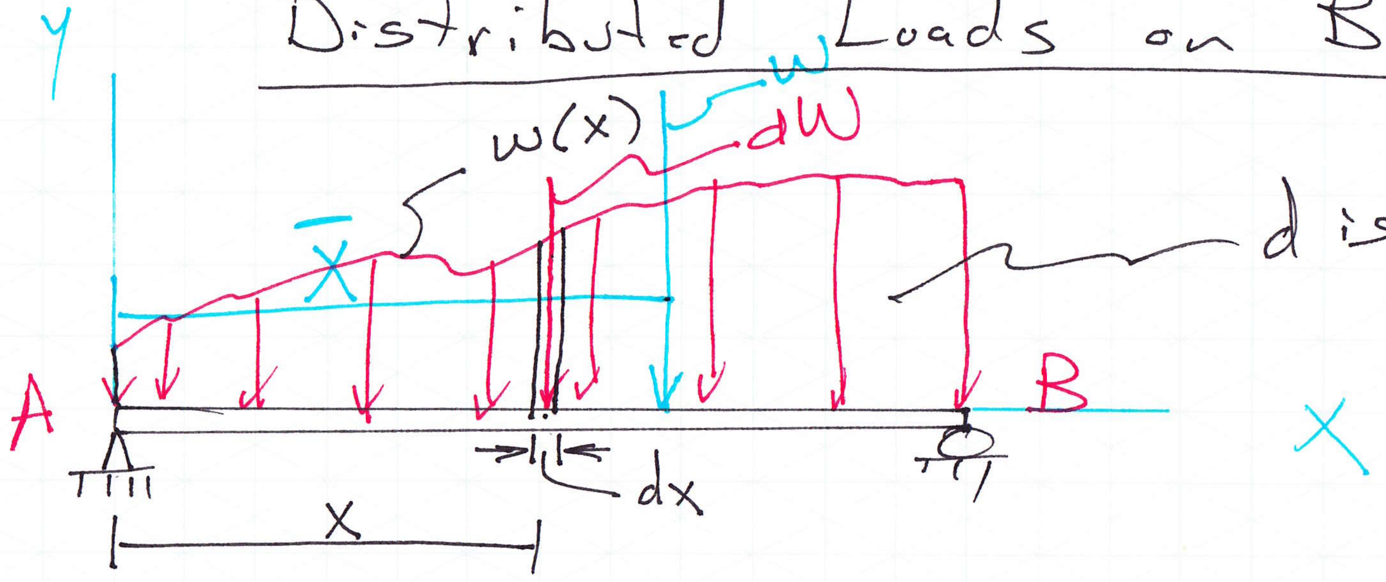
Distributed Loads on Beams



distributed Load

lbs/ft

N/m

$$dW = w(x)\,dx$$

w as a function of x
it is not w times x

$$W = \int_0^L w(x)\,dx$$

$$W = \int_0^L w\,dx$$

Area under the load diagram

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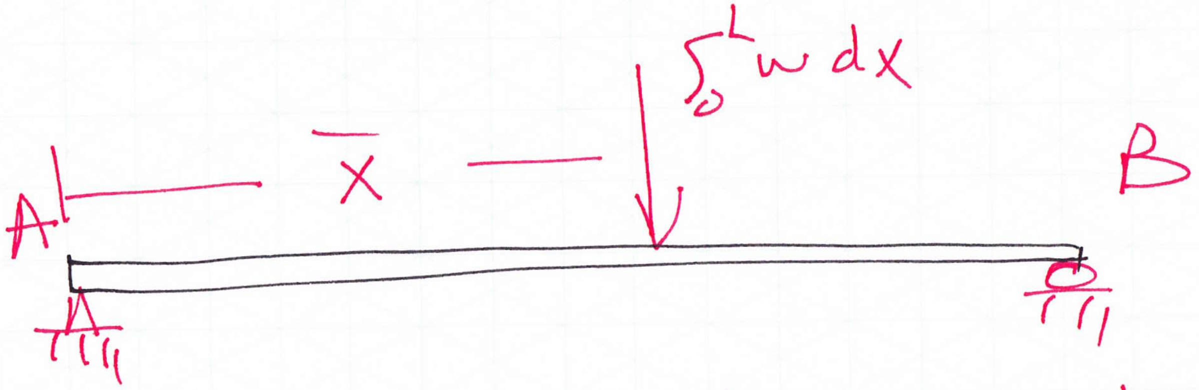
Take moments about A

$$W \bar{x} = \int_0^L x w \, dx$$

$$\bar{x} = \frac{\int_0^L x w \, dx}{W} = \frac{\int_0^L x w \, dx}{\int_0^L w \, dx}$$



