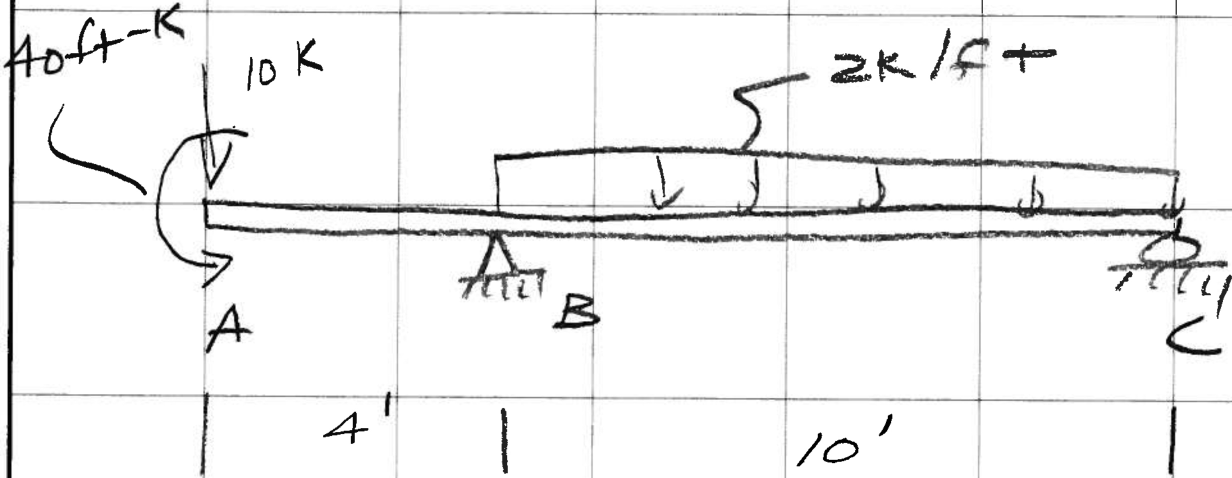
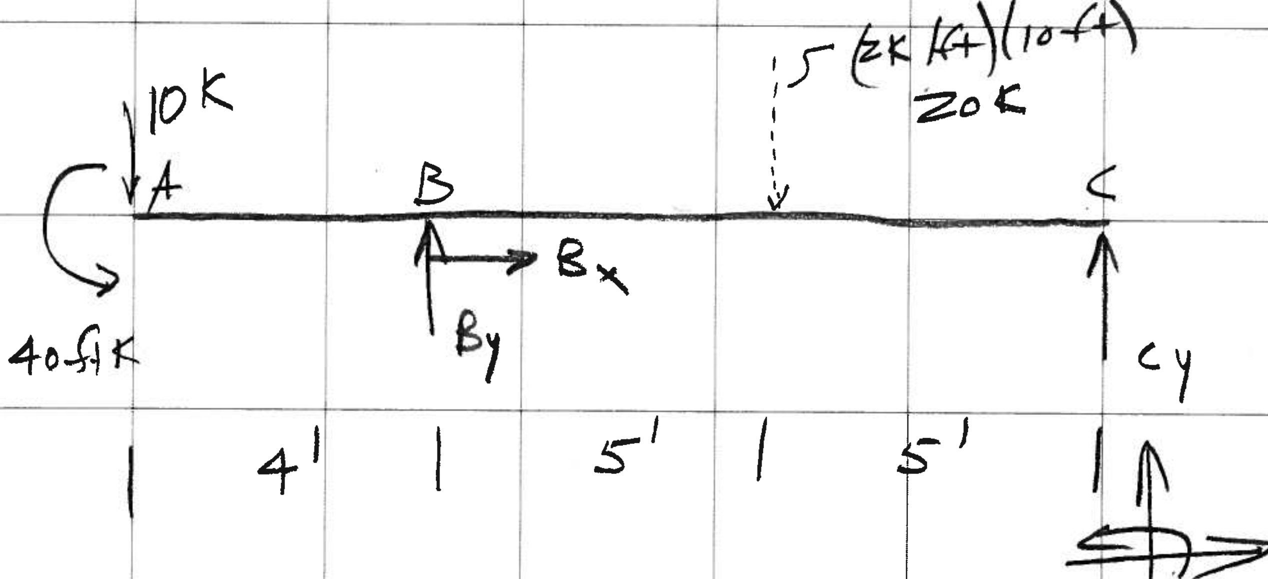
Calculate the external reactions for the beam loaded as shown.



