
AHMEDMAHDY
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مدرس خصوصى
اونلاين
يحصل الطالب على ...
*مقاطع فيديوهات لشرح المقرربشكل وافي
*ملخص للمادة للمراجعة النهائية
*محاضرات مباشرة على برنامج Zoom
*تواصل مستمر مع معلم المادة للمناقشة
للتواصل
00201024041097
00201096019763

Assignment No (1)

Analysis of statically determinate structures

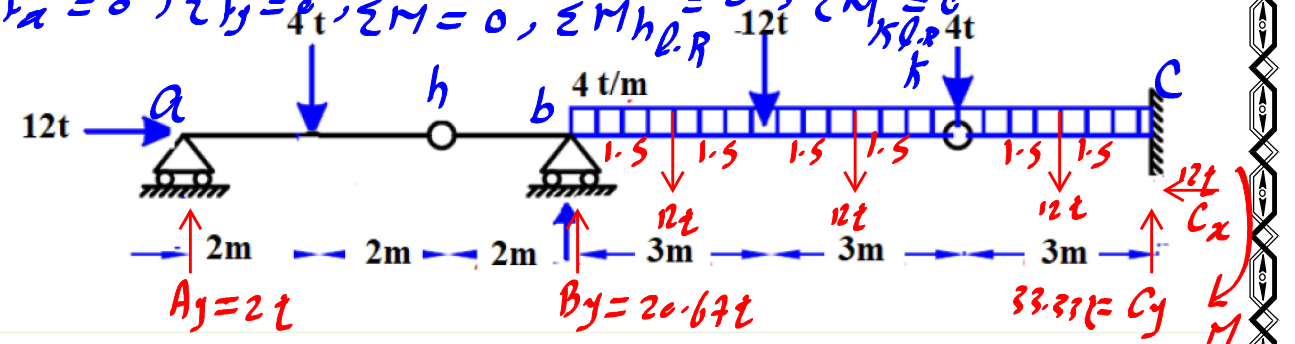
Check Static Determinacy

$r = 5 \Rightarrow 2 + 3$

مستقر و محدد
stable and determinate

1. The beam shown in figue below, it is required to ensure its equilibrium, find reactions at the supports and draw N.F.D, S.F.D & B.M.D.

$\Sigma f_x = 0$, $\Sigma f_y = 0$, $\Sigma M = 0$, $\Sigma M_{h\,left} = 0$, $\Sigma M_{k\,left} = 0$



$\Sigma f_x = 12 - C_x = 0 \Rightarrow C_x = 12\,t \leftarrow$

$\Sigma M_{h\,left} = A_y * 4 - 4 * 2 = 0 \Rightarrow A_y = 2\,t \uparrow$

$\Sigma M_{k\,left} = -12 * 1.5 - 12 * 3 - 12 * 4.5 + B_y * 6 - 4 * 10 + A_y * 12 = 0$ (A_y: 2t)

$A_y = 20.67\,t \uparrow$

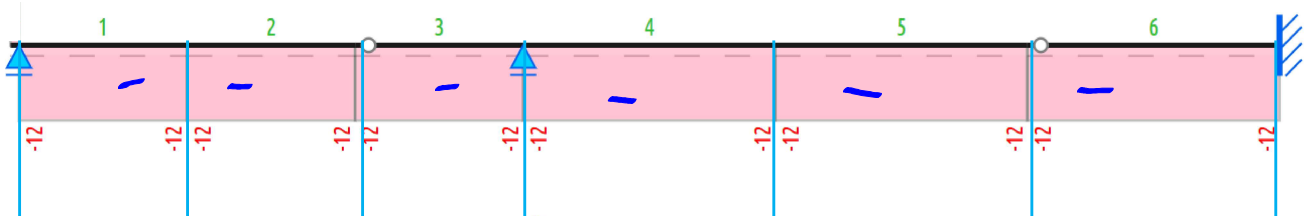
$\Sigma f_y = A_y - 4 + B_y - 12 - 12 - 12 - 4 - 12 + C_y = 0$ (A_y: 2t, B_y: 20.67)

