

#13 Work is 18 from 0 to 4
Find the work done stretching
from 4 to 7. $\leftarrow$
"three additional inches"

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Note: 18 is in ft pounds, but all distances are in inches

so $(18)(12) = 216$ units of work using inches.

Note: I will NOT mix units on the exam.

$$W = \int_0^4 kx = 216$$

$$\Rightarrow \left[\frac{kx^2}{2} \right]_0^4 = 216$$

$$\Rightarrow \left[\frac{k(4)^2}{2} \right] - (0) = 216$$

$$\Rightarrow k(8) = 216$$

$$\Rightarrow k = 27$$

$$\Rightarrow \underline{\underline{F(x) = 27x}}$$

$$\text{so } W = \int_a^b F(x) dx$$

$$= \int_4^7 27x dx$$

$$= \left[\frac{27x^2}{2} \right]_4^7$$

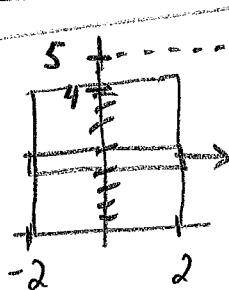
$$= \left[\left(\frac{27(7)^2}{2} \right) - \left(\frac{27(4)^2}{2} \right) \right]$$

$$= \frac{1323}{2} - \frac{432}{2}$$

$$= \boxed{\frac{891}{2} \text{ units}}$$

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Side View



ground level

radius = 2
thickness = 1

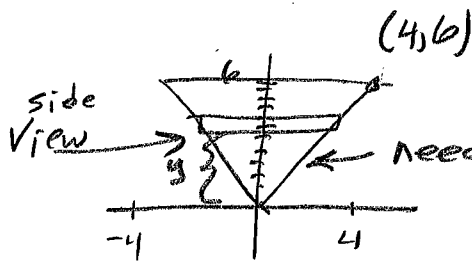
$\delta = 9800$

Note!

$$W = \int_a^b (\text{density})(\text{radius})^2 (\text{thickness})(\text{distance})$$

$$\text{so } W = (9800) \int_0^4 (5-y)(2)^2 dy$$

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#23



assume density = δ
need equation of this line

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slope = $\frac{6}{4}$ $\Rightarrow y = \frac{6}{4}x$

volume y-int = 0 $\Rightarrow y = \frac{3}{2}x$

$\Rightarrow \frac{2}{3}y = x$ ← Function of y

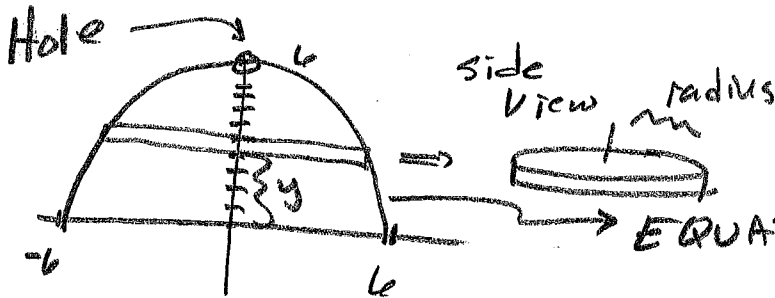
$W = \text{density} \int_c^d (\text{distance})(\text{radius})^2 (\text{thickness})$

$$W = \delta \int_0^6 (6-y) \left(\frac{2}{3}y\right)^2 dy$$

#25 OMIT THIS ITEM (Filling the tank)

do instead this: For the same tank, assume it is Full of a liquid with density δ .

Find the work done emptying the liquid through a hole at the top (see diagram)



EQUATION: $x^2 + y^2 = 6^2$
 $\Rightarrow x^2 + y^2 = 36$

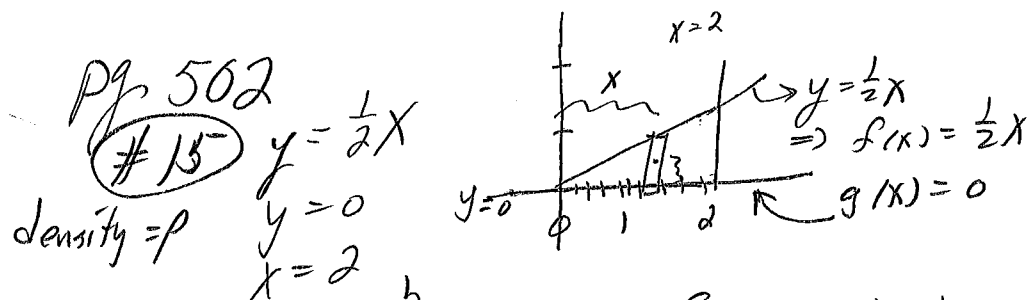
Function of y

$\Rightarrow x = \pm \sqrt{36 - y^2}$

choose the positive for Quadrant 1

$W = \text{density} \int_c^d (\text{distance})(\text{radius})^2 (\text{thickness})$