The support at B is a pin and the support at C is a roller.

First draw a FBD and replace distributed load with resultant.



Then apply scalar equations of equilibrium

Take moments about C

$\circlearrowleft + \ \sum M_c = 0$

(1) $+40 + 10(14) - B_y(10) + 20(5) = 0$

(2) $10 B_y = 40 + 140 + 100$

(3) $\underline{B_y = +28\,K \uparrow \text{ as shown}}$

Then sum forces in the y-direction

$+\uparrow \sum F_y = 0$

(4) $-10 + \xcancel{B_y}^{\,28} - 20 + C_y = 0$

(5) $\underline{C_y = +2\ K \uparrow \text{ as shown}}$

While it may be trivial sum forces in the x-direction

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

(6) $B_x = 0$

Solve again using alternate method

Take moments about B

$\circlearrowleft + \quad \Sigma M_B = 0$

(7) $10(4) + 40 - 20(5) + C_y 10 = 0$

(8) $10 C_y = 100 - 40 - 40$

(9) $C_y = 2k \uparrow$ as shown

Sum Forces in the y-direction

$+\uparrow \quad \Sigma F_y = 0$

(10) $-10 + B_y - 20 + \cancel{C_y}^{2} = 0$

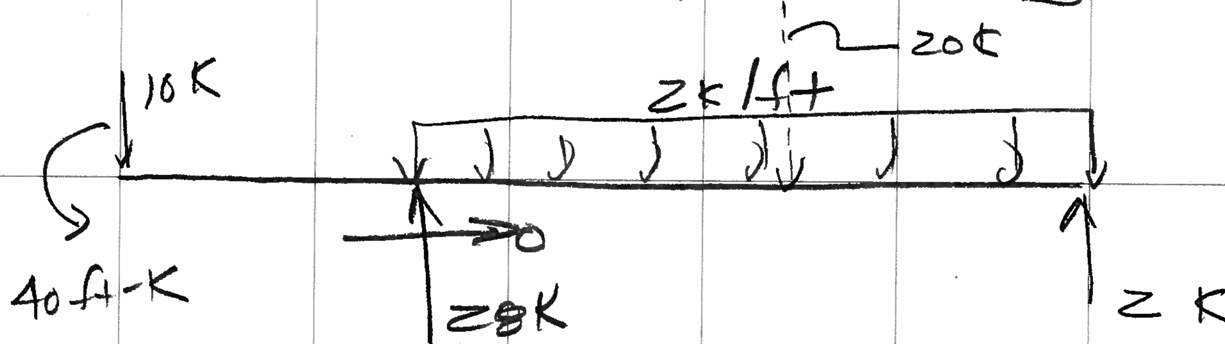
(11) $B_y = 28\ K \uparrow$ as shown

while it may be trivial sum forces in the x-direction

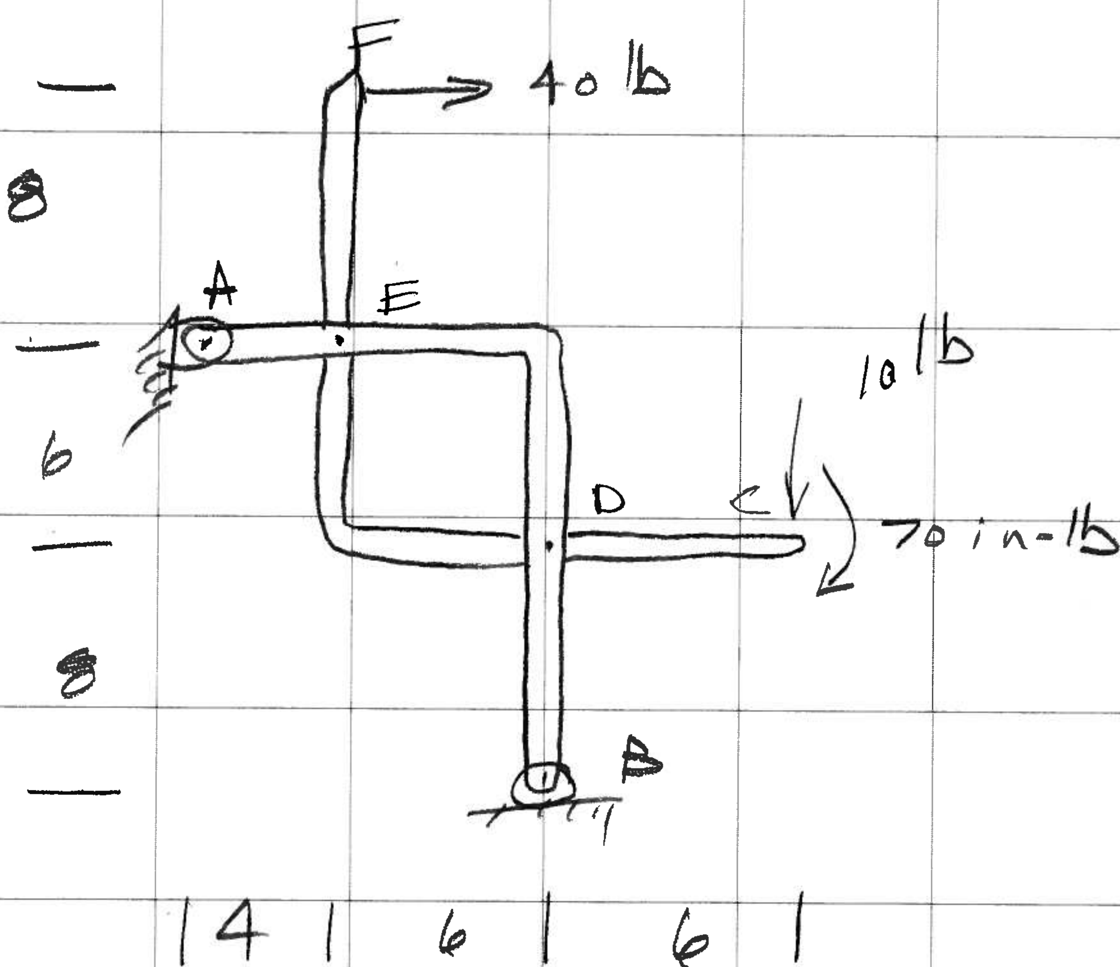
$\xrightarrow{+} \sum F_x = 0$

(12) $B_x = 0$

Show results on a F.B.D

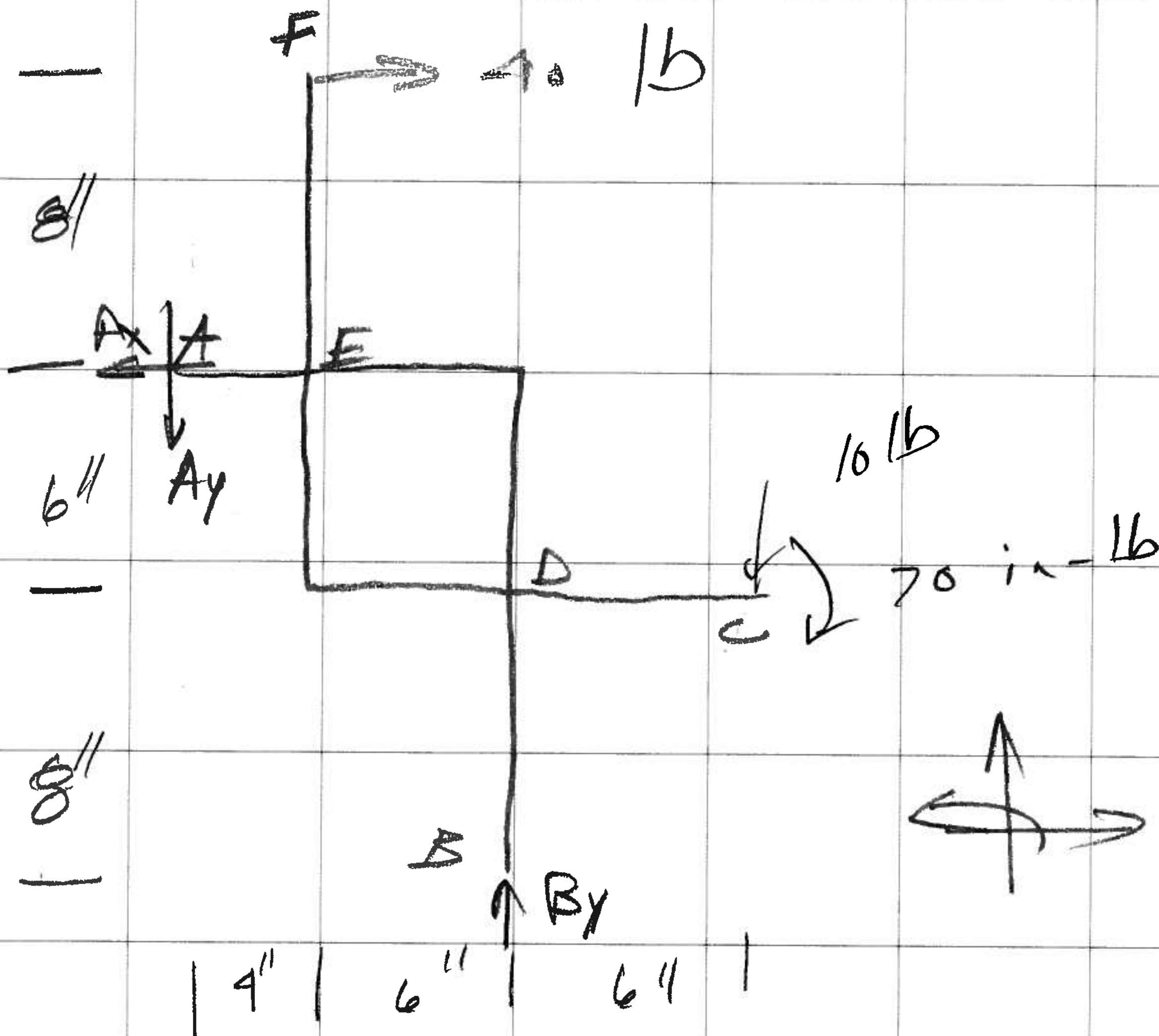


