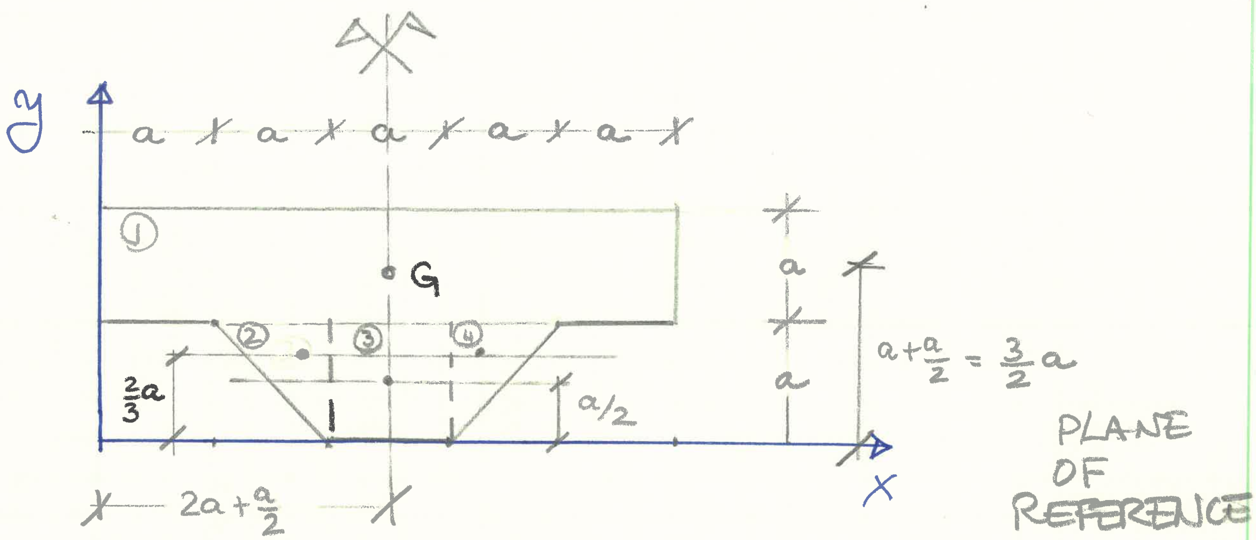


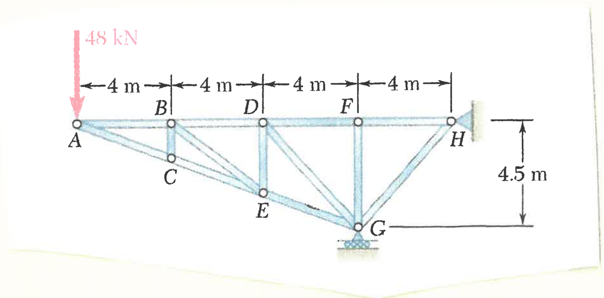
$\frac{5}{2}a$

$x_G \equiv$ by symmetry

	Area	y	A * y
1	$5a(a) = 5a^2$	$\frac{3}{2}a$	$\frac{15}{2}a^3$
2	$\frac{1}{2}aa = \frac{a^2}{2}$	$\frac{2}{3}a$	$\frac{a^3}{3}$
3	$aa = a^2$	$a/2$	$a^3/2$
4	$\frac{1}{2}aa = \frac{a^2}{2}$	$\frac{2}{3}a$	$\frac{a^3}{3}$
	$a^2\left[5+1+\frac{1}{2}+\frac{1}{2}\right]$		$a^3\left[\frac{15}{2}+\frac{1}{3}+\frac{1}{2}+\frac{1}{3}\right]$

$$y_G = \frac{\sum A_i y_i}{\sum A_i} = \frac{a^3\left[\frac{15\times3+2+3+2}{6}\right]}{7a^2} = \frac{52\,a}{42} = 1.24a$$

