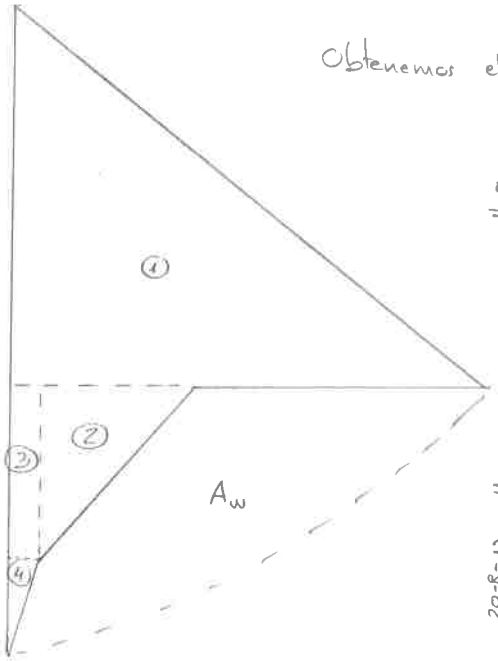
RESOLUCIÓN EJERCICIO

a)

1º Debemos determinar el área del material deslizante A_w

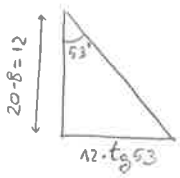
Obtenemos el área total y le restamos ①, ②, ③ y ④



A_{TOTAL}

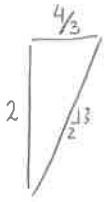
$360° \text{ — } \pi r^2 \Rightarrow x = 185\ m^2 = A_{TOTAL}$
$53° \text{ — } x$

A_1



$A_1 = \frac{1}{2} 12 \cdot 12 \, tg\, 53 = 95{,}54\ m^2$

A_4

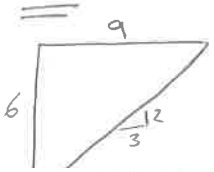


$A_4 = \frac{1}{2} \cdot 2 \cdot \frac{4}{3} = \frac{4}{3} m^2$

A_3

$A_3 = 6 \cdot \frac{4}{3} = 8 m^2$

A_2



$A_2 = \frac{1}{2} 6 \cdot 9 = 27 m^2$

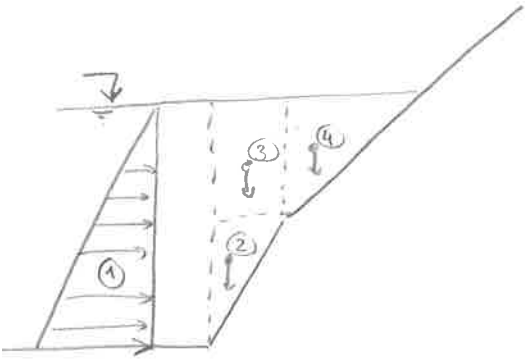
A_{TOTAL}

$A_w = A_T - A_1 - A_2 - A_3 - A_4 = 53{,}13\ m^2$

W

$Q = 80 \times 5{,}59 = 447{,}3\ KN/m$ @ $\frac{5{,}59}{2} + 9 + \frac{4}{3} = 13{,}13\ m$.

3º Hallamos los empujes del agua. Los dividimos para simplificar



$E_{w_1} = \frac{1}{2} \cdot 4^2 \cdot 10 = 80 \text{ kN/m}$ @ $20 - \frac{2}{3}4 = 17{,}3 \text{ m}$

$E_{w_2} = \frac{1}{2} 2 \cdot \frac{4}{3} \cdot 10 = 13{,}3 \text{ kN/m}$ @ $\frac{1}{3}\frac{4}{3} = \frac{4}{9} \text{ m}$

$E_{w_3} = 2 \cdot \frac{4}{3} \cdot 10 = 26{,}6 \text{ kN/m}$ @ $\frac{1}{2}\frac{4}{3} = \frac{2}{3} \text{ m}$

$E_{w_4} = \frac{1}{2} 3 \cdot 2 \cdot 10 = 30 \text{ kN/m}$ @ $\frac{1}{3}3 + \frac{4}{3} = \frac{7}{3} \text{ m}$

14º Planteamos el F.S y resolvemos:

$$FS = \frac{\sum M_{est}}{\sum M_{mov}}$$

$\sum M_{est} = C_u \cdot L \cdot R = 185 \cdot 45 \cdot 20 = 16.650{,}44 \text{ kNm}$

$L \rightarrow \quad 360^\circ - 2\pi r$
$53 - x$
$\downarrow$
$L = x = 18{,}5 \text{ m}$

$\sum M_{mov} = M_{w_0} + M_q + M_{w_{H_2O}}$

$M_w = 1062{,}53 \cdot 8 = 8500{,}24 \text{ kNm}$

$M_q = 447{,}3 \cdot 13{,}13 = 5873 \text{ kNm}$

$M_{w_{H_2O}} = -M_{w_1} + M_{w_2} + M_{w_3} + M_{w_4} = -80 \cdot 17{,}3 + 13{,}3 \cdot \frac{4}{9} + 26{,}6 \cdot \frac{2}{3} + 30 \cdot \frac{7}{3} = -1290{,}36 \text{ kNm}$
(¡OJO SIGNO!!)

$\sum M_{mov} = 13082{,}9 \text{ kNm}$

$FS = 1{,}27$

b) Para obtener la F debemos añadir el momento que nos introduce