The structure below is loaded as shown. Calculate the external reactions.



It appears that the structure is pin supported at A and is supported by a roller at B.

First sketch a F.B.D of the entire structure



The directions for Ax, Ay and By are assumed directions — If they are wrong we will get minus signs

Next apply scalar equations of equilibrium.

$\circlearrowleft + \ \sum M_A = 0$

(1) $-40(8) - 10(16) - 70 + B_y(10) = 0$

(2) $10 B_y = 320 + 160 + 70$

(3) $B_y = 55 \text{ lbs} \uparrow$ as shown

$+\uparrow \ \sum F_y = 0$

(4) $-A_y + \overset{55}{B_y} - 10 = 0$

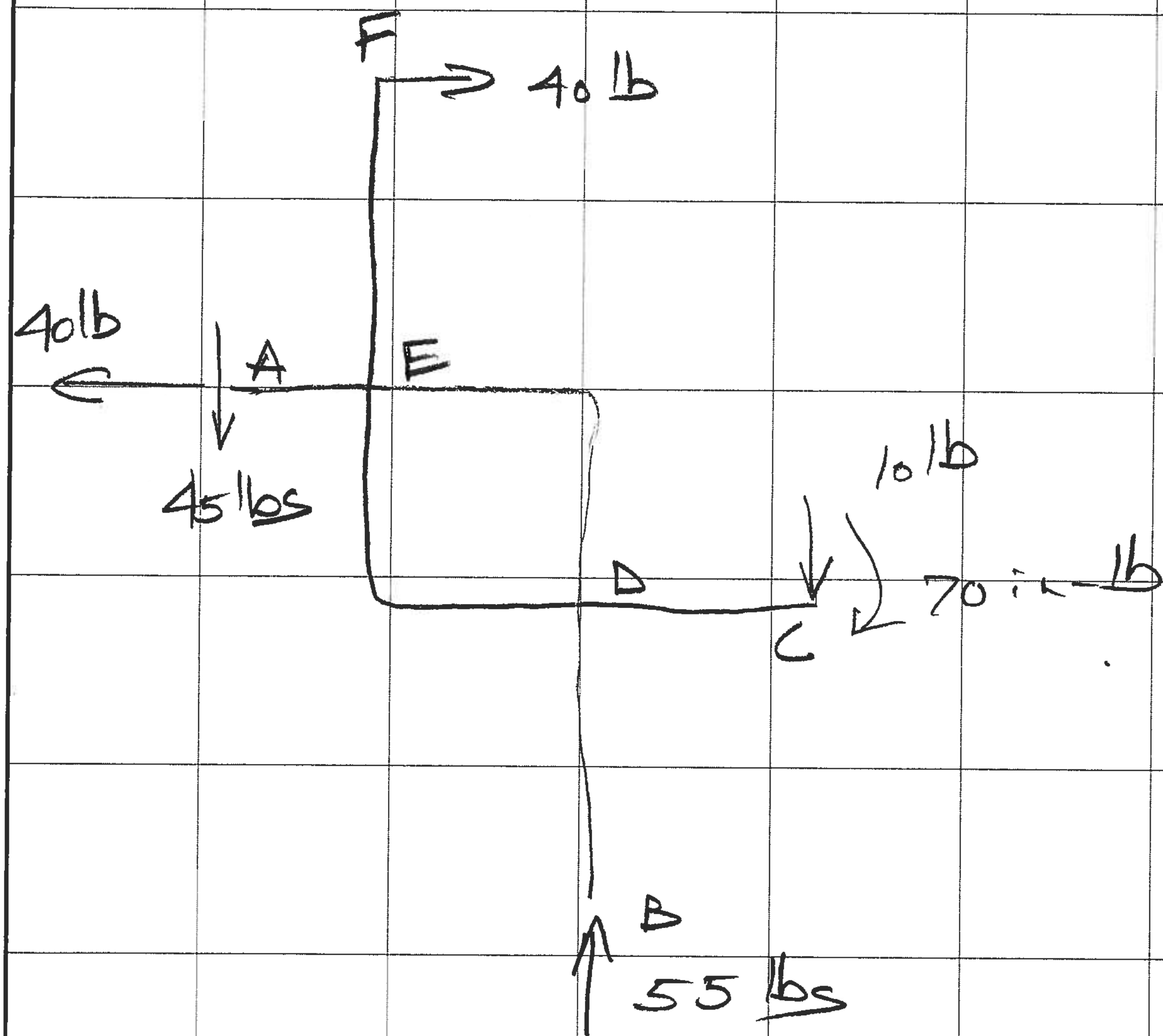
(5) $A_y = 45 \text{ lbs} \downarrow$ as shown

