

0.1. **Application I: y -center of mass.** (15.4.5) Find the y center of mass of the triangle with vertices $(0, 0)$, $(2, 1)$ and $(0, 3)$ with density function $\rho(x, y) = x + y$.

0.2. **Application II: Polar Moment of inertia.** Consider the lamina a square with side length 4, centered at the origin, whose density is given by $\frac{1}{r^2}$ (where r is the distance from the origin.) Compute the polar moment of inertia of this square around the origin.

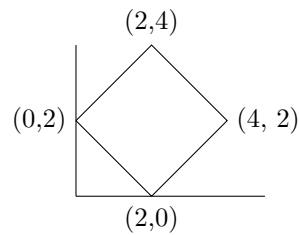
0.3. **Application III: Volume.** *The Gabriel Horn* is the solid given by the bounds

$$0 \leq z \leq \frac{1}{x^2 + y^2}$$
$$x^2 + y^2 \leq 1$$

Compute the volume of the Gabriel horn (In particular, show that this solid has finite volume.)

Then, using techniques from single variable calculus, compute the surface area of the corresponding region (by treating this as a surface of rotation.) Show that the surface area is non-finite.

0.4. **Jacobians.** Compute the integral of $f(x, y) = xy$ over the following region



by using the change of coordinates

$$x = u + v \quad y = u - v$$