Completely Equivalent as Far as calculating the External Reactions

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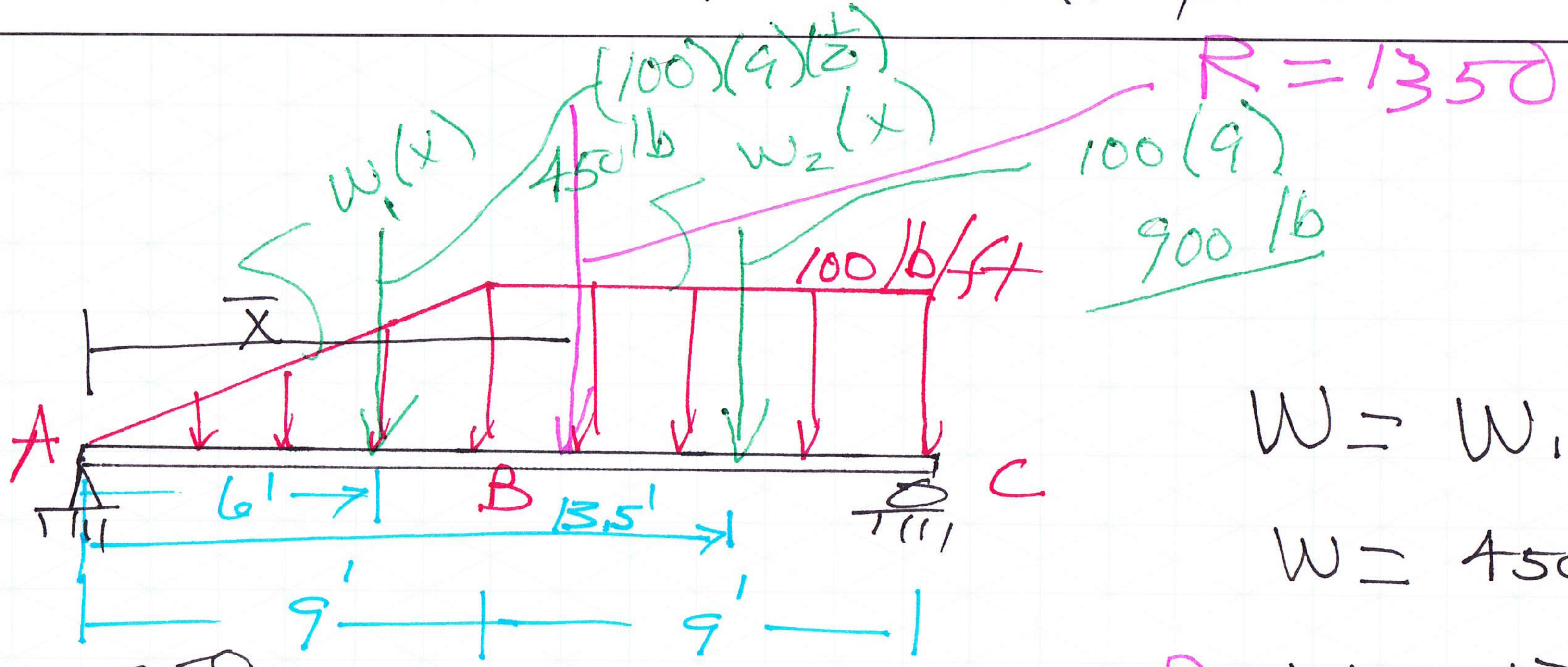