$C_y = 33.33\,t \uparrow$

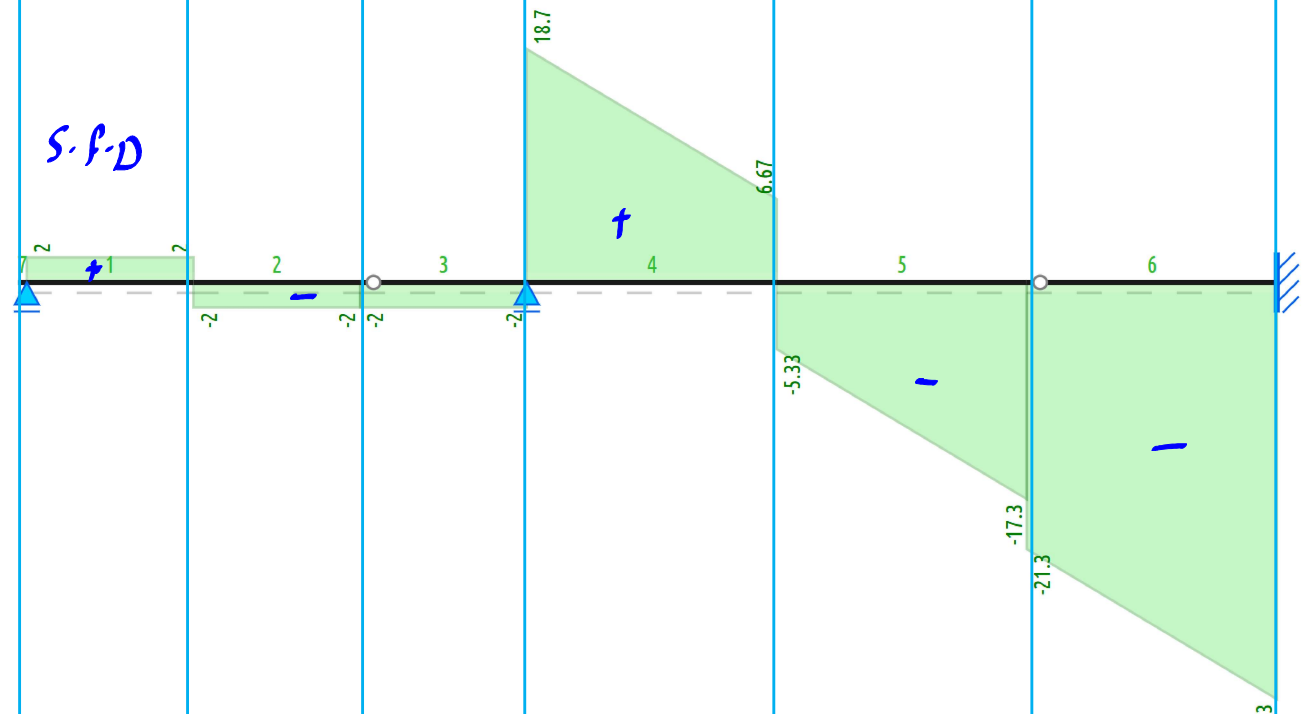
$\Sigma M_{k\,right} = 12 * 1.5 - C_y * 3 + M_c = 0$ (C_y: 33.33t)

