Solution:

1. Draw a picture of the situation.

2. A conical tank with its point at the bottom has its top 4 feet underwater. The top of the tank has a radius of 5 feet and the tank is 10 feet tall. Suppose the tank is filled with water weighing 62.5 lbs/cu ft. Find the work W done against gravity to pump all the water out of the tank over the top edge of the tank.

We have:

\[ W = \int_{\gamma}^{\gamma+\pi} e^{x} dx = x \pi \int_{\gamma}^{\gamma+\pi} \frac{e^{x}}{x} \, dx \]

\[ W = 1.2 \]

Solution:

(1) Draw a picture of the situation.

(2) Write down the integral for work W required to pump water to the ground until there is a depth of 6 feet of water in the tank.

(3) Evaluate the integral for work W.

(4) Evaluate the integral (optional).

For the constant k, first find the work W done extending the spring from a length of 2 meters to 1 meter. Then, calculate 12 joules of work are required to extend a spring from its length of 1 meter to 2 meters. Show all your work. Jumps into the right answer with minimum reasoning described on credit.
\( \int_{0}^{\pi/2} \frac{8}{1} n \int_{0}^{\pi/2} \frac{\rho g}{n} \left( \theta - \theta \right) \int_{0}^{1} d \theta = \int_{0}^{\pi/2} \frac{\rho g}{n} \int_{0}^{1} d \theta = M \)

\( (c) \) The required work is

\[ \frac{8}{1} \frac{x}{\theta} = \frac{x}{\theta} = (x) \frac{8}{1} = x \quad \text{Since} \quad \frac{8}{1} = x \]

\( (2) \)

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The center of mass is

\[ \frac{\bar{x}}{g} = \frac{V}{xW} = \bar{y} \]

\[ \bar{y} = \frac{V}{xW} = \bar{x} \]

(4)

The moment around the x-axis is

\[ \frac{\mathcal{E}_x}{\mathcal{E}_y} = \frac{1}{\bar{y}} \left( \bar{x} + \frac{\bar{z}}{\bar{y}} \right) = \frac{x}{\bar{y}} (\bar{x} - \bar{z}) \int \bar{y} = xW \]

(3)

The moment around the y-axis is

\[ \frac{\mathcal{E}_y}{\mathcal{E}_x} = \frac{1}{\bar{y}} \left( \bar{z} + \bar{x} + \bar{z} \right) = x \int (\bar{x} - \bar{z}) = xW \]

(2)

On the interval \( [0,1] \), \( \bar{x} \leq 0 \leq \bar{z} + \bar{x} \), hence:

\[ \bar{x} = \bar{z} = 0 \]

(1)

5. Consider the region \( R \) bounded by the graphs of the two graphs.

Solution (1)

Find the area of the region.

\[ \mathcal{A} = \int \left( x + \frac{x}{\bar{y}} \right) dx \]

(2)

Calculate the moment around the y-axis.

\[ \mathcal{E}_y = \int \left( x^2 + \frac{x}{\bar{y}} \right) dx \]

(3)

Calculate the moment around the x-axis.

\[ \mathcal{E}_x = \int \left( x + \frac{x}{\bar{y}} \right) dx \]

(4)

Finally, let's calculate the moment:

\[ \mathcal{E}_y = \int \left( x^2 + \frac{x}{\bar{y}} \right) dx \]

Since

\[ \mathcal{E}_y = \mathcal{A} \]

Then:

\[ \mathcal{E}_y = \mathcal{A} \]

(1)

Solution (2)

By the symmetry around the x-axis, \( \mathcal{E}_y = 0 \).

\[ \mathcal{E}_y = \int \left( x^2 + \frac{x}{\bar{y}} \right) dx \]

= \( (x) \left( \frac{x}{\bar{y}} + \frac{x}{\bar{y}} \right) \)

To obtain \( x = \bar{x} \), we calculate \( \mathcal{E}_y = 0 \).

4. Find the center of mass of the region bounded by the graphs of the two graphs.