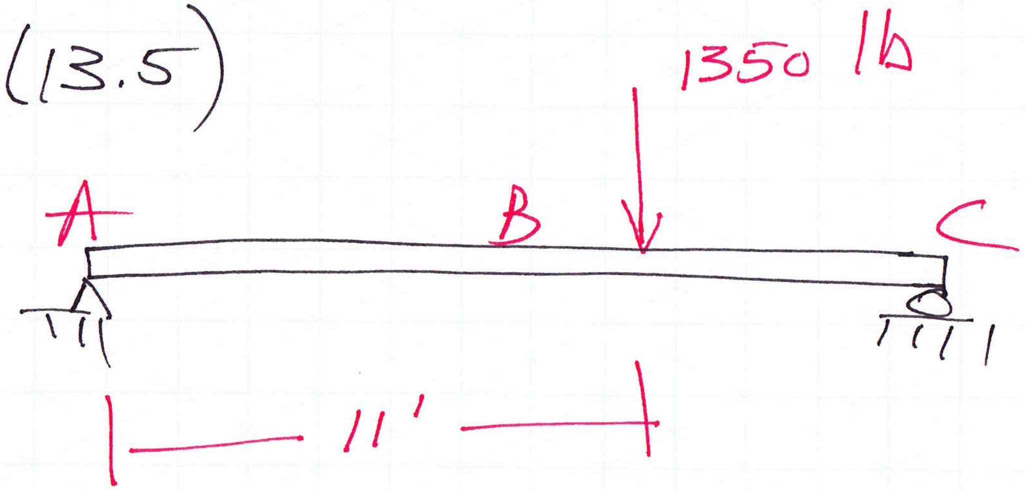
$$W = W_1 + W_2$$

$$W = 450 + 900$$

$$R = W = 1350 \text{ lb}$$

$$\overset{1350}{\cancel{R}}\ \bar{X} = 450(6) + 900(13.5)$$

$$\bar{X} = 11 \text{ ft}$$



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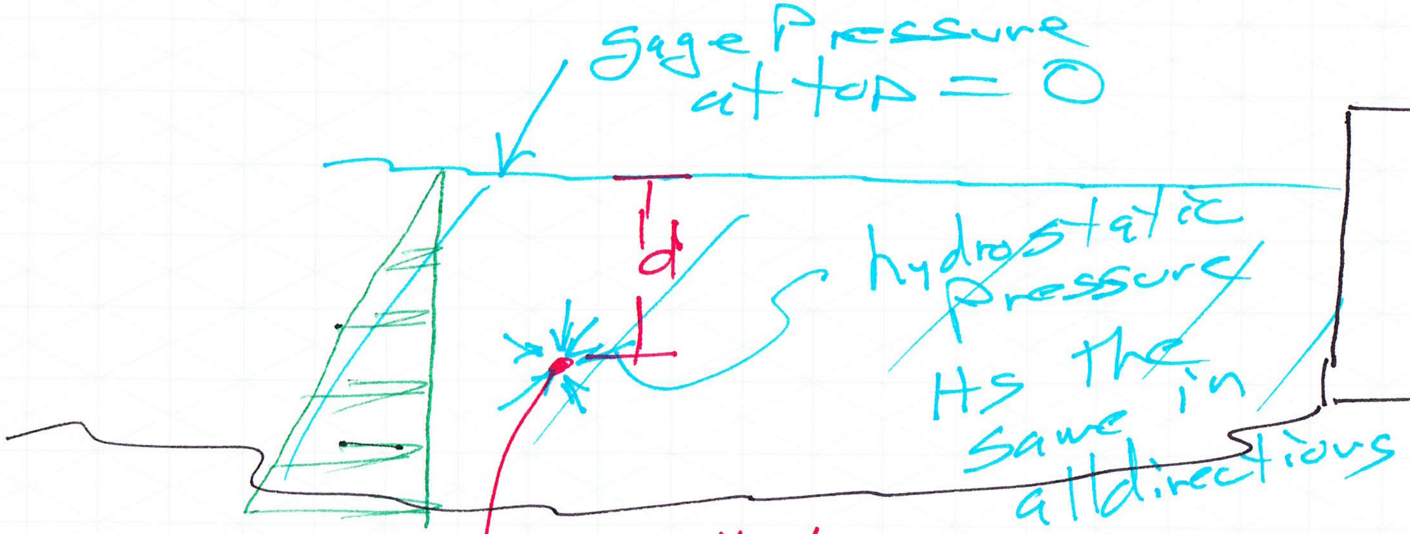
Forces on Submerged Surfaces