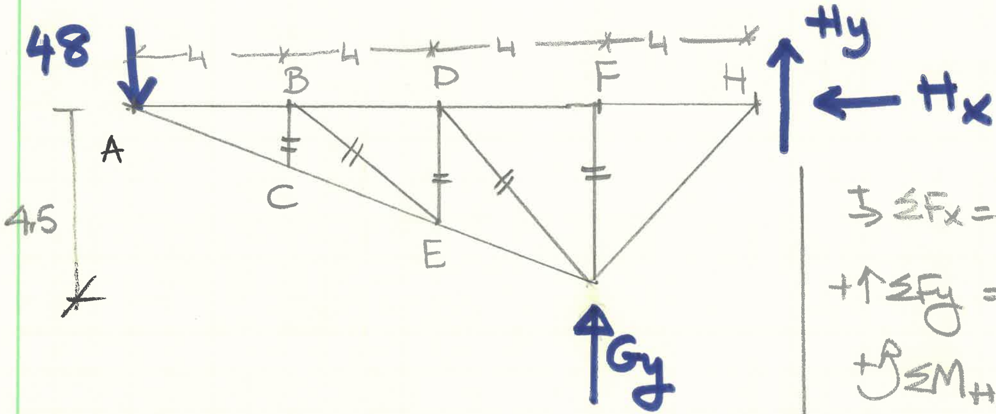
$$\boxed{x_G = \frac{5}{2}a} \quad \boxed{y_G = 1.24a}$$



a) Det zero-force members

b) Det force F_{BD}, F_{CE} w/ method of sections

c) Det the rest w/ method of joints



$\xrightarrow{+} \Sigma F_x = 0 \Rightarrow \boxed{H_x = 0}$

$+\uparrow \Sigma F_y = 0 \quad H_y + G_y = 48$

$+\circlearrowleft \Sigma M_H = -G_y \cancel{4} + 48 \cdot 4 \times \cancel{4} = 0$

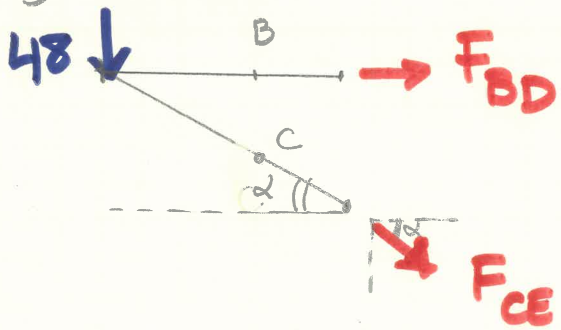
$G_y = 192 \text{ kN}$

$H_y = 48 - 192 = -144 \Rightarrow H_y = 144 (\downarrow)$

a) zero force members

$F_{BC} = F_{BE} = F_{DE} = F_{DG} = F_{FG} = 0$

b) Sections



$\tan\alpha = \dfrac{4.5}{12} \rightarrow \alpha = 20.55$

$\cos\alpha = 0.9363$
$\sin\alpha = 0.3511$

$+\downarrow \Sigma F_y = 0 \qquad 48 + F_{CE}\sin\alpha = 0 \rightarrow F_{CE} = \dfrac{-48}{\sin\alpha} = -136.7$

$$\boxed{F_{CE} = 136.7 \text{ kN} \ (C)}$$

$\xrightarrow{+} \Sigma F_x = 0 \qquad F_{BD} + F_{CE}\cos\alpha = 0$

$F_{BD} = -F_{CE}\cos\alpha = 136.7\,(0.9363)$

$$\boxed{F_{BD} = 128 \text{ kN} \ (T)}$$

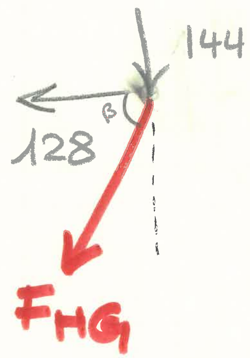
TRUSS PROBLEM

$$F_{AB} = F_{BD} = F_{DF} = F_{FH} = 128 \text{ kN} \; (T)$$

$$F_{AC} = F_{CE} = F_{EG} = 136.7 \; (C)$$

we just have HG left :