$\overset{+}{\rightarrow} \sum F_x = 0$

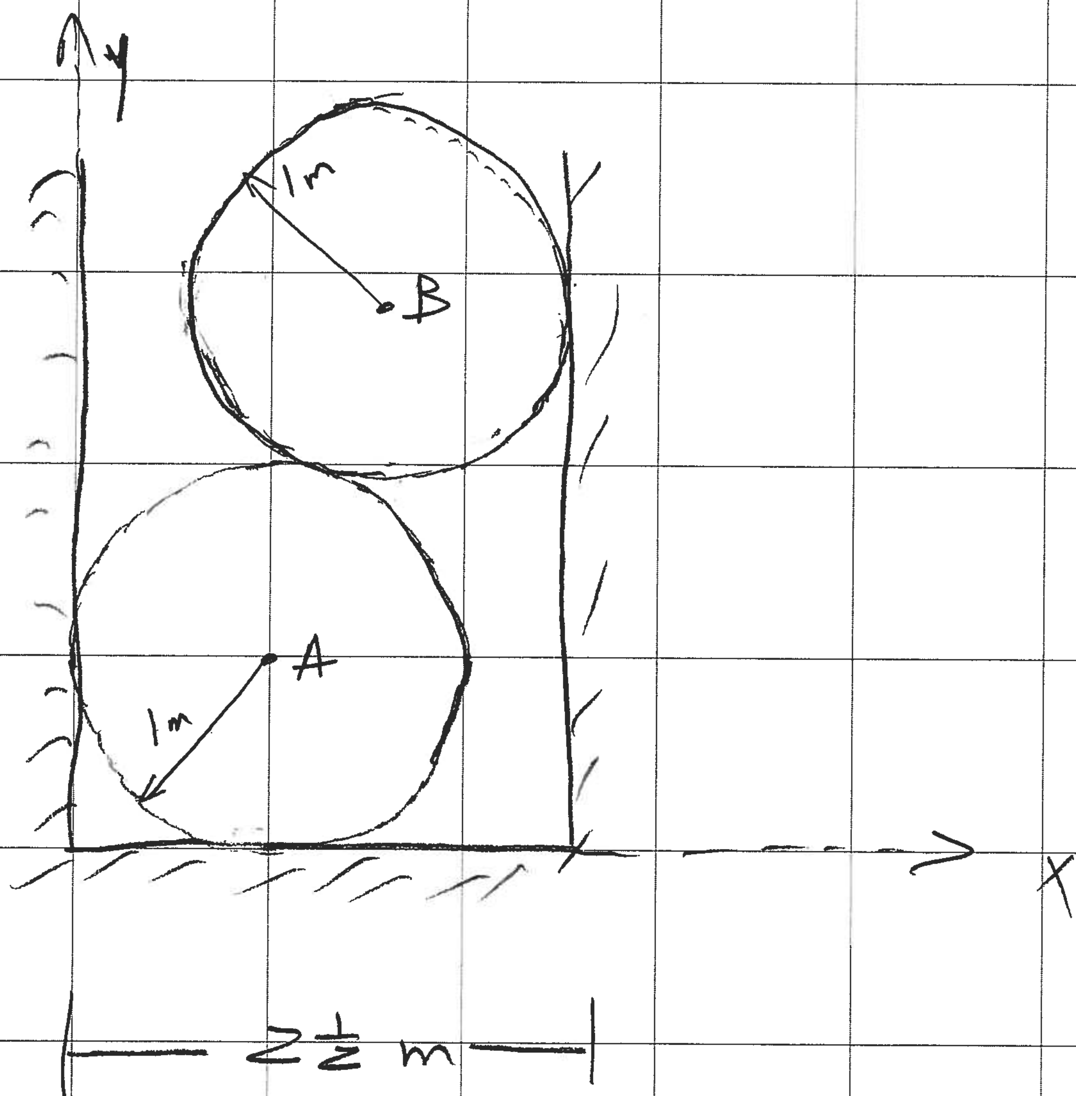
(6) $-A_x + 40 = 0$

(7) $A_x = 40 \text{ lb} \leftarrow$ as shown

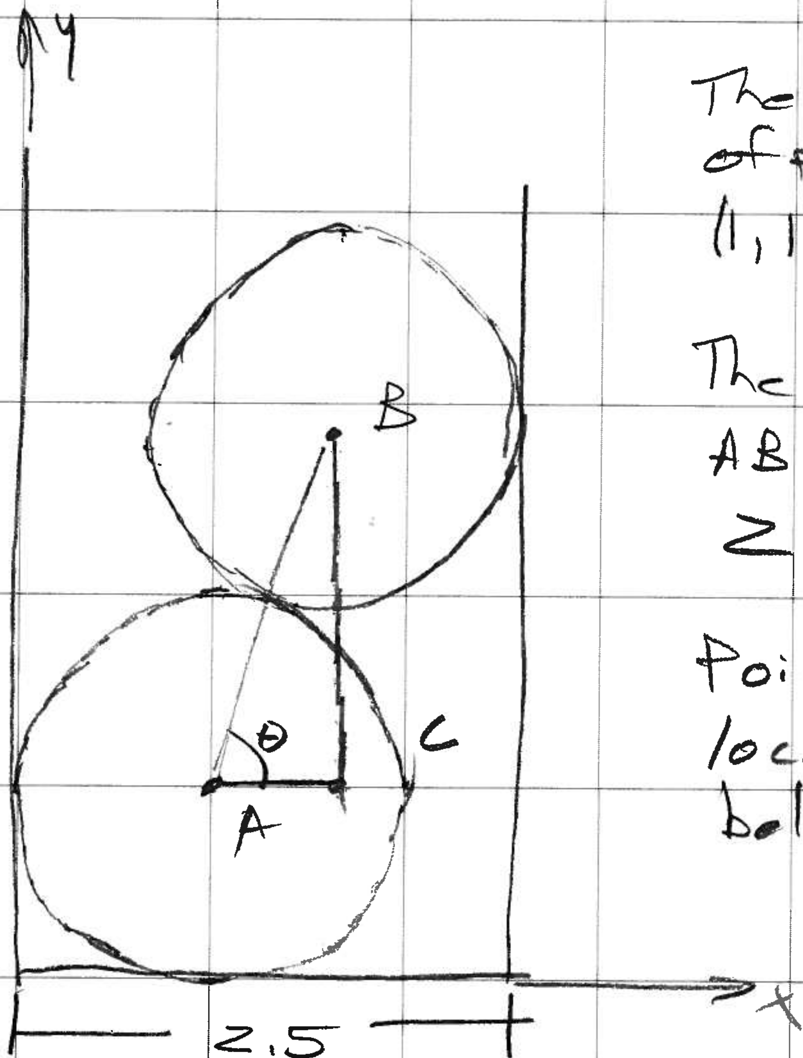
Shown results on F.B.D.



Two 100 kg uniform cylinders each with a diameter of 1m are stacked in a rectangular enclosure as shown. Assume all surfaces are smooth. Determine all forces acting on each cylinder.