Absolute Pressure

$14.7 \frac{lb}{in^2}$

Gage Pressure

$\gamma_{water} = 62.4 \ lb/ft^3$

$$p = \underbrace{\gamma}_{weight} d = \underbrace{\rho}_{mass} g d$$

US – γd

Metric – $\rho g d$

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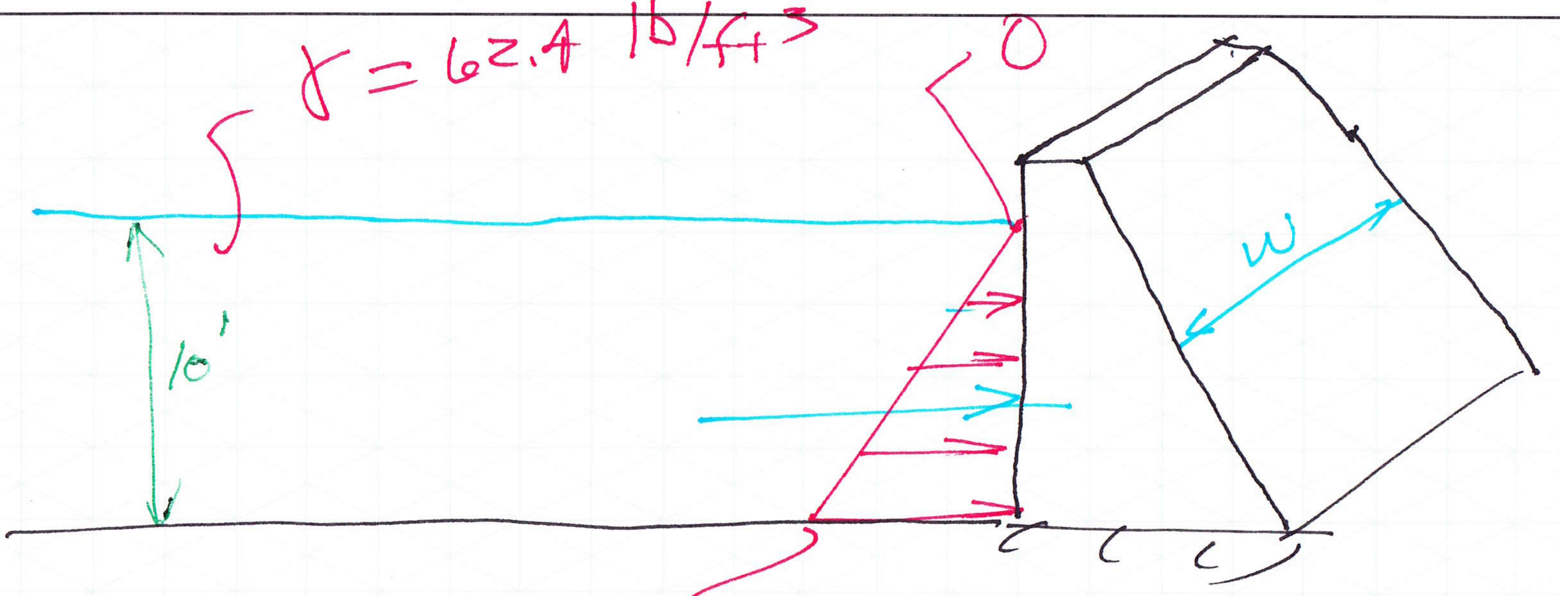
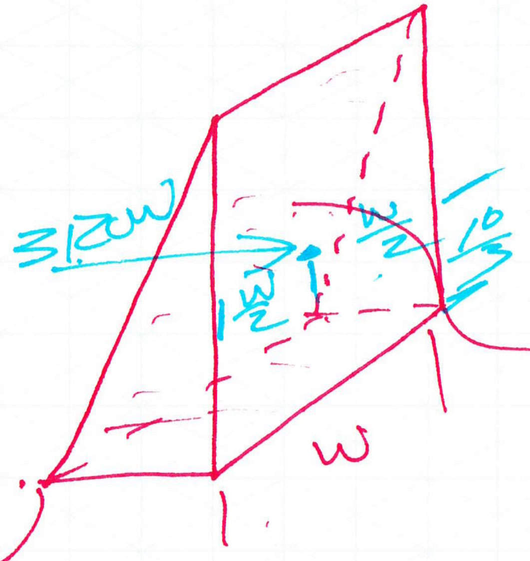