$M_c = 82\ m.t$

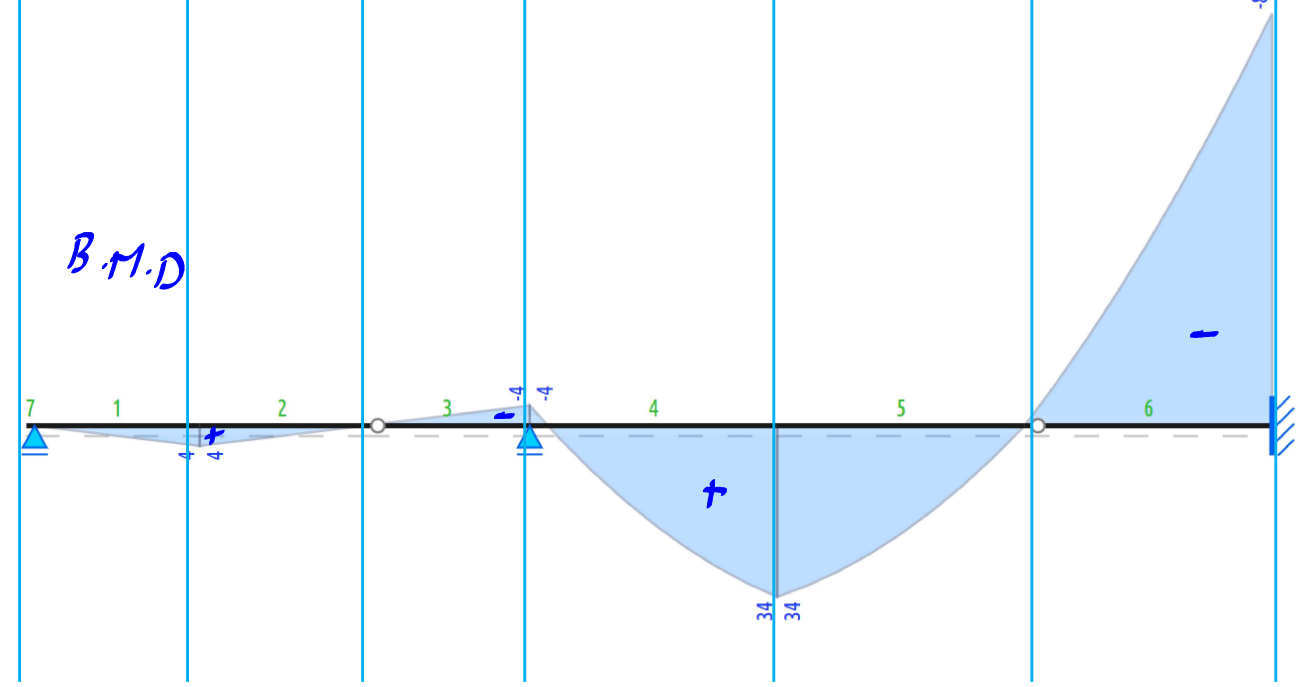
N.F.D



S.F.D



B.M.D

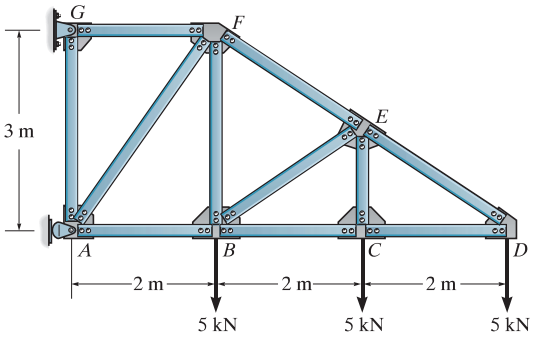


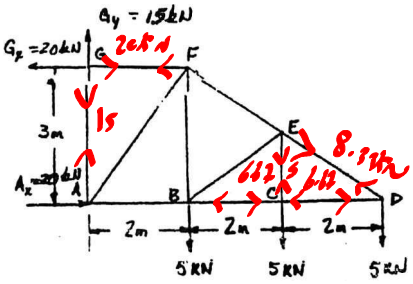
2.For the truss shown in fIgure below

A.Calculate the reactions

B.Determine the force in members EF, BE and BC using the joint method and confirm it by the section method.

C.State whether the forces are tension or compression



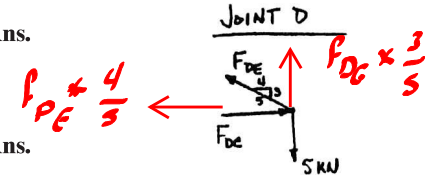


Joint *D*:

$+\uparrow \sum F_y = 0; \quad F_{ED}\left(\frac{3}{5}\right) - 5 = 0; \quad F_{ED} = 8.33 \text{ kN (T)}$ **Ans.**

$\pm\rightarrow \sum F_x = 0; \quad F_{CD} - \frac{4}{5}(8.33) = 0;$

$F_{CD} = 6.67 \text{ kN (C)}$ **Ans.**



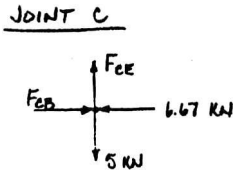
Joint *C*:

$\pm\rightarrow \sum F_x = 0; \quad F_{BC} - 6.67 = 0;$

$F_{BC} = 6.67 \text{ kN (C)}$ **Ans.**

$+\uparrow \sum F_y = 0; \quad F_{CE} - 5 = 0;$

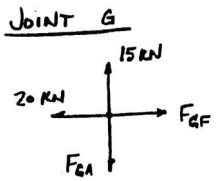
$F_{CE} = 5 \text{ kN (T)}$ **Ans.**



Joint *G*:

$\pm\rightarrow \sum F_x = 0; \quad F_{GF} - 20 = 0; \quad F_{GF} = 20 \text{ kN (T)}$ **Ans.**

$+\uparrow \sum F_y = 0; \quad 15 - F_{GA} = 0; \quad F_{GA} = 15 \text{ kN (T)}$ **Ans.**



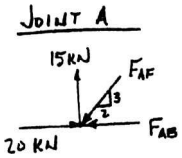
Joint *A*:

$+\uparrow \sum F_y = 0; \quad 15 - F_{AF}(\sin 56.3°) = 0;$

$F_{AF} = 18.0 \text{ kN (C)}$ **Ans.**

$\pm\rightarrow \sum F_x = 0; \quad -F_{AB} - 18.0(\cos 56.3°) + 20 = 0;$

$F_{AB} = 10.0 \text{ kN (C)}$ **Ans.**



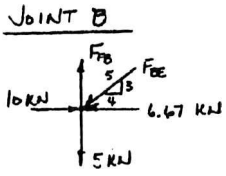
Joint *B*:

