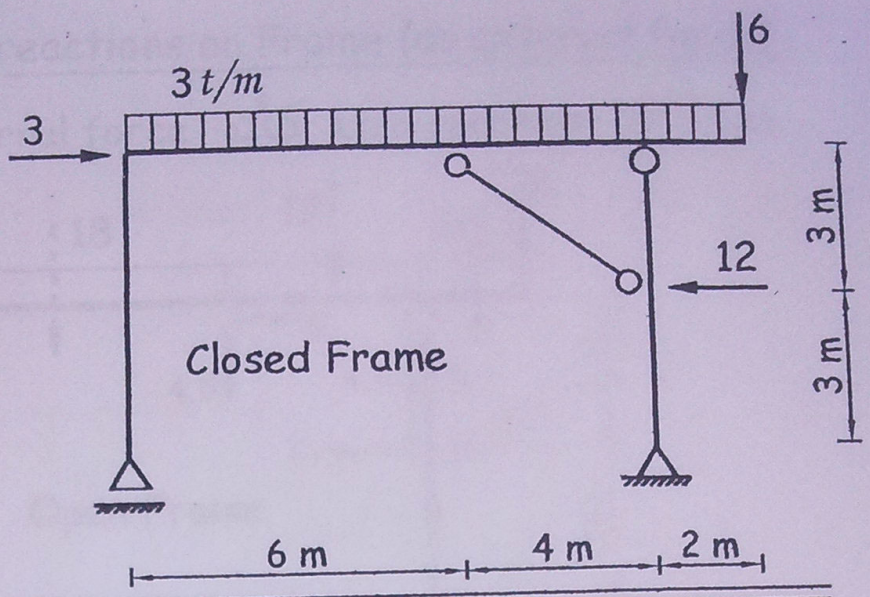
ROBLEM(1):



SOLUTION

Link member شايل Frame

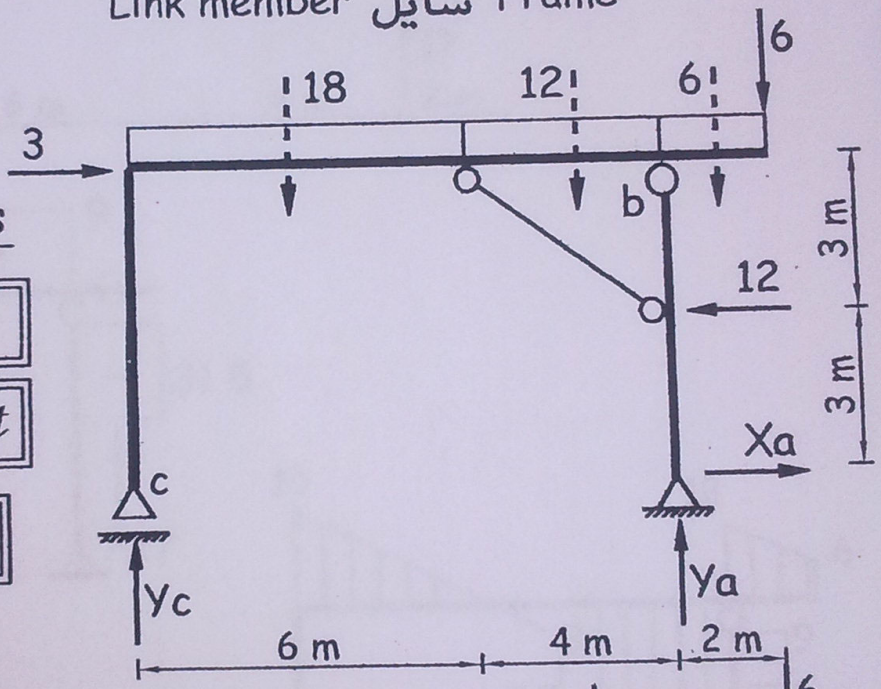
Step (1):

Get External reactions

$\sum X = 0 \Longrightarrow$ **Xa = 9 t**

$\sum M_c = 0 \Longrightarrow$ **Ya = 27 t**

$\sum Y = 0 \Longrightarrow$ **Yc = 15**