$(62.4)(10)$
624 lb/ft^2



624 lb/ft

$$\text{Volume} = \frac{1}{2}(624)(10)(w)$$

$$\text{Volume} = 3120\,w$$

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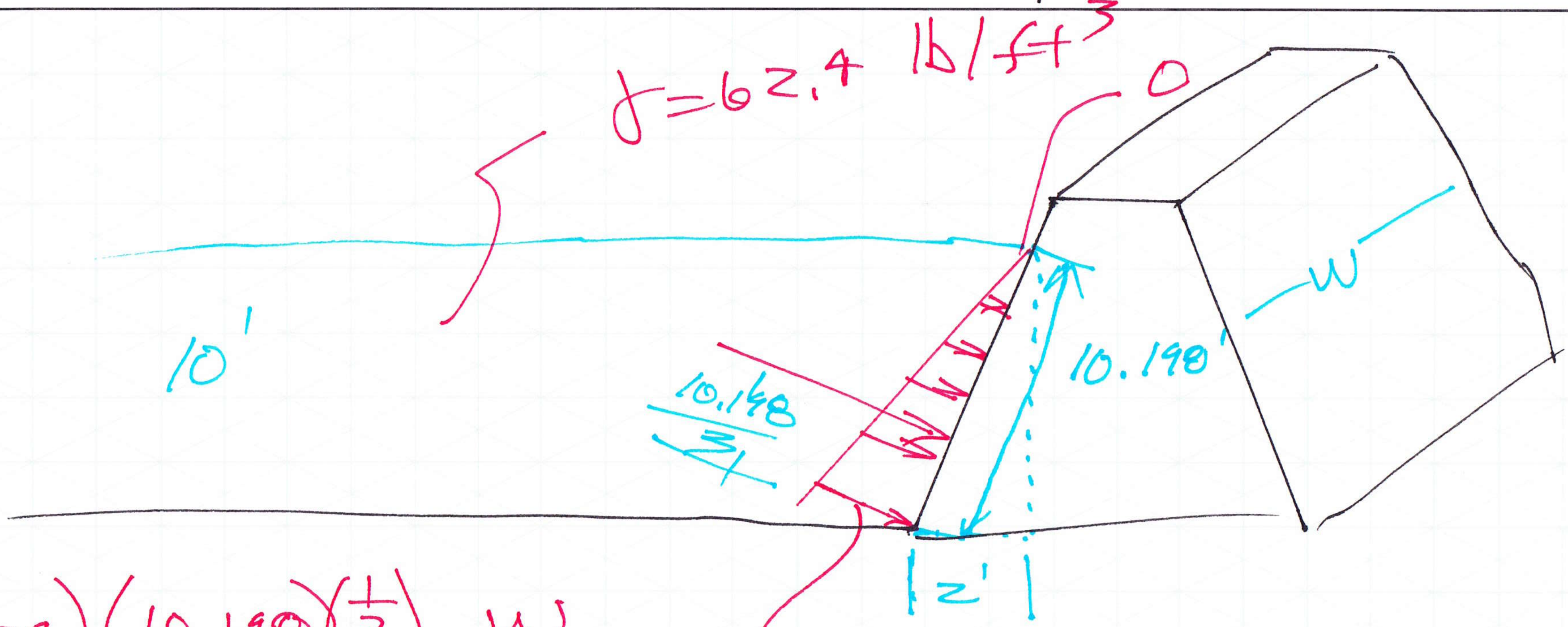

$(624)(10.198)(\frac{1}{2})$ w

3,182 w

(62.4)(10)

