UNIVERSITY OF TORONTO
FACULTY OF APPLIED SCIENCE & ENGINEERING

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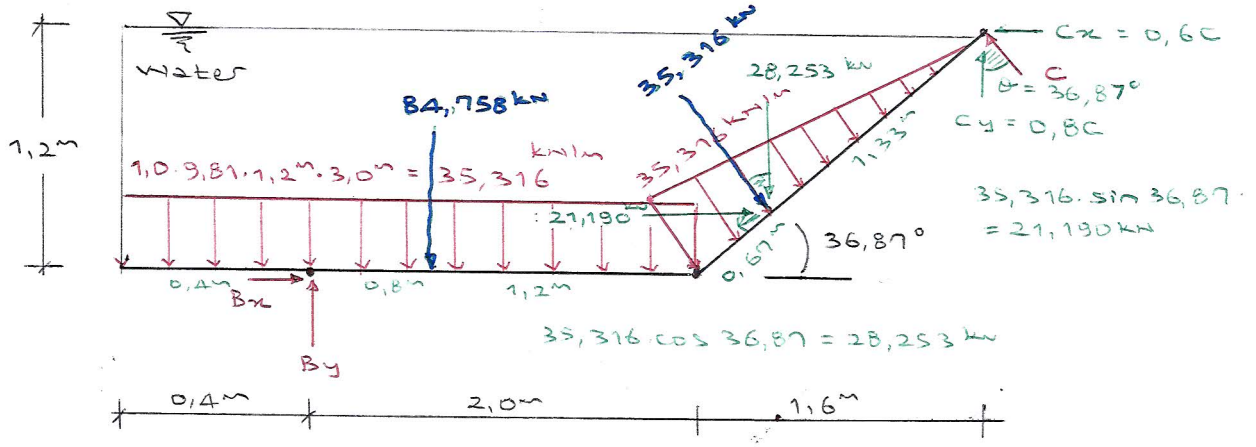
COURSE NO.	COURSE NAME	2
CIV100F	Mechanics	student #

Problem Set 10

Solution

1.



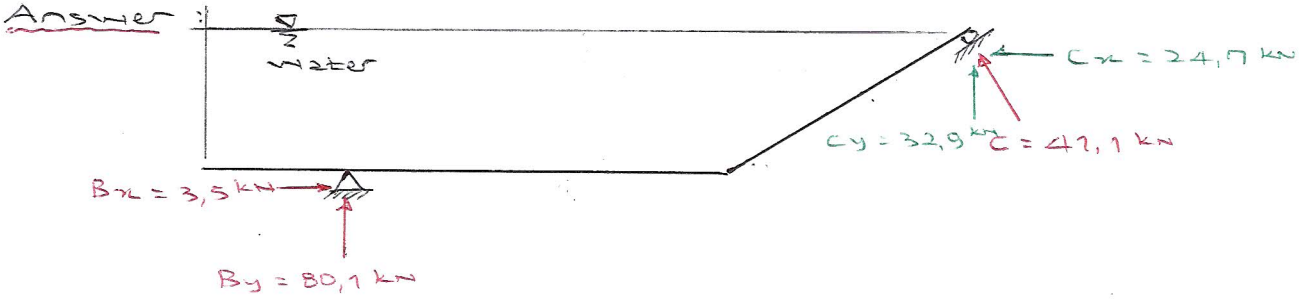
- This is in fact a beam problem.
- $\Sigma M_B = 0 \Rightarrow 0,8C \cdot 3,6 + 0,6C \cdot 1,2 - 84,758 \cdot 0,8 - 21,190 \cdot (0,67 \sin 36,87) - 28,253 \cdot (2,0 + 0,67 \cdot \cos 36,87) = 0 \Rightarrow C = 41,1 \text{ kN}$

  $C_x = 24,7 \text{ kN}$

  $C_y = 32,9 \text{ kN}$

- $\Sigma F_y = 0 \Rightarrow B_y + C_y = 84,758 + 28,253 \Rightarrow B_y = 80,1 \text{ kN}$
- $\Sigma F_x = 0 \Rightarrow B_x + 21,190 - C_x = 0 \Rightarrow B_x = 3,5 \text{ kN}$

Answer:

