Moment of Inertia II
The Parallel Axis Theorem

A great many people think they are thinking when they are merely rearranging their prejudices.

The Homework Problem

- For Problem 10-12 you probably got a very interesting integral when you took the moment of inertia about the x axis.
The Homework Problem

- There is a different way to do this problem that often makes the integrals easier.

Parallel Axis Theorem

- If you know the moment of inertia about a centroidal axis of a figure, you can calculate the moment of inertia about any parallel axis to the centroidal axis using a simple formula.

\[
I_y = I_{y} + Ax^2
\]

\[
I_x = I_{x} + Ay^2
\]
Parallel Axis Theorem

Since we usually use the bar over the centroidal axis, the moment of inertia about a centroidal axis also uses the bar over the axis designation.

\[ I_y = I_y + Ax^2 \]
\[ I_x = I_x + Ay^2 \]

If you look carefully at the expression, you should notice that the moment of inertia about a centroidal axis will always be the minimum moment of inertia about any axis that is parallel to the centroidal axis.

\[ I_y = I_y + Ax^2 \]
\[ I_x = I_x + Ay^2 \]
The Homework Problem

- So now we can try and redo the problem using the parallel axis theorem and an element with a width of dx.

Problem 10-19

- Here is another problem we can try using both methods.
Another physical characteristic of a shape is the radius of gyration.

It is the square root of the ratio of the moment of inertia to the area under consideration.

We often are given the value for this from a table and so we can use this table value to find the moment of inertia.

The formula for the radius of gyration about the x-axis is given as

\[ k_x = \sqrt{\frac{I_x}{A}} \]