624 lb/ft²

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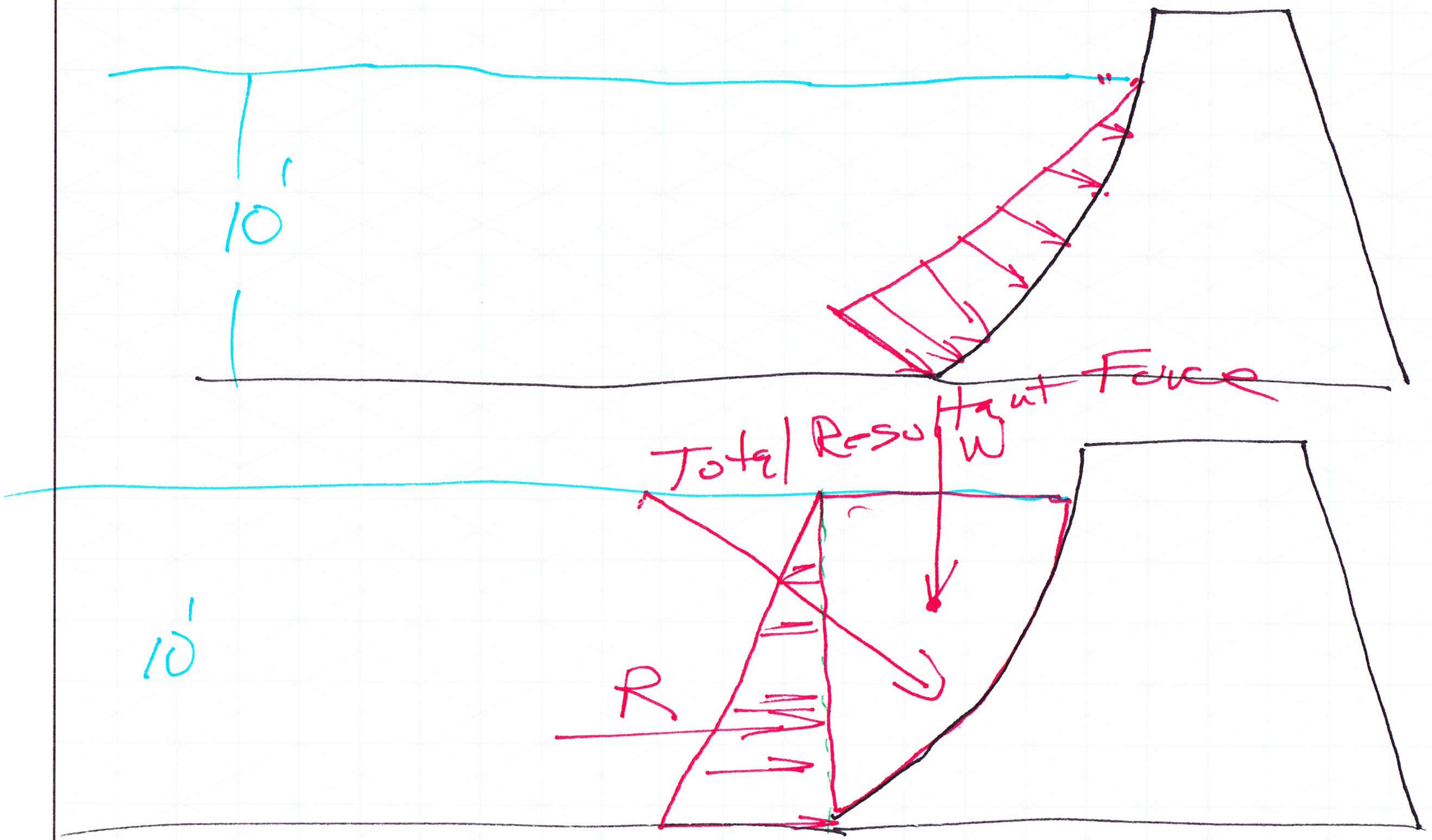

