Consider the region bounded by $y = 1 - x^2$, the $y$-axis, and the line $y = -3$. The figure represents a thin plate made of material (steel) that weighs 41 lbs/ft². Both axes are measured in feet.

1. Sketch the region on your own paper. Slice it into horizontal slices and draw a typical slice.
2. Find the (tiny) moment about the $x$-axis caused by your slice.
   \[ dM_x = \quad \]

   **Warning:** The sign convention can be counter-intuitive.
   If you drew your slice above the $x$-axis then the moment acts in the negative direction.
   If you drew your slice below the $x$-axis, then the distance to the slice is
   \[(\text{top}) - (\text{bottom}) = 0 - y\]
3. Find the correct bounds of integration. Then compute the integral to find the total moment about the $x$-axis. Round your answer to the nearest ft·lb.
   **Note:** The integral will require either substitution or machine help.
   \[ M_x = \int \quad dM_x = \int \quad \]
Consider the region bounded by $y = \sqrt{x+2}$, the $x$-axis, and the line $y = x$. The figure represents a thin plate made of material (steel) that weighs 41 lbs/ft$^2$. Both axes are measured in feet. The pivot axis is a horizontal line, $l$, located at $y = 1$.

1. Sketch the region on your own paper. Slice it into horizontal slices and draw a typical slice.

2. Find the (tiny) moment about $l$ caused by your slice.

   $$dM_l = \ldots$$

3. Find the correct bounds of integration. Then compute the integral to find the total moment about $l$. Be accurate to one decimal place.

   $$M_l = \int \ldots dM_l = \ldots$$
Consider the region bounded by \( y = x + 1 \) and \( y = x^2 - 1 \). The figure represents a thin plate of material (steel) that weighs 40 lbs/ft\(^2\). Both axes are measured in feet.

1. Sketch the region on your own paper. Slice it into vertical slices and draw a typical slice.
2. Find the (tiny) weight of your slice.
   \[ dF = \]
3. Find the (tiny) moment about the \( y \)-axis caused by your slice.
   \[ dM_y = \]
4. Find the total weight of the plate.
   \[ F = \]
5. Find the total moment about the \( y \)-axis.
   \[ M_y = \]
6. Compute \( \frac{M_y}{F} \) include correct units.
   \[ \frac{M_y}{F} = \]
Consider the region bounded by \( y = x + 1 \) and \( y = x^2 - 1 \). The figure represents a thin plate of material (steel) that weighs 40 lbs/ft\(^2\). Both axes are measured in feet. The moment axis, \( l \), is positioned at an unknown location, \( x = b \).

1. Find the moment about \( l \). Give an exact symbolic answer in terms of \( b \).

\[
M_l = \boxed{\text{Expression in terms of } b}
\]

2. Simplify your answer for \( M_l \) as far as possible. You should end up with a simple answer that contains both of the numbers you computed in the previous problem, \( F \) and \( M_y \).

Which of the following is correct?

- \( M_l = M_y - Fb \)
- \( M_l = F - M_y b \)
- \( M_l = F + M_y b \)
- \( M_l = M_y + Fb \)

3. Find \( b \) so that the plate is perfectly balanced on the moment axis, \( l \).

\[
b = \boxed{\text{Expression}}
\]

\textbf{Warning!} Only 3 submits allowed. Don't guess.
Consider the region bounded by $y = \sqrt{2x+4}$, the $x$-axis, and the line $x = 3$. The figure represents a thin plate made of material that weighs 25 N/m$^2$. Both axes are measured in meters. The pivot axis is a horizontal line, $l$, at an unknown location $b$.

Find $b$ so that the plate balances on the moment axis, $l$. Be accurate to three decimal places and include units.

$$b = \boxed{\text{}}$$