [8] \[\int_C \vec{F} \cdot d\vec{s}\]

\(C\) is the twisted cubic given by \(\vec{c}(t) = <t, t^2, t^3>\) for \(t\) from \(-1\) to 1 and \(\vec{F} = <xy, yz, xz>\).