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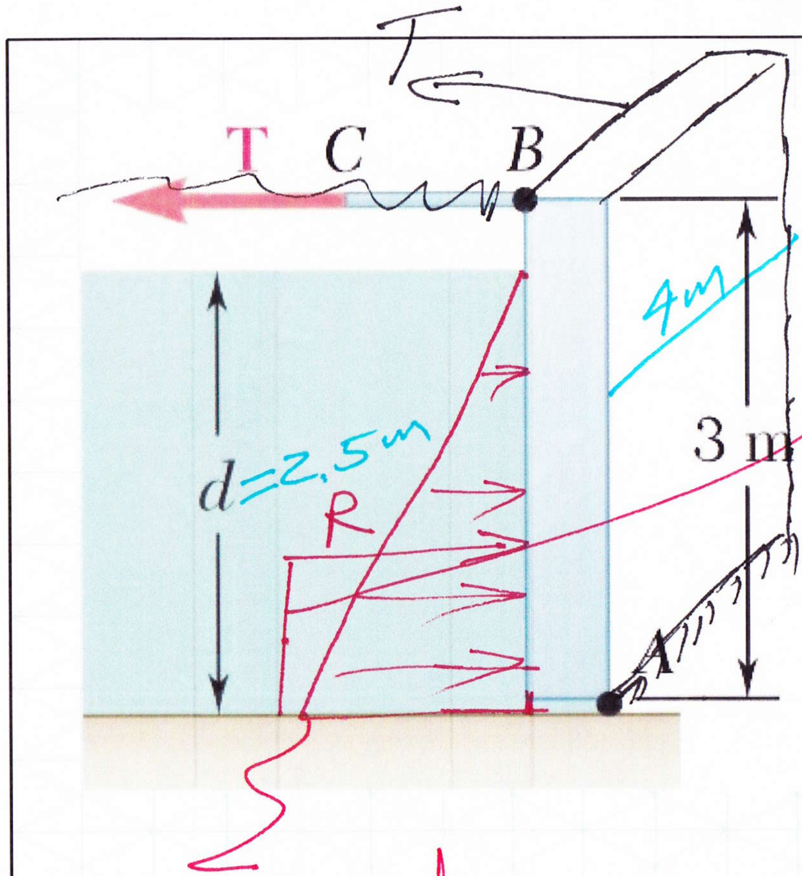
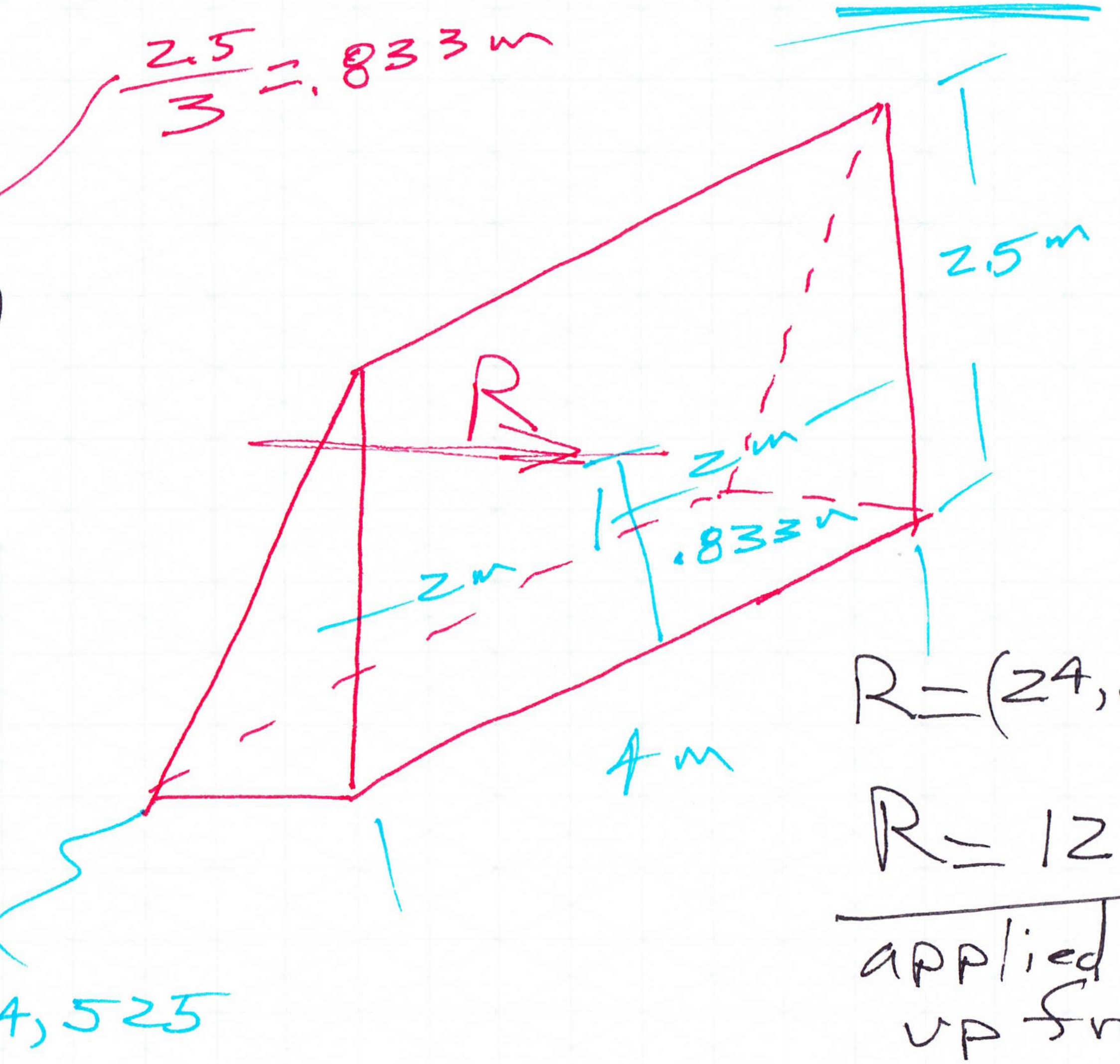
The 3 x 4 m side AB of a tank is hinged at the bottom with a pin at A and it is held in place by a single thin rod at B. The tank is filled with water such that it has a depth of 2.5 m. Determine the force in the thin rod at B. Assume that the density of water is 1000 kg/m^3