Node H



$\tan\beta = \frac{4.5}{4} \rightarrow \beta = 48.36$

$\cos\beta = 0.66$

$\sin\beta = 0.74$

$\overset{+}{\rightarrow} \Sigma F_x = 0 \qquad 128 + F_{HG} \cos\beta = 0$

$$F_{HG} = -\frac{128}{\cos\beta} = -\frac{128}{0.66} = -192.7$$

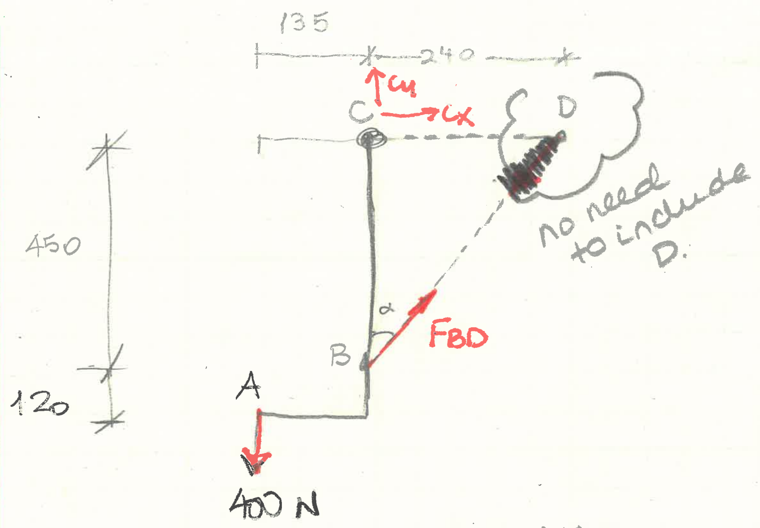
$$\boxed{F_{HG} = 192.7 \; (C)}$$

BAR	FORCE	T or C
AB	128	T
BD	128	T
DF	128	T
FH	128	T
AC	136.7	C
CE	136.7	C
EG	136.7	C
GH	192.7	C
BC	0	0
BE	0	0
DE	0	0
DG	0	0
FG	0	0

FBD for CBA

$F_{BD} = ?$

React @ C $(C_x ; C_y)$



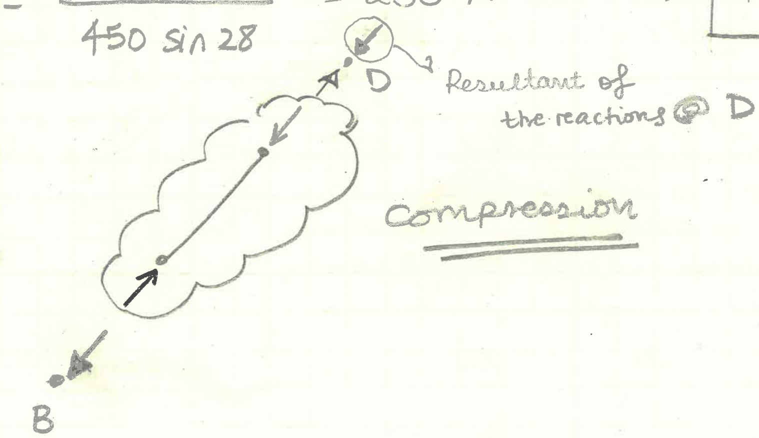
$\tan\alpha = \frac{240}{450} = 0.53$

$\alpha = 28°$

same line

$\circlearrowleft + \; \Sigma M_C = 0 \qquad \cancel{F_{BD}\cos\alpha} * + F_{BD}\sin\alpha * 450 + 400 * 135 = 0$

$F_{BD} = \frac{400 * 135}{450 \sin 28} = -255\ N \longrightarrow \boxed{F_{BD} = 255 N (C)}$



compression

$\xrightarrow{+} \Sigma F_x = 0 \qquad C_x + F_{BD}\sin\alpha = 0 \rightarrow C_x = -F_{BD}\sin\alpha = -(-255)\sin 28$