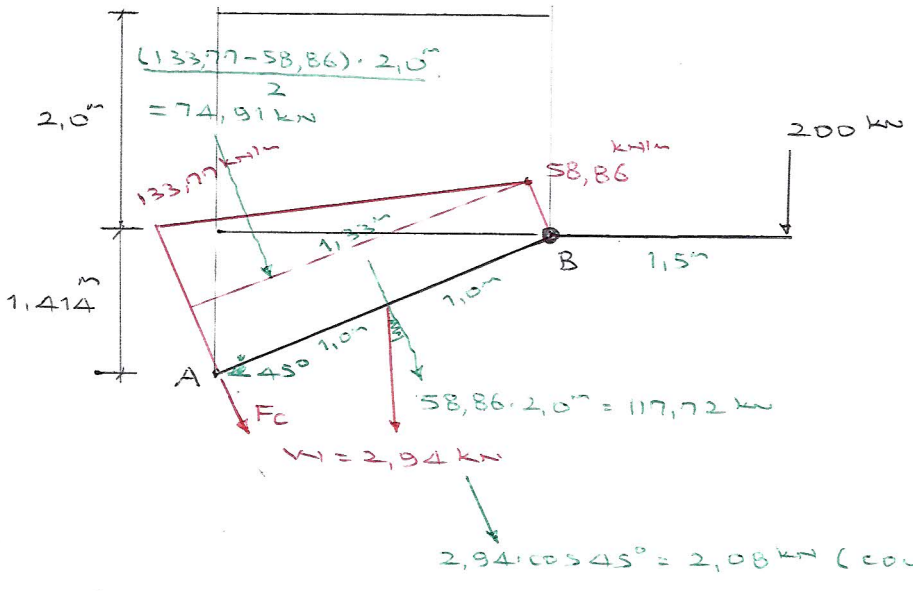


2. First, draw a large FBD. (only include the gate)

Distributed load at B : $1,0 \cdot 9,81 \cdot 2,0^m \cdot 3,0^m = 58,86\ kN/m$

C : $58,86 + 1,8 \cdot 9,81 \cdot 1,414 \cdot 3,0^m = 133,77\ kN/m$

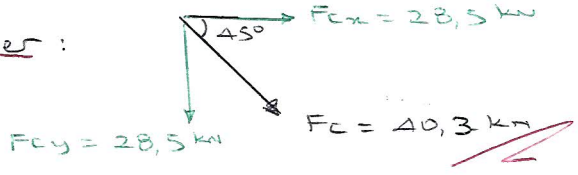
Gate weight : $W = 0,3 \cdot 9,81 = 2,94\ kN$



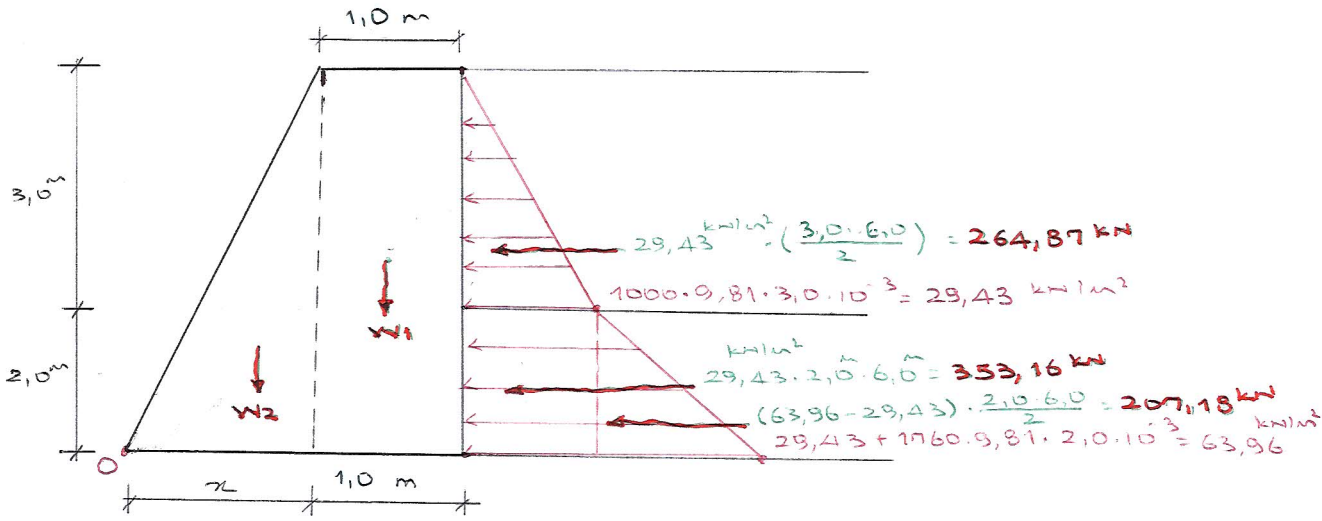
- $\Sigma M_B = 0 \Rightarrow (117,72 + 2,08)^{kN} \cdot 1,0^m + 74,91^{kN} \cdot 1,33^m - 200^{kN} \cdot 1,5^m + F_C^{kN} \cdot 2,0^m = 0$

  $\Rightarrow F_C = 40,3\ kN$

- Answer :



3-



- Determine the force components due to water and silt. (see the figure above)
- Determine the self-weight of the dam.

$W_1 = \rho \cdot g \cdot V_1 = 2500 \cdot 9,81 \cdot (1,0 \cdot 5,0 \cdot 6,0)\,m^3 \cdot 10^{-3} = 735,75\ kN$

$W_2 = \rho \cdot g \cdot V_2 = 2500 \cdot 9,81 \cdot (x \cdot 5,0 \cdot 6,0/2) \cdot 10^{-3} = 367,88x\ kN$

i-) $\Sigma M_{A\,OUT} = 264,87\,kN \cdot (1,0+2,0)\,m + 353,16\,kN \cdot (1,0)\,m + 207,18\,kN \cdot \left(\frac{2,0}{3}\right)m$

$= 1285,9\ kNm$

ii-) $\Sigma M_{A\,RESIST} = 735,75 \cdot (0,5+x)\,m + 367,88 \cdot x \cdot \left(\frac{2x}{3}\right)$

$= 245,25 \cdot x^2 + 735,75x + 367,88$

iii-) $\Sigma M_{OUT} = \Sigma M_{A\,RESIST} \Rightarrow 245,25 \cdot x^2 + 735,75x - 918,02 = 0$

$\Rightarrow x = 0,95\,m$ or ~~$x = -3,95\,m$~~

$\Rightarrow d = 1,0\,m + x = \mathbf{1,95\,m}$

~THE END~