$\rho g d$

$(1000)(9.81)(2.5)$

24,525 N/m^2



$R = (24{,}525)(2.5)(\frac{1}{2})(4)$

$R = 122{,}624$ N

applied .833 m up from the bottom

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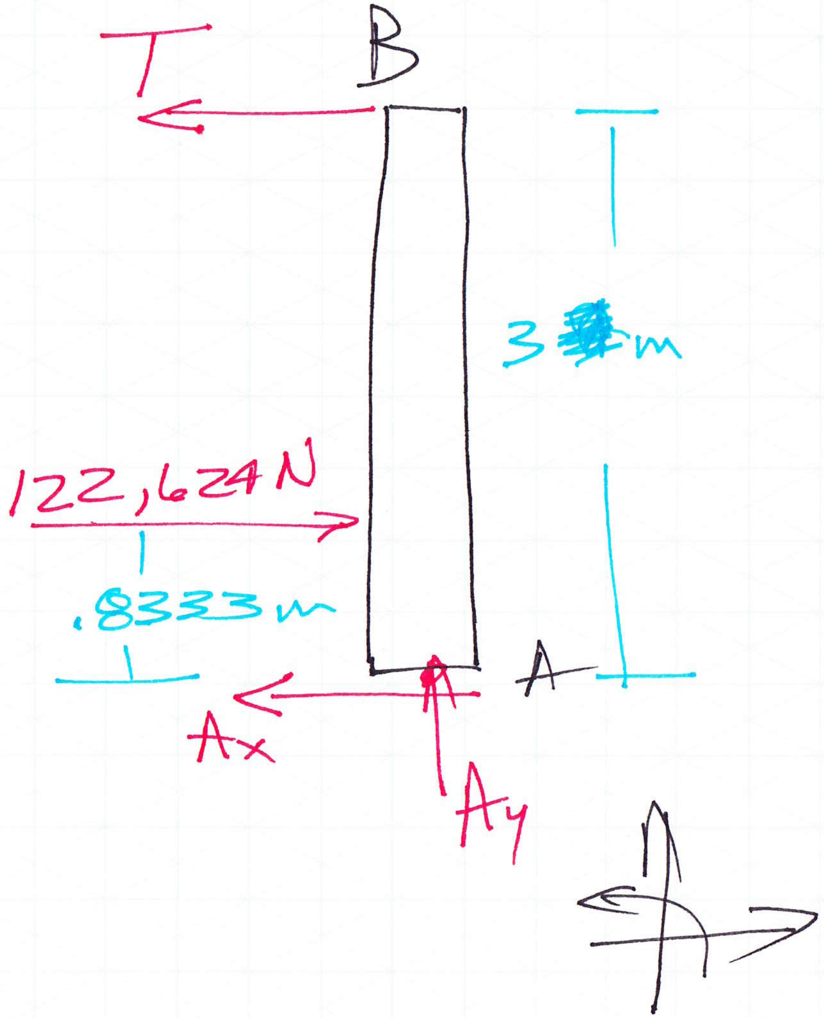

$$\circlearrowleft + \sum M_A = 0$$

$$+3T - 122{,}624(.833) = 0$$

$$\underline{T = 34{,}049 \text{ N}}$$

$$\xrightarrow{+} \sum F_x = 0$$

$$-34{,}049 + 122{,}624 - A_x = 0$$

$$\underline{A_x = 119{,}175 \text{ N}}$$

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