First it is necessary to understand geometry



The coordinates of point A are (1,1)

The length of line AB has to be 2 m

Point C is located directly below point B

The horizontal coordinate of point B must be 1.5 m

Since point C is directly below point B, then the length of line AC must be .5 m

Then using the Pythogoren theorem

(1) $AC^2 + BC^2 = AB^2$

So

(2) $.5^2 + BC^2 = 2^2$

(3) $BC = 1.936$

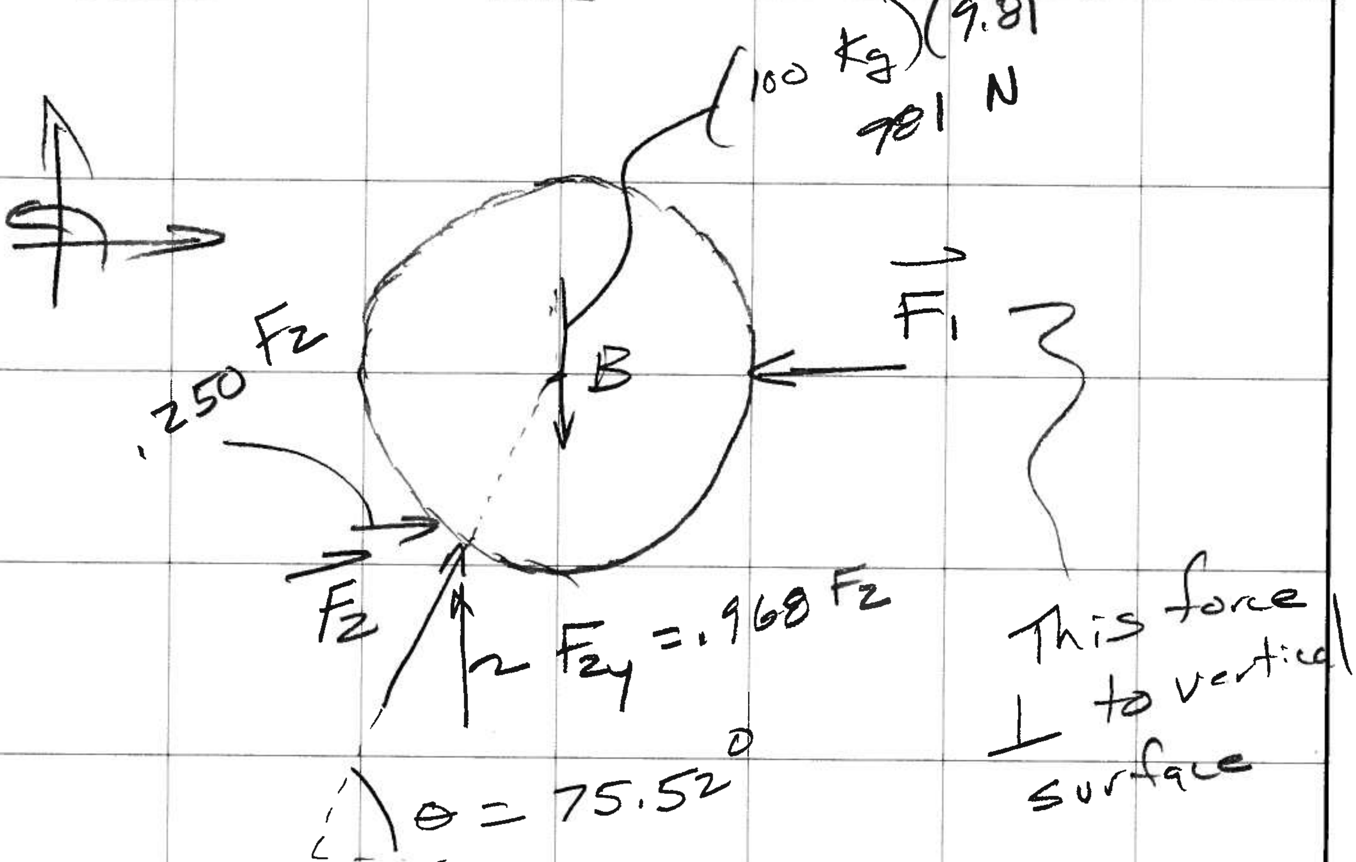
That means that angle CAB or θ is

(4) $\theta = Tan^{-1}\left(\frac{1.936}{.5}\right)$

(5) $\theta = 75.52^{0}$

Geometry is now understood

Next examine a F.B.D. of Cylinder B



