Instructions
Read today's Notes and Learning Goals.

1. Question Details

Find the location of the vertical balance line for the shape shown below.

Follow these steps. Write all symbolic answers in terms of \( x \). Write all numerical answers as exact numbers or fractions.

Find the area of the pictured slice.

\[ dA = \]

Find the total area.

\[ \int dA = \]

Find the total moment about the \( y \)-axis.

\[ \int x dA = \]

Find the \( x \)-coordinate of the balance line.

\[ x = \]
Find the location of the vertical balance line for the shape shown below.

Follow these steps. Write your answers as exact numbers or fractions.

Find the area of the shape.

\[ \int dA = \]

Find the moment about the y-axis.

\[ \int x dA = \]

Find the x-coordinate of the balance line.

\[ x = \]
3. Question Details

Find the location of the horizontal balance line for the shape shown below.

Follow these steps. Write your answers as exact numbers or fractions.

Find the area of the shape.

\[ \int dA = \]  

Find the moment about the \( x \)-axis.

\[ \int y\,dA = \]  

Find the \( y \)-coordinate of the balance line.

\[ y = \]  

4. Question Details

Find the location of the vertical balance line for the shape shown below.

Write your answer as a decimal with correct units.

\[ x = \]
Find the location of the horizontal balance line for the shape shown below.

\[ y = 2 - \frac{x^2}{8} \]

Write your answer as a decimal with correct units.

\[ y = \boxed{\phantom{0}} \]
An 12 foot long beam carries a distributed load of 

\[ w(x) = 50x \text{ lbs/ft} \]

as shown below.

This distributed load is equivalent to a concentrated force as shown here:

What is the equivalent amount of force?

\[ F = \quad \text{lb} \]

At what point on the beam does the force act? Your answer should be an \( x \)-coordinate. Note that the origin is at the left end of the beam.

\[ x = \quad \text{ft} \]

What is the distance from the concentrated force to the wall at the right end of the beam?

\[ \text{distance} = \quad \text{ft} \]

What is the counter-clockwise moment at the wall caused by this load?

\[ M = \quad \text{ft-lb} \]
A 4 meter beam carries a distributed load of

\[ w(x) = \frac{200}{8-x} \text{ N/m} \]

as shown below.

This distributed load is equivalent to a concentrated force as shown here:

What is the equivalent force? Round to one decimal place.

\[ F = \boxed{\text{ }} \]

At what point on the beam does the force act? Round to two decimal places.

\[ x = \boxed{\text{ }} \]
A 4 meter beam carries a distributed load of
\[ w(x) = 200 + 100x \text{ N/m} \]
on the portion of the beam from \( x = 0 \) to \( x = 2 \).

The distributed load can be replaced by an equivalent concentrated force.

What is the equivalent force?
\[ F = \]

At what point on the beam does the force act? Round to two decimal places.
\[ x = \]

Compute the counter-clockwise moment at the point where the beam joins the wall. That is, at the right end of the beam. Round to the nearest newton-meter.
\[ M = \]
Find the centroid of the shape pictured below.

Note: One of the two coordinates can be found by symmetry; no integrals needed. Which coordinate can be found by symmetry?

- y-coordinate
- x-coordinate

Enter both coordinates as exact numbers or fractions.

\[ x = \]

\[ y = \]
10. Question Details

Find the centroid of the shape pictured below.

$$x = 4 - (y - 2)^2$$

Enter both coordinates as exact numbers or fractions.

$$x = \quad y = \quad$$

11. Question Details

A twelve foot beam carries a distributed load of

$$w(x) = 120x - 5x^2 \text{ lbs/ft}$$

where $x$ is the distance in feet from the left end of the beam.

Compute the moment about $B$. You can use methods from Lesson 10-1, or you can replace the load with a concentrated force acting though the centroid.

$$M_B = \quad$$
12. Question Details

An eight foot beam carries a distributed load given by

\[ w(x) = 40 - kx \text{ lbs/ft} \]

where \( k \) is an unknown constant.

If the total force on this beam is 250 pounds, what is the moment about \( B \) caused by the load? Use any methods. Be accurate to the nearest foot-pound.

13. Question Details

The figure below depicts a retaining wall in cross-section. On one side the wall holds back soil, which exerts a distributed load on the wall given by

\[ w(y) = 14000(2 - y) \text{ N/m} \]

where \( y \) is the distance in meters from the base of the wall.

A designer is asked to create an external support that attaches to the wall at the point \( B \). The attachment point must be chosen so that the soil load creates zero moment about \( B \). How far up the wall should the designer put the attachment point? Be accurate to two decimal places and include units.

**Warning!** Only 5 submits allowed. Don't guess.
A four meter beam is supported in the center and loaded as shown. The distributed load in the leftmost 1.5 meters is given by

\[ w(x) = 50x^2 \text{ N/m} \]

where \( x \) is the distance in meters from the left end of the beam.

Find the force, \( F \), so that the beam balances on its center point. Be accurate to one decimal place.

\[ F = \]