$\pm\rightarrow \sum F_x = 0; \quad -F_{BE}\left(\frac{4}{5}\right) + 10.0 - 6.67 = 0;$

$F_{BE} = 4.17 \text{ kN (C)}$ **Ans.**

$+\uparrow \sum F_y = 0; \quad F_{FB} - 5 - 4.17\left(\frac{3}{5}\right) = 0;$

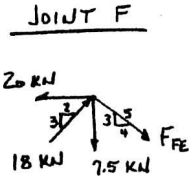
$F_{FB} = 7.50 \text{ kN (T)}$ **Ans.**

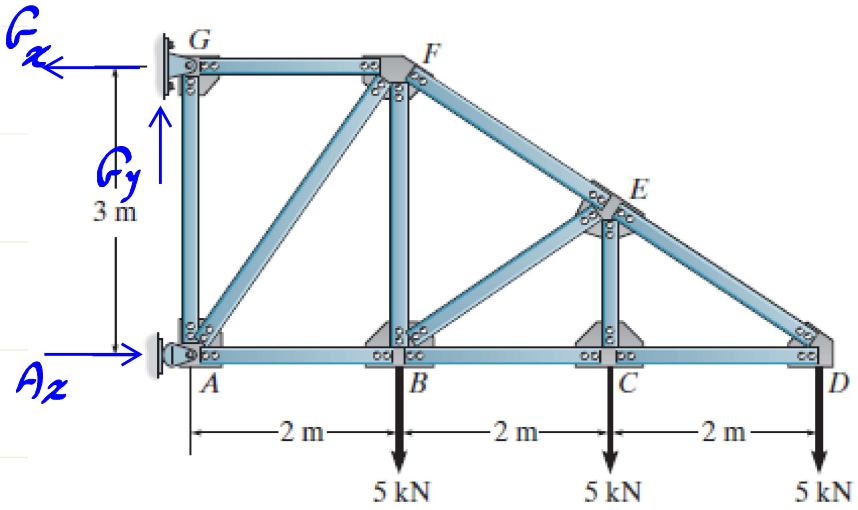


Joint *F*:

$+\uparrow \sum F_y = 0; \quad 18(\sin 56.3°) - 7.5 - F_{FE}\left(\frac{3}{5}\right) = 0;$

$F_{FE} = 12.5 \text{ kN (T)}$ **Ans.**





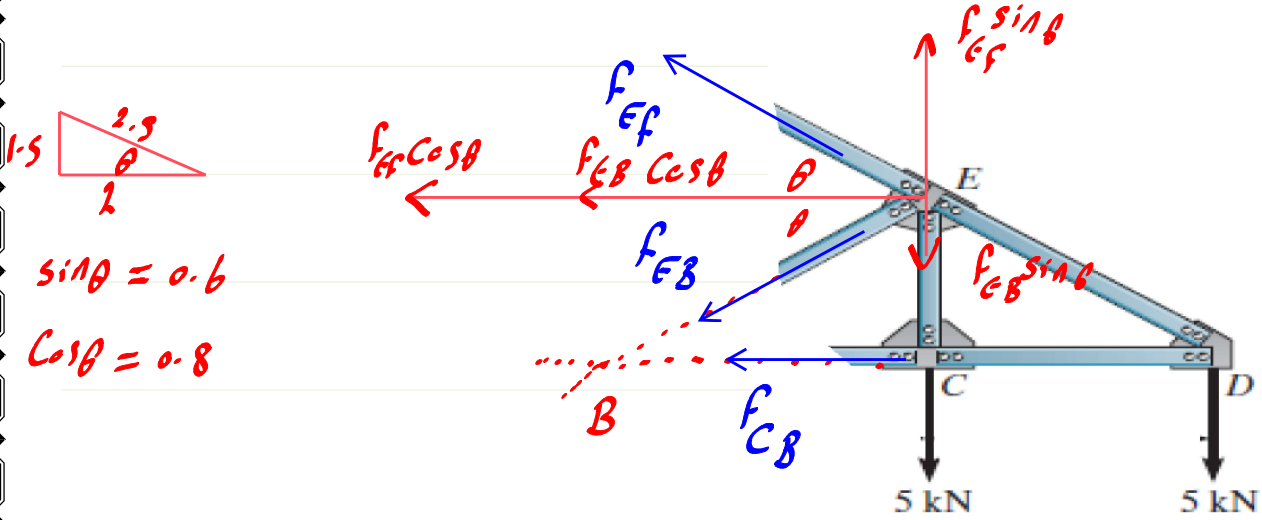
(a)

