Section 6.4; work, day 2.

Notetaker's name _____ Class _____ Date Apr. 20. 09

§ 6.4 Work

The Weighty Chain

These notes were taken by a helpful student ... notice that they represent ~~class notes from day 2 on the topic.~~

part 1:

work to raise bucket

$w = \int_0^6 70(9.8)\,dx$

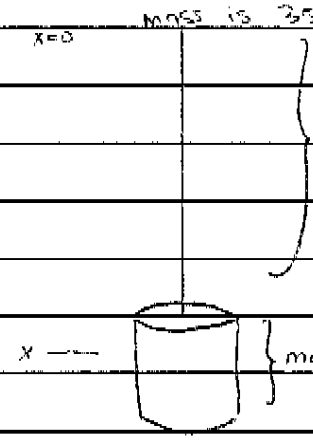
part 2:

work to raise bucket and chain

$w = \int_0^6 9.8(70 + 0.55x)\,dx$

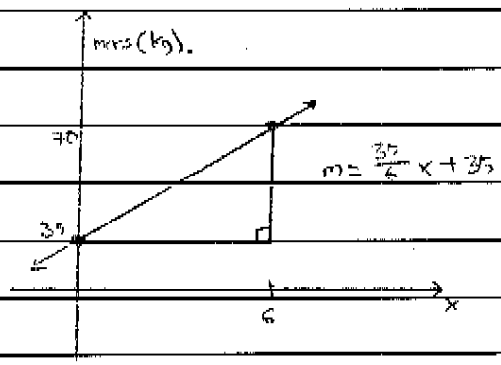
part 3:

work to raise leaky bucket and chain.



To find the mass at depth x

(6, 70) and (0, 35)



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(1)

$\Delta W = 9.8\left[\left(\frac{35}{6}x + 35\right) + 0.55x\right]\Delta x$

infinitesimal distance over which the force remains constant.

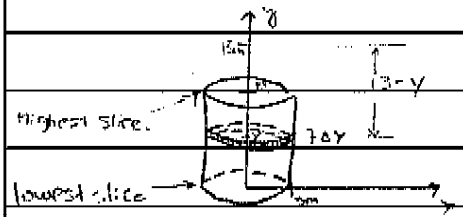
$W = \int_0^6 9.8\left(\frac{35}{6}x + 35 + 0.55x\right)dx = 9.8\left[\frac{35}{12}x^2 + 35x + \frac{0.55}{2}x^2\right]_0^6 =$

$= 9.8\left[\frac{35}{12}(36) + 35(6) + \frac{0.55}{2}(36)\right]$

$= 3184.02$

Ex: #5

How much work to empty the cylindrical tank out 3 m above the top.



$9.8 \cdot 1000 \cdot 9\pi\Delta y$

force on slice of water.

the slice then is moved a distance of: $13-y$

$\Delta W = 9000\,(9.8)\pi\,(13-y)\,\Delta y$

work required to move 1 slice of water.

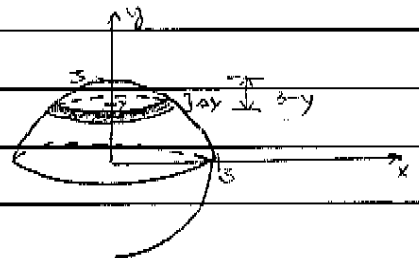
$W = \int_0^{10} 9000\,(9.8)\pi\,(13-y)\,dy$

where the slices live.

thickness of slice.

Ex: 6

How much work to empty the tank.



Area of the slice

$\pi x^2 = \pi\left(\sqrt{9-y^2}\right)^2$

$\Delta W = \pi\,(9-y^2)\,\Delta y \cdot (1000) \cdot 9.8\,(3-y)$

dist

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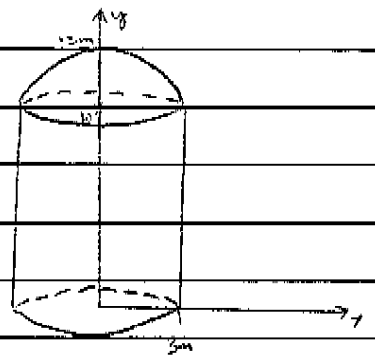
relate x and y: $x^2 + y^2 = 9$

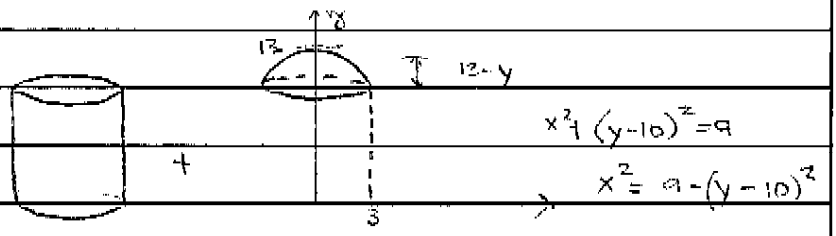
$x = \pm\sqrt{9 - y^2}$

$$\Rightarrow W = \int_0^3 1000\,(9.8)\,(9 - y^2)\,\pi\,(3 - y)\,dy$$

(gravity; distance; density of H_2O; radius)

Ex:7 How much work to empty the silo?





$x^2 + (y-10)^2 = 9$

$x^2 = 9 - (y-10)^2$

$$W_{bot.} = \int_0^{10} 1000\,(9.8)\,\pi\,(13 - y)\,dy$$

$$W_{top} = \int_{10}^{13} 1000\,(9.8)\,\pi\,(13 - y)\left(9 - (y-10)^2\right)\,dy$$

Let $u = y - 10$

$$W = \int_0^3 1000\,(9.8)\,\pi\,(9 - y^2)\,(3 - y)\,dy.$$