Your Name: VIJAYANAND MURALIDHARAN

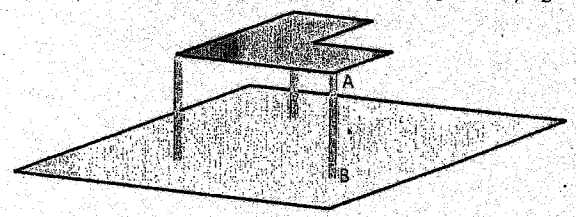
ENGRD 202 Quiz 4

Section day & time: _____

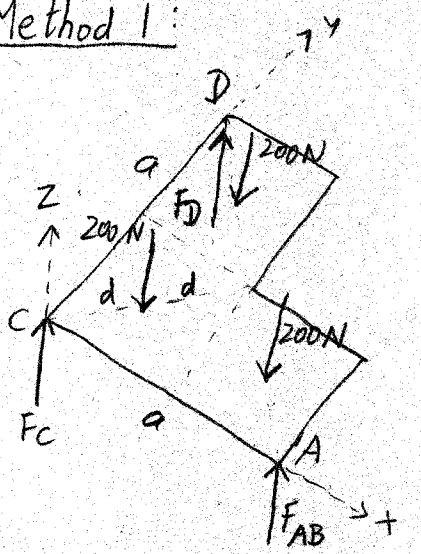
March 12, 2003

TA name & section #: _____

7) (7 pts) An 80 kg square table has one quarter cut away. The remaining 60 kg are supported on 3 massless legs on a level floor. Use g=10N/kg. What is the load carried by leg AB?



Method 1:



Symmetry $\Rightarrow F_A = F_D$

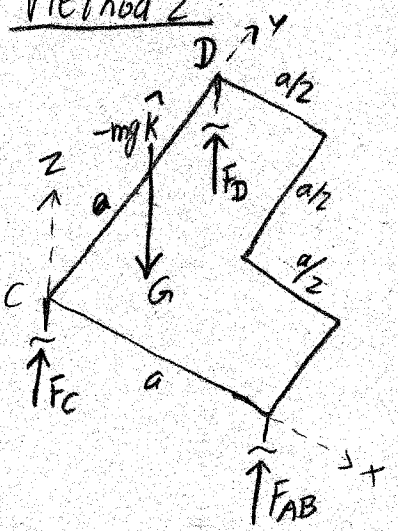
$\Sigma M_{/AD} = 0 : (200N)\,d = F_C(2d)$

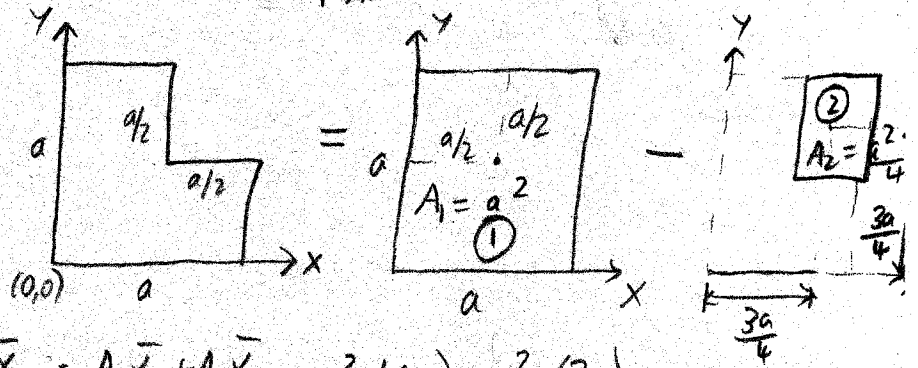
$\Rightarrow F_C = 100N$

$\Sigma F_Z = 0 = F_C + 2F_{AB} - 600N$

$\Rightarrow \boxed{F_{AB} = 250N}$

Method 2:





$$\bar{X}_{CM} = \frac{A_1\bar{X}_1 + A_2\bar{X}_2}{A_1 + A_2} = \frac{a^2\left(\frac{a}{2}\right) - \frac{a^2}{4}\left(\frac{3a}{4}\right)}{a^2 - \frac{a^2}{4}} = \frac{5a}{12} = \bar{Y}_{CM}$$