$\Sigma f_y = G_y - 5 - 5 - 5 = 0 \Rightarrow G_y = 15\ kN \uparrow$

$\Sigma M_G = -A_x * 3 + 5 * 2 + 5 * 4 + 5 * 6 = 0$

$A_x = 20\ kN \rightarrow$

$\Sigma f_x = A_x - G_x = 0 \Rightarrow G_x = 20\ kN \leftarrow$



(B) $\Sigma M_E = f_{CB} * 1.5 + 5 * 2 = 0 \Rightarrow f_{CB} = -6.67\,KN$ TM

$f_{CB} = 6.67\,KN$ Comp

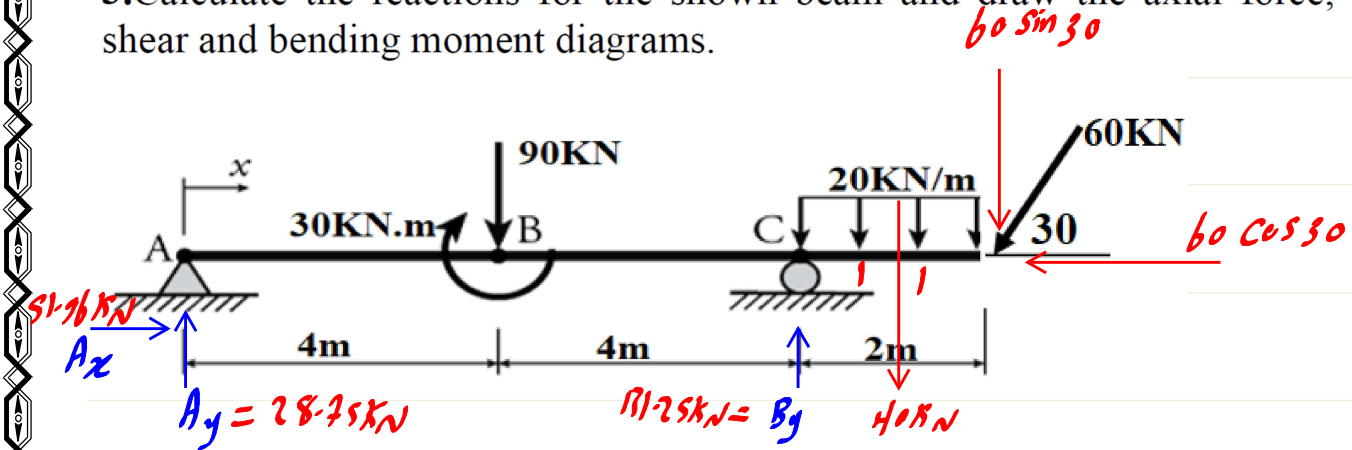
$\curvearrowleft \Sigma M_D = -5 * 2 - f_{EB}\sin\theta * 2 - f_{EB}\cos\theta * 1.5 = 0$

$f_{EB} = -4.167\,KN$ TM $= 4.167\,KN$ Comp

$\curvearrowleft \Sigma f_y = -5 - 5 - f_{BG}\sin\theta + f_{EF}\sin\theta = 0$

$f_{EF} = 12.5\,KN$ T/M

3.Calculate the reactions for the shown beam and draw the axial force, shear and bending moment diagrams.