Then apply scalar equations of equilibrium

$+\uparrow \Sigma F_y = 0$

(6) $-981 + .968 F_2 = 0$

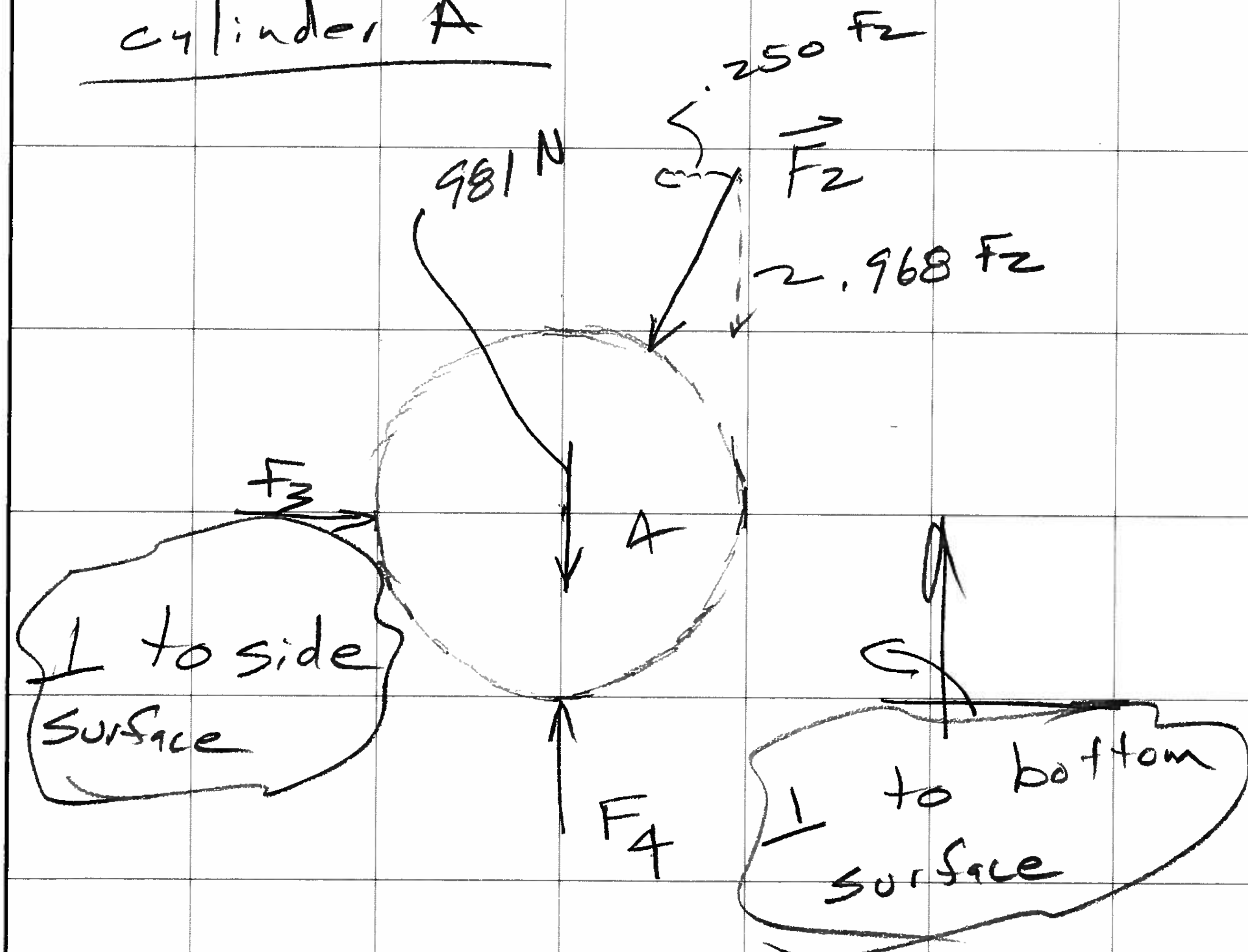
(7) $F_2 = 1013.4 \text{ N}$ as shown

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

(8) $.250 \, \overset{1013.4}{\cancel{F_2}} - F_1 = 0$

(9) $\underline{F_1 = 253.4}$ N as shown

Then draw a F.B.D. of cylinder A



Apply scalar equations of equilibrium

$\sum F_y = 0$

(10) $-.968 \cancel{F_2}^{1013.4} - 981 + F_4 = 0$

(11) $F_4 = 1961.97$ N as shown

$\sum F_x = 0$

(12) $F_3 - .250 \cancel{F_2}^{1013.4} = 0$

(13) $F_3 = 253.35$ N as shown