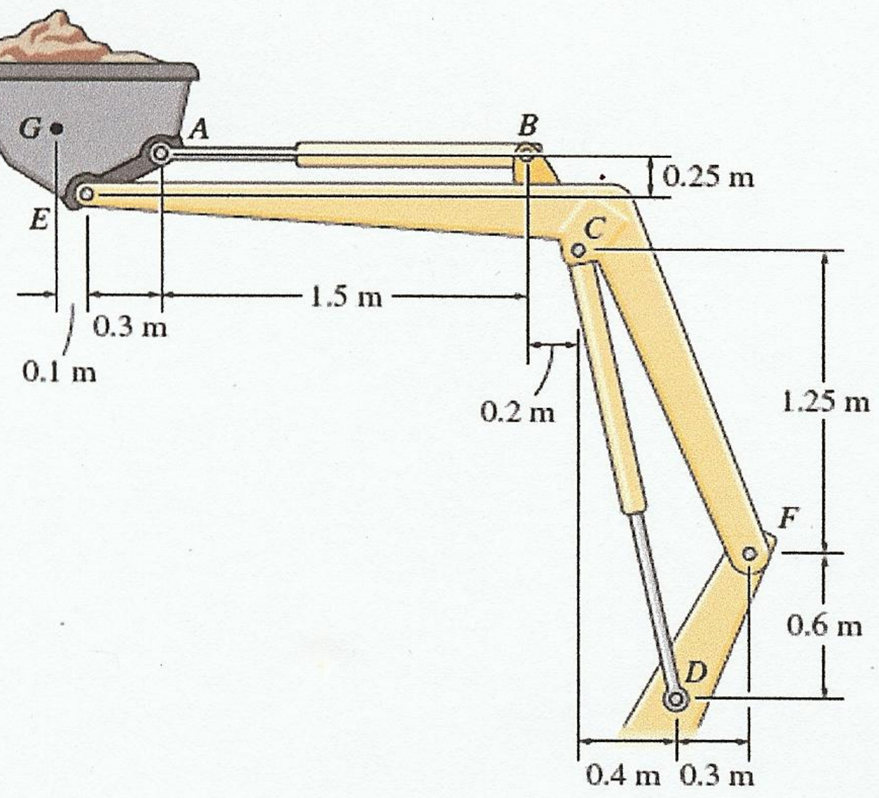
Problem 2 - Frames II

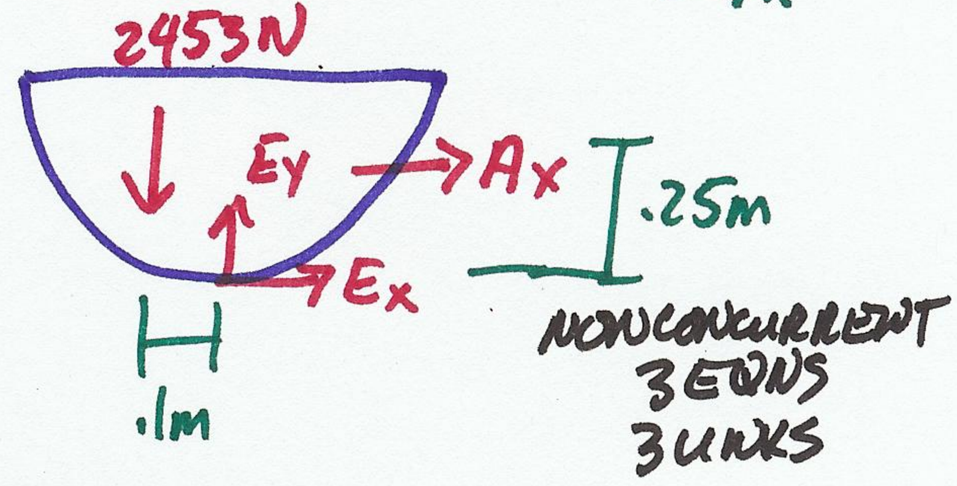
The tractor boom supports the uniform mass of 500 kg in the bucket which has a center of mass at *G*. Determine the force in each hydraulic cylinder *AB* and *CD* and the resultant force at the pins *E* and *F*. The load is supported equally on each side of the tractor by a similar mechanism.