$= 119.7 = 120\ N$

$\boxed{C_x = 120 N (\rightarrow)}$

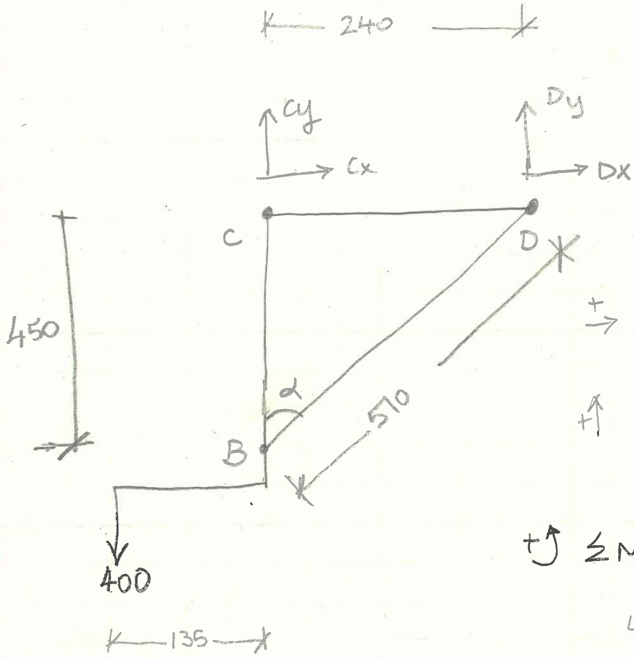
$+\uparrow \Sigma F_y = 0 \qquad F_{BD}\cos\alpha + C_y - 400 = 0$

$C_y = 400 - F_{BD}\cos\alpha = +400 - (-255)\cos 28 = 625 N \uparrow$

$\boxed{C_y = 625 N (\uparrow)}$

TOPS 35502

No need for this, this is just to show we get the same results - w/ more work!



$\overset{+}{\rightarrow} \Sigma F_x = 0; \; C_x + D_x = 0$ ①

$+\uparrow \Sigma F_y; \; C_y + D_y - 400 = 0$ ②

$+\circlearrowleft \Sigma M_c = 0$

$400 * 135 + D_y * 240 = 0$ ③

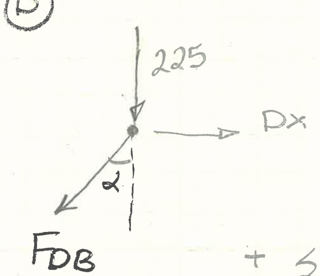
$$D_y = -\frac{400 * 135}{240} = -225\,N$$

$$\boxed{D_y = 225 N \downarrow}$$

Plug ③ in ② $C_y = 400 - D_y = 400 - (-225) = 625$

$$\boxed{C_y = 625\,N \uparrow}$$

Node (D)



$\sin\alpha = \frac{240}{510}$

$\cos\alpha = \frac{450}{510}$

$\overset{+}{\rightarrow} \Sigma F_x = 0 \; ; \; D_x - F_{DB}\sin\alpha = 0$

$D_x = F_{BD}\,\frac{240}{510}$ ④

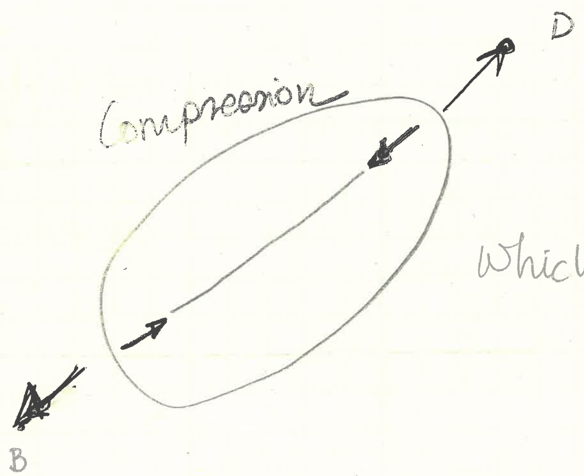
$+\uparrow \Sigma F_y = 0 \; ; \; -225 - F_{DB}\cos\alpha = 0 \rightarrow F_{DB} = \frac{-225}{\cos\alpha}$

$$F_{DB} = \frac{-225}{450/510} = -255\ N$$

in 4 $\qquad D_X = (-255)\,\dfrac{240}{510} = -120\ N$

$$\boxed{D_X = 120\,N \leftarrow}$$

So let's see how the bar looks (T or C)



Which is the same as we wrote in page 1.

But the problem was asking for C_x, C_y

from 1 $\quad C_X = -D_X = 120\ N$

$$\boxed{\begin{aligned} C_X &= 120\,N \rightarrow \\ C_y &= 625\ N \uparrow \end{aligned}}$$

$$\boxed{F_{BD} = 255\ N\,(C)}$$