$$W = \delta \int_0^6 (6-y) (\sqrt{36-y^2})^2 dy$$



so $M_x = \rho \int_a^b (f(x) - g(x)) \left(\frac{f(x) + g(x)}{2} \right) dx$

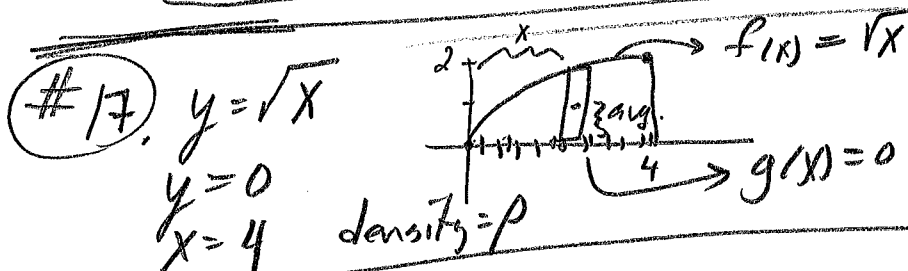
$= \rho \int_0^2 \left(\frac{1}{2}x - 0 \right) \left(\frac{\frac{1}{2}x + 0}{2} \right) dx$

$M_y = \rho \int_a^b (f(x) - g(x)) (x) dx$

$= \rho \int_0^2 \left(\frac{1}{2}x - 0 \right) (x) dx$

$M = \rho \int_a^b (f(x) - g(x)) dx$

$= \rho \int_0^2 \left(\frac{1}{2}x - 0 \right) dx$

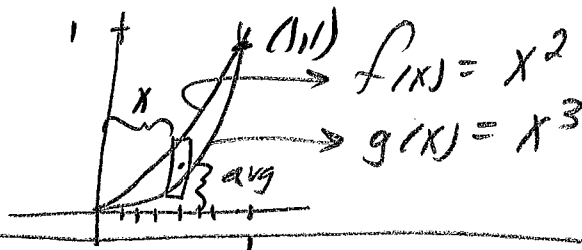


so $M_x = \rho \int_0^4 (\sqrt{x} - 0) \left(\frac{\sqrt{x} + 0}{2} \right) dx$

$M_y = \rho \int_0^4 (\sqrt{x} - 0) (x) dx$

$M = \rho \int_0^4 (\sqrt{x} - 0) dx$

#19 $y = x^2$
density $y = x^3$
 $= \rho$



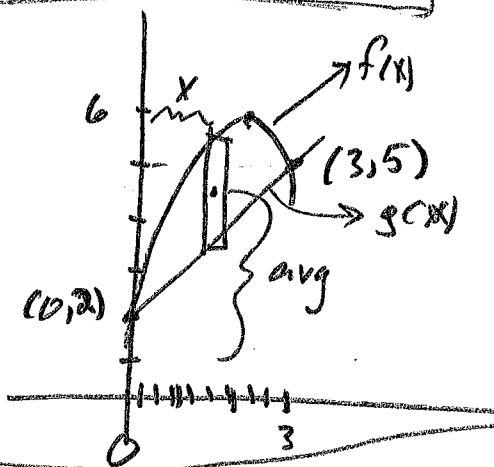
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$$M_x = \rho \int_0^1 (x^2 - x^3) \left(\frac{x^2 + x^3}{2} \right) dx$$

$$M_y = \rho \int_0^1 (x^2 - x^3) (x) dx$$

$$m = \rho \int_0^1 (x^2 - x^3) dx$$

#21 $y = -x^2 + 4x + 2$
 $y = x + 2$
density $= \rho$



So

$$M_x = \rho \int_0^3 ((-x^2 + 4x + 2) - (x + 2)) \left(\frac{(-x^2 + 4x + 2) + (x + 2)}{2} \right) dx$$

$$M_y = \rho \int_0^3 ((-x^2 + 4x + 2) - (x + 2)) (x) dx$$

$$m = \rho \int_0^3 ((-x^2 + 4x + 2) - (x + 2)) dx$$