500 kg = 4905 N

½ TO EACH = 2453 N

FBD BUCKET



NONCONCURRENT
3 EQNS
3 UNKS

$\curvearrowleft \Sigma M_E = 0$

$-2453(.1) + .25 A_x = 0$

$A_x = 981\ N \rightarrow$ ON BUCKET

$= AB$

$\uparrow \Sigma F_y = 0$

$-2453 + E_y = 0$

$E_y = 2453\ N \uparrow$ ON BUCKET

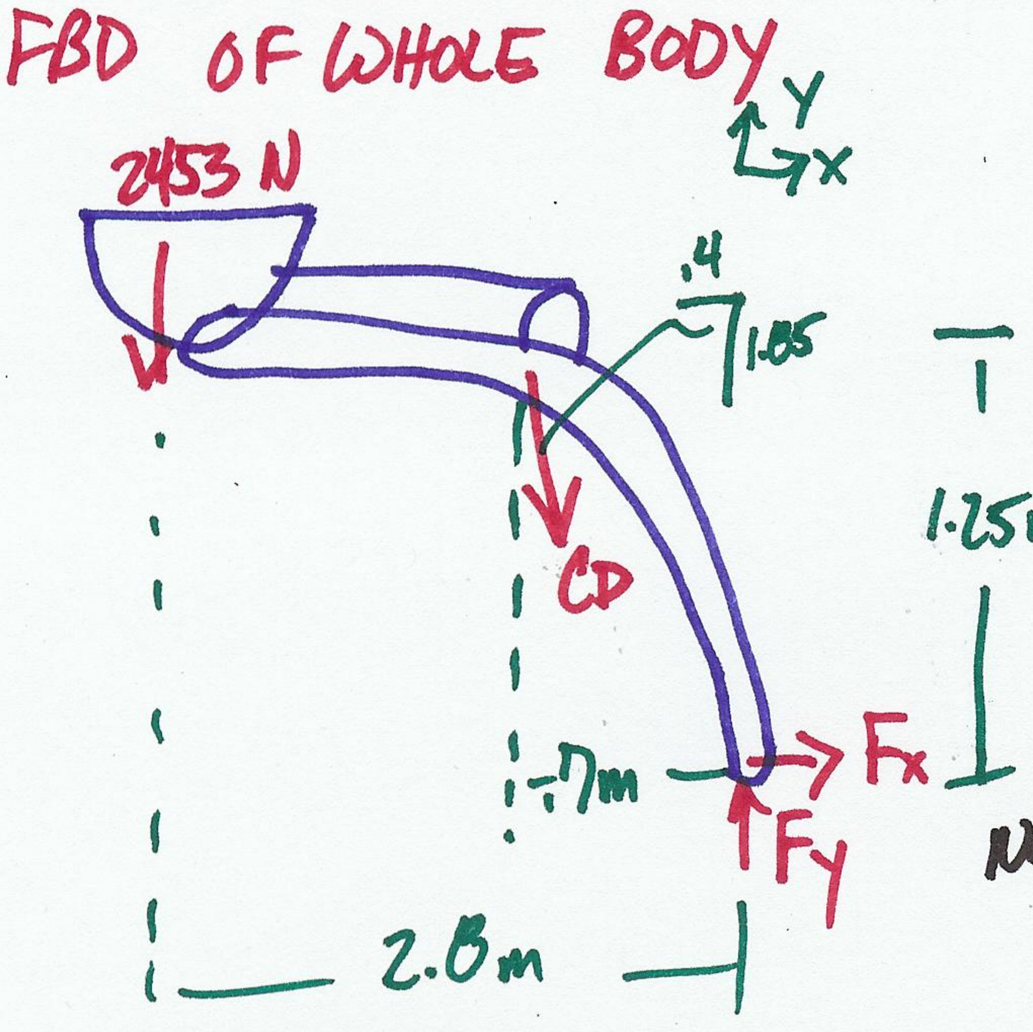
$\rightarrow \Sigma F_x = 0$

$E_x + A_x = 0 \quad E_x = -981$

$= 981 \leftarrow$ ON BUCKET

$R_E = \sqrt{2453^2 + 981^2} = 2.64\ KN$

FBD OF WHOLE BODY



NONCONCURRENT
3 EQNS
3 UNKS

$\curvearrowleft \Sigma M_F = 0$

$-2453(2.8) - .7\,CD\left(\frac{1.05}{1.09}\right) + 1.25\,CD\left(\frac{.4}{1.09}\right) = 0$

$CD = -16328 = 16.33\ KN$ ON ECF

$\uparrow \Sigma F_y = 0$

$F_y - 2453 - \frac{1.05}{1.09} CD = 0$

$F_y = -13.5N = 13.5\ KN \downarrow$ ON ECF

$\rightarrow \Sigma F_x = 0 \quad \frac{.4}{1.09} CD + F_x = 0$

$F_x = -3.4 = 3.41\ KN \leftarrow$ ON ECF

$R_F = \sqrt{13.5^2 + 3.4^2} = 13.9\ KN$