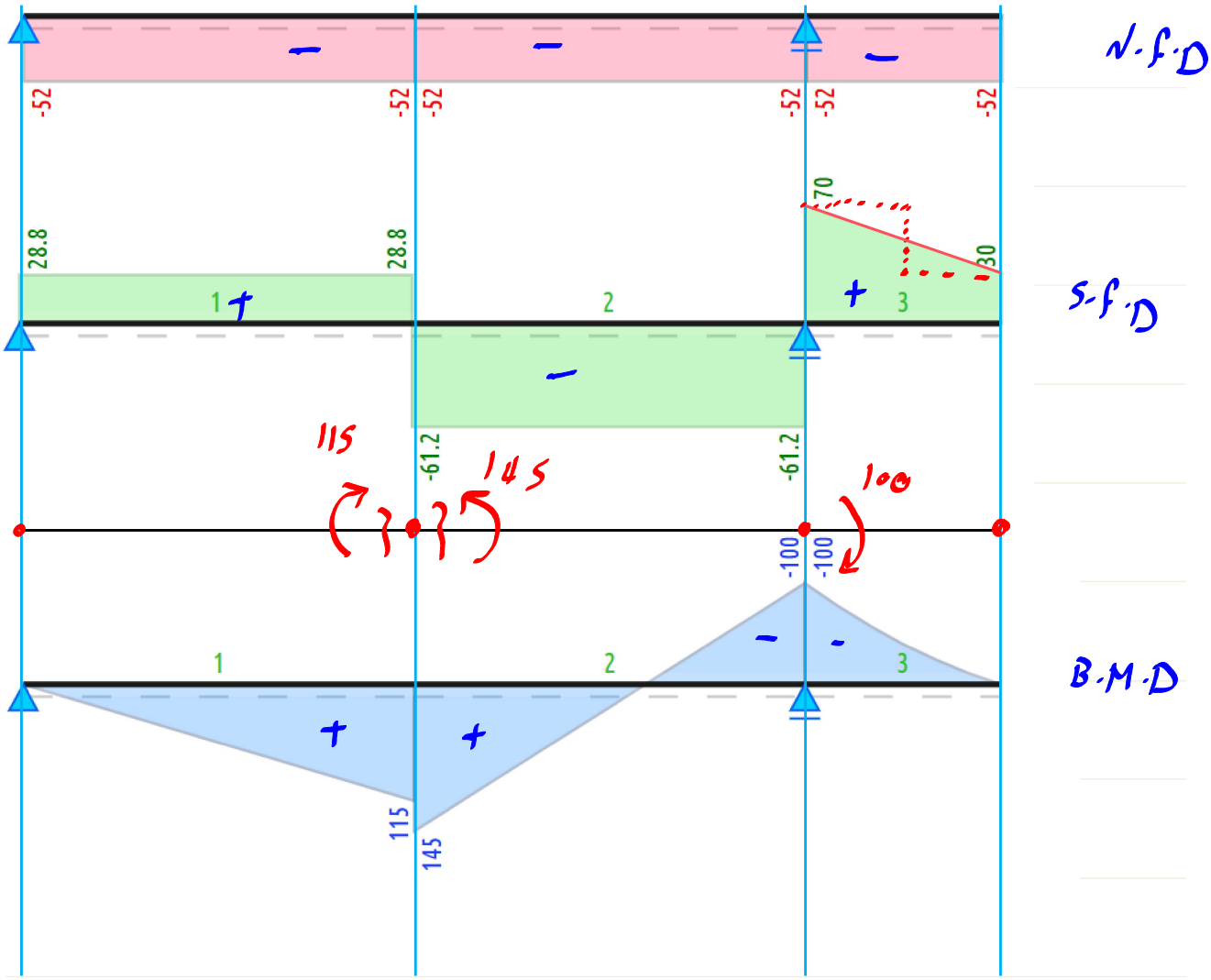
$\Sigma f_x = A_x - 60\cos 30 = 0 \Rightarrow A_x = 51.96\,KN \rightarrow$