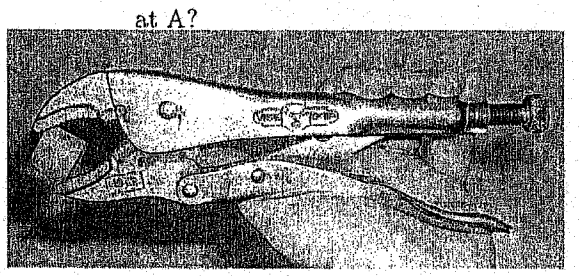
$\Sigma M_{/CD} = 0$:

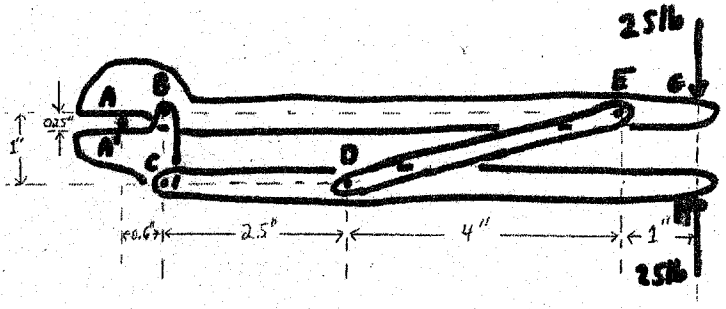
$mg \times \left(\frac{5a}{12}\right) - F_{AB} \times (a) = 0$

$\Rightarrow F_{AB} = \frac{5mg}{12} = \frac{5}{12}(600N) = 250N$

$\boxed{F_{AB} = 250N}$

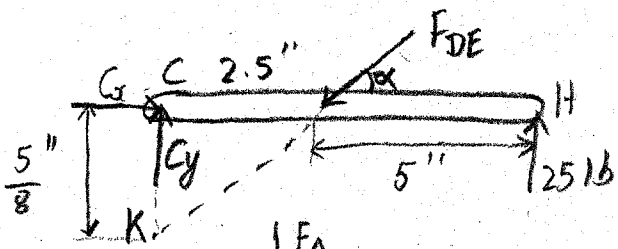
8) (10 pts) For simplicity the vice grips shown in the photo are approximated as in the drawing. Round piece AA' is gripped between the upper handle/jaw ABEG and the lower jaw A'BC. The upper handle ABEG is pinned to the lower jaw A'BC at B. Handle CDH is pinned to the lower jaw at C and to the bar DE at D. Bar DE is pinned to the upper handle ABEG at E. The 25 pound forces act at G and H as shown. Dimensions are as shown. What is the magnitude of the force at A?



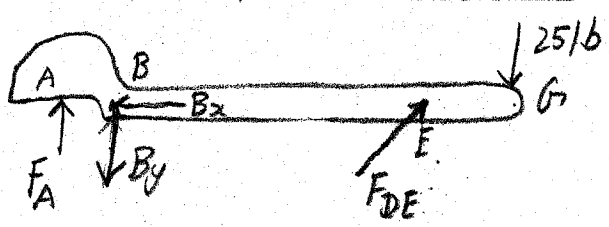


Solution:

FBD of Lower handle CDH:



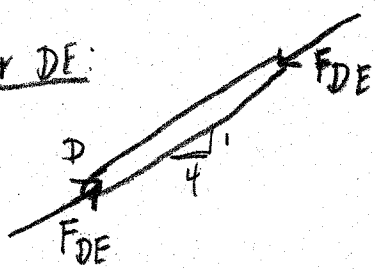
FBD of upper handle ABEG



Piece AA':

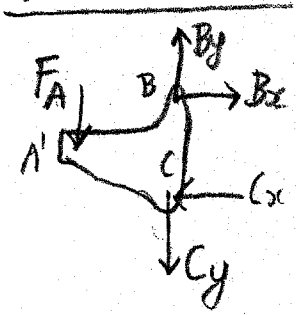
Hence, $F_A = F_A'$

Bar DE:



DE is a 2-force member

Lower Jaw A'BC:



From FBD of CDH:

$\Sigma M_K = 0$: $C_x \times \frac{5''}{8} = 25\text{lb} \times 7.5''$

$\Rightarrow C_x = 300\text{lb}$

From FBD of A'BC:

$\Sigma M_B = 0$: $F_A \times 0.6'' = C_x \times 1''$

$\Rightarrow F_A = \frac{(300\text{lb}) \times 1''}{0.6''} = 500\text{lb}$

$F_A = 500\text{lb}$