December 3, 2024

Make a Gift Day

Today in History:

A Streetcar Named Desire opens on Broadway (1947)

Oberlin College was the first college to go Coed (1833)

Number of the Day: 684

684 = 2 x 2 x 3 x 3 x 19

684 is the sum of three consecutive cubes: $684 = 5^3 + 6^3 + 7^3$

Fun Fact:

The first non-human to win an Oscar was Mickey Mouse.

Quote of the Day:
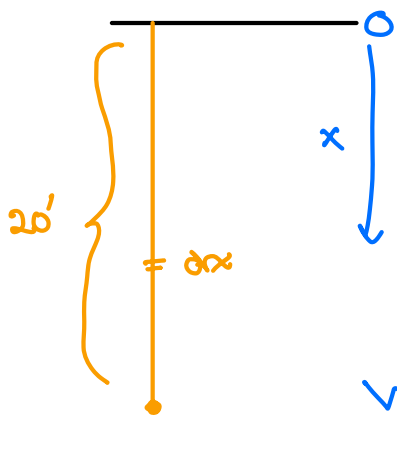
"Black holes are where God divided by zero."

- Steven Wright

Today's Weather:

Cloudy skies, high 31°.

Math 121 - Quiz #48

A 20-ft chain weighing 2 lb/ft is attached to a drum hung from the ceiling. The ceiling is high enough so that the free end of the chain does not touch the floor. How much work is required to wind the chain around the drum?
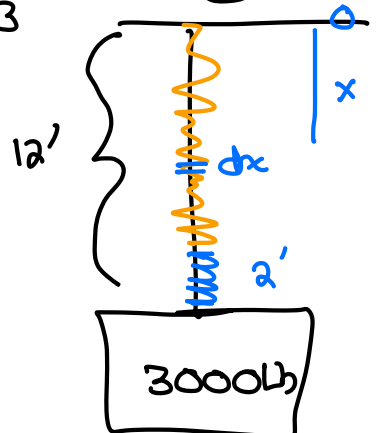
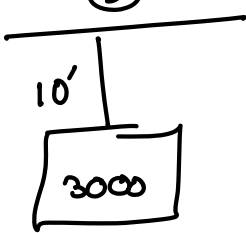$$W = F \cdot d$$

$$F = \text{WEIGHT} = 2\,dx$$

$$d = x$$

$$W = \int_0^{20} 2x\,dx = x^2 \Big|_0^{20} = 400 \text{ ft} \cdot \text{Lbs}$$

 # 3

(a)

(b)

12'

2'

3000lb

10'

3000

15 Lb/ft

$$W = W_E + W_{BLUE} + W_{ORANGE}$$

$$W_E = 3000\,Lb \cdot 10ft = 30{,}000 \text{ ft} \cdot \text{Lbs}$$

$$W_{BLUE} = (2)(15)(10ft) = 300 \text{ ft} \cdot \text{Lbs.}$$

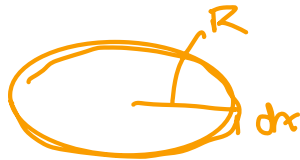$$W_{ORANGE} = \int_0^{10} 15x\,dx = \frac{15x^2}{2}\Big|_0^{10} = 750 \text{ ft} \cdot \text{lb}$$

$$W = 30,000 + 300 + 750 = 31,050 \text{ ft·lb}$$

A right circular conical tank of altitude 20 ft and radius of base 5 ft has its vertex at ground level and axis vertical. If the tank is full of orange marmalade weighting 100 lb/ft³, find the work done in pumping all the orange marmalade over the top of the tank.