$\Sigma M_A = 90 * 4 + 30 - B_y * 8 + 40 * 9 + 60\sin 30 * 10 = 0$

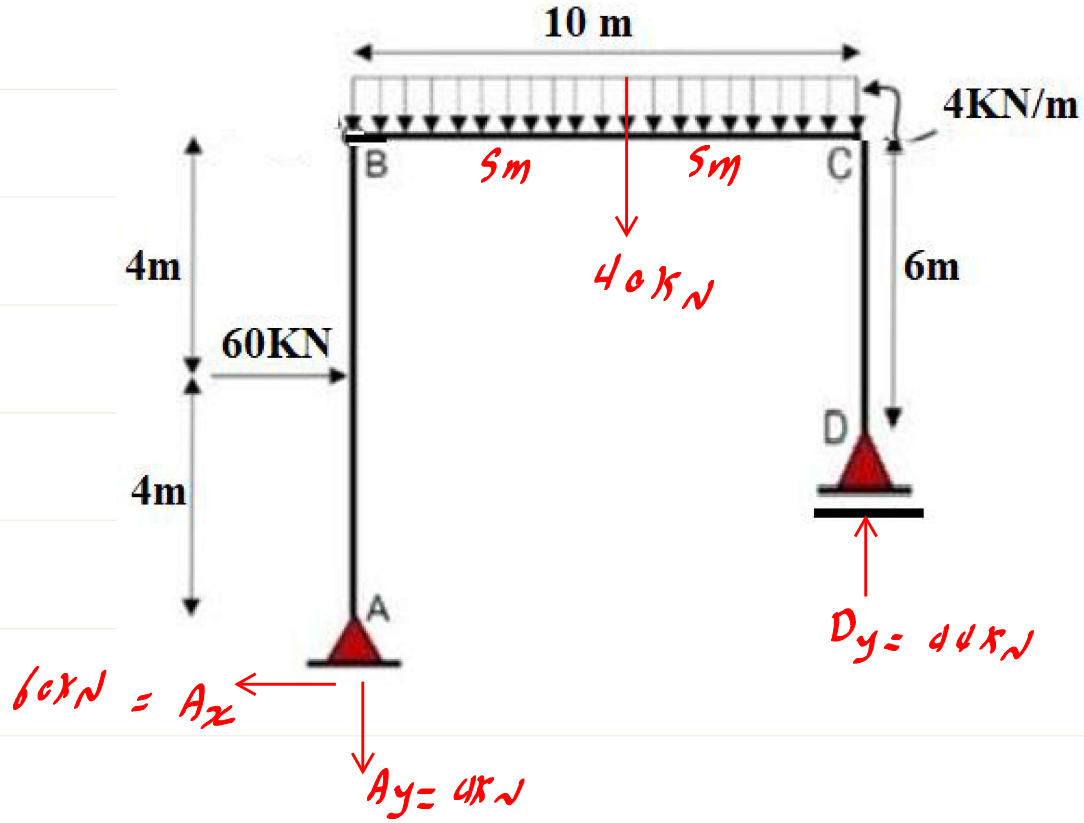
$B_y = 131.25\,KN \uparrow$

$\Sigma f_y = A_y - 90 + B_y - 40 - 60\sin 30 = 0$

$A_y = 28.75\,KN \uparrow$


N.f.D
-52
-52
-52
-52
-52
S.f.D
28.8
28.8
70
30
1
2
3
-61.2
-61.2
B.M.D
115
145
100
-100
-100
1
2
3
115
145

4.**Compute** the support reactions **and plot** the axial force, shear and bending moment diagrams for each member of the portal frame structure under applied loads in figure below.



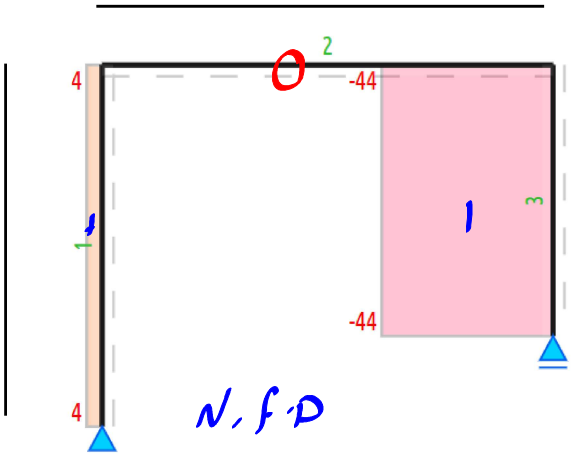
$\Sigma f_x = 60 - A_x \Rightarrow A_x = 60\,KN \leftarrow$

