1. Calculate $I_{com}$ for a thin rectangular plate about an axis parallel to the plane of the plate and passing through the center of mass. The plate has edge lengths $L_1$ and $L_2$, a uniform mass/area $\sigma$ and a total mass $M$. Express your answer in terms of $M, L_1, L_2$ and constants.

(a) Sketch.
   - draw a diagram showing your object and the axis of rotation
   - pick a “slice” (or piece), $dm$, at constant $r$ -- which is not at the middle or the end of your object -- and show $r$ (the distance from the axis of rotation to $dm$) on your diagram

(b) • get a formula for $dm$:
   \[ dm/dA = \sigma \quad \text{for 2-dimensional objects} \]

(e) By direct integration develop an expression for the moment of inertia about the axis of rotation for this plate in terms of $M, L_1, L_2$, known constants.

(f) What units/dimensions should your result for $I$ have?

   Show that your formula has the correct units.
2. A rod with a non-uniform mass distribution lies along the x-axis. Its left end is at the origin, and it extends to the right along the +x axis a distance L (to x = L+D). We will rotate the rod in the x-y plane, about the z-axis (coming out of the page). The linear mass density (mass per unit length) is \( \lambda \), and
\[
\lambda = \beta x
\]
where \( \beta \) is a constant.

(a) What are the units for \( \lambda \)? For \( \beta \)?

\[
\lambda: \quad \text{________} \quad \beta: \quad \text{________}
\]

(b) Sketch.
- draw a diagram showing your object and the axis of rotation
- pick a “slice” (or piece), dm, at constant \( r \) -- which is not at the middle or the end of your object -- and show \( r \) (the distance from the axis of rotation to dm) on your diagram

(c) • get a formula for dm:
\[
dm/dr = \lambda \quad \text{for linear objects [and in this case,} \ r = x] \]

(d) By direct integration develop an expression for the moment of inertia about the axis of rotation for this rod as a function of \( \beta \), L, known constants.

(e) What units/dimensions should your result for I have?

Show that your formula has the correct units.

(g) Integrate dm to find the total mass of the rod