$$W = F \cdot d$$
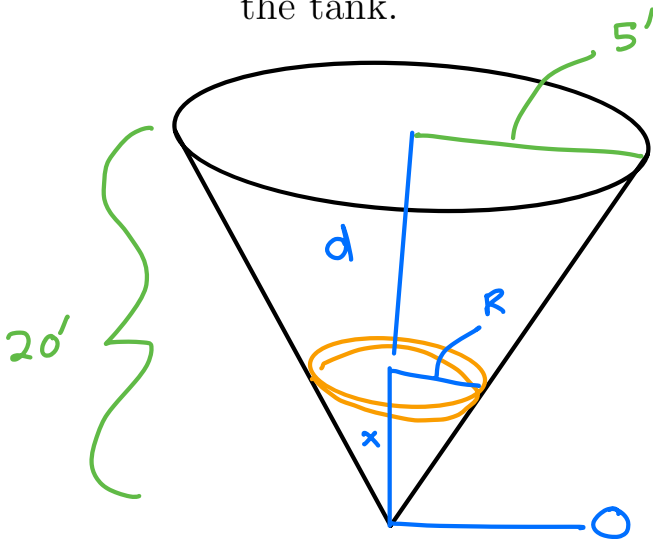
$$F = \text{WEIGHT} = \text{VOLUME} \cdot \text{DENSITY}$$
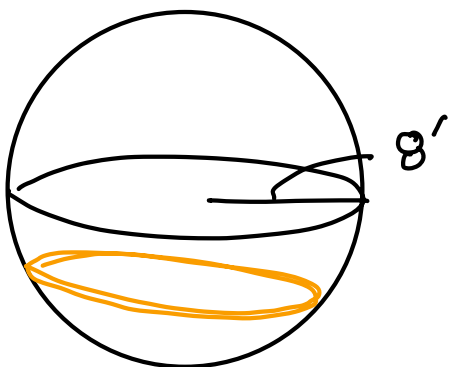
$$= \pi R^2 \, dx \, (100)$$

$$V = \pi R^2 \, dx$$

$$d + x = 20$$

$$d = 20 - x$$

$$\frac{R}{x} = \frac{5}{20} \qquad R = \frac{1}{4}x$$

$$W = \int_0^{20} \pi \left(\frac{1}{4}x\right)^2 (100)(20-x) \, dx$$

A spherical tank of radius 8 feet is half full of oil that weighs 50 pounds per cubic foot. Find the work required to pump oil out through a hole in the top of the tank.

$$W = F \cdot d$$

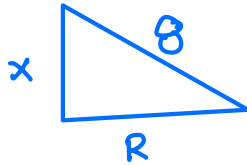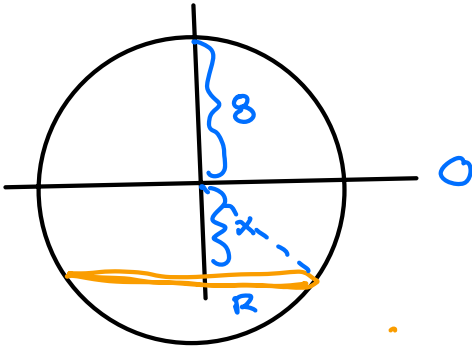$$F = \text{WEIGHT} = \text{VOLUME} \cdot \text{DENSITY}$$

$$d$$

$$V = \pi R^2 \, dx$$
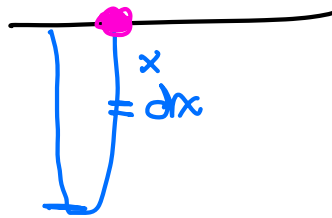
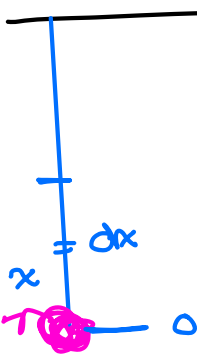$$F = (\pi R^2 \, dx)(50)$$

$$d = 8 + x$$

$$R^2 + x^2 = 64$$
$$R^2 = 64 - x^2$$

$$F = \pi(64 - x^2) \, dx \cdot 50$$

$$W = \int_0^8 \pi(64 - x^2)(50)(8 + x) \, dx$$

A 5-lb monkey is attached to the free end of a 20-ft hanging chain that weights 0.25 lb/ft. The monkey climbs the chain to the top. How much work does he do?

$$dist = 20 - 2x$$

$$W = W_{MONKEY} + W_{CHAIN}$$

$$W_{MONKEY} = 5 \, Lb \cdot 20 \, ft = 100 \, ft \cdot lbs$$

$$W_{CHAIN} = WEIGHT \cdot dist$$
$$\int_0^{10} (.25) \, dx \, (20 - 2x) = 25 \, ft \cdot Lbs$$

$$W = 100 + 25 = 125 \, ft \cdot Lbs$$