$\Sigma M_a = 60 \times 4 + 40 \times 5 - D_y \times 10 = 0$

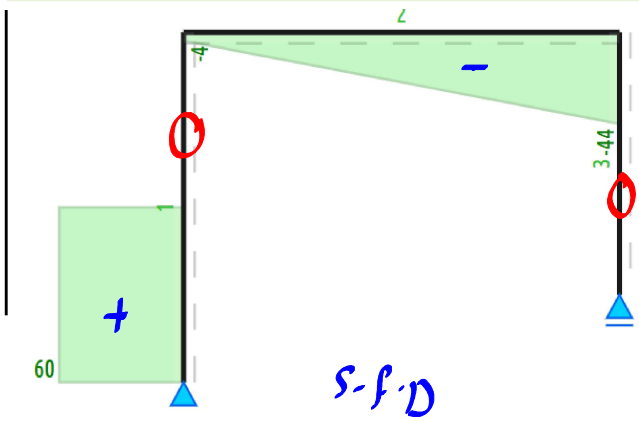
$D_y = 44\,KN \uparrow$

$\Sigma f_y = A_y - 40 + 44 = 0 \Rightarrow A_y = -4\,KN \uparrow$

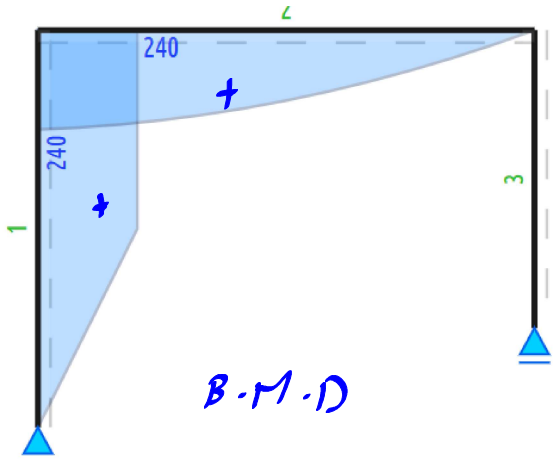
$A_y = 4\,KN \downarrow$



N.F.D



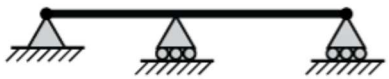
S.F.D



B.M.D

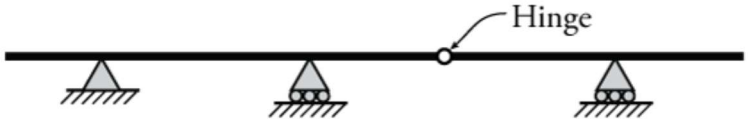
5. Check for the structures shown below as statically determinate or statically indeterminate. If statically indeterminate calculate degree of indeterminacy and the number of degrees-of-freedom

a)

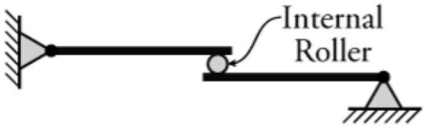


b)

c)

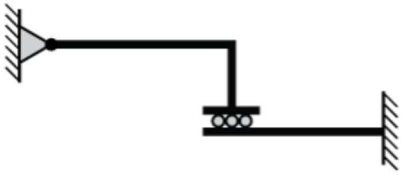


d)

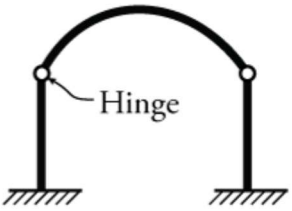


e)

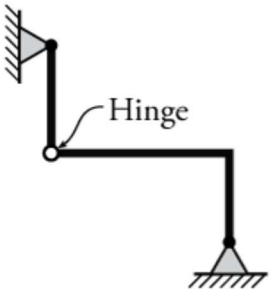
f)



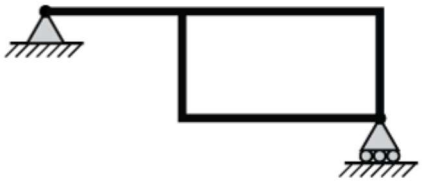
g)



h)



i)



a) $r = 4$, $c = 0$

$r > c + 3$

$4 > 0 + 3$ indeterminate to first degree

b) $r = 6$, $c = 0$

$r > c + 3$

$6 > 0 + 3$

indeterminate to third degree

c) $r = 4$, $c = 1$

$r = c + 3$ stable, determinate

d)

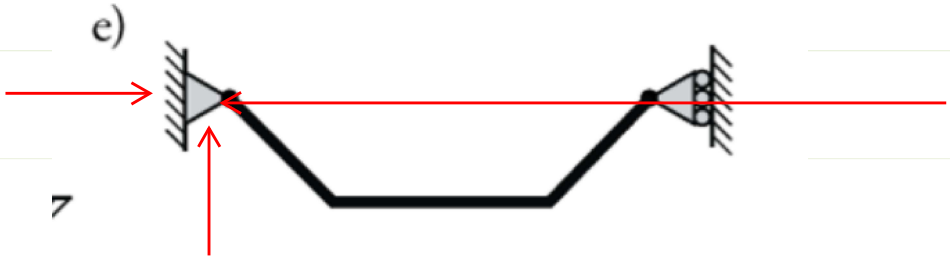
$r = 4$, $c = 2$

$r < c + 3$

$4 < 2 + 3$

unstable

e)



unstable due to concurrent reactions

f) $r = c + 3$

$S = 2 + 3$ stable, determinate

حل اخر

$3m + r = 3j + c$

$3 * 3 + 5 = 3 * 4 + 2$

stable, determinate

حل اخر لنفس السؤال

$3m + r = 3j + c$

$3 * 2 + 5 = 3 * 3 + 2$

كل الحلول صحيحة

g) $3m + r > 3J + c$

$3 * 3 + 6 > 3 * 4 + 2$ (15, 14)

indeterminate to first degree

h) unstable (internal collapse mechanism)

i) $r = 3 + 3 = 6$

$r > c + 3$

$6 > 3$ indeterminate to third degree

حل آخر

$3m + r > 3J + c$

$3 * 5 + 3 > 3 * 5 + 0$

$18 > 15$

indeterminate to third degree

Question 1

(a) 1° S.I.
(b) 3° S.I.
(c) Determinate
(d) Unstable
(e) Unstable (concurrent reactions)
(f) Determinate
(g) 1° S.I.
(h) Unstable (internal collapse mechanism)
(i) 3° S.I.

← حل المرجع