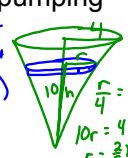Bonus Lesson 3 - More Work! $W = Fd$

1. A tank in the shape of a right circular cone is full of water. If the height is 10 feet and the radius is 4 feet, find the work done in pumping the water: 62.4 lbs/ft^3

$F = \text{weight of the slice}$
$F = \pi r^2 \Delta y \cdot \text{water weight}$
$F = \pi (\tfrac{2}{5}h)^2 \Delta y (62.4)$

$\frac{r}{4} = \frac{h}{10}$
$10r = 4h$
$r = \tfrac{2}{5}h$

a) Over the top edge

$$\frac{4\pi}{25} \, 62.4 \int_0^{10} h^2 (10-h)\, dh$$

b) To a height 10 ft above the top of the tank.

$$\frac{4\pi}{25} \, 62.4 \int_0^{10} h^2 (20-h)\, dh$$

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2. Find the work done pumping all the oil (50 lbs/ft³) over the edge of an upright cylindrical tank. Radius is 5 ft, height 10 ft, and the tank is full.
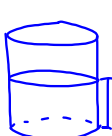
$F = \pi r^2 dh (50)$
$F = 1250\pi\, dh$

a) Find work to pump all water out over edge.

$$1250\pi \int_0^{10} (10-h)\, dh$$

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b) What if tank was ½ full?

$$1250\pi \int_0^{5} (10-h)\, dh$$

c) What if pump ⅘ of the water out?

$$1250\pi \int_8^{10} (10-h)\, dh$$

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3. A 20 ft chain weighing 5 lbs/ft lying on the ground. How much work is required to raise one end to a height of 20 ft so it is fully extended? $W = Fd$

Weight changing:
$F = 5\Delta y$

$$5 \int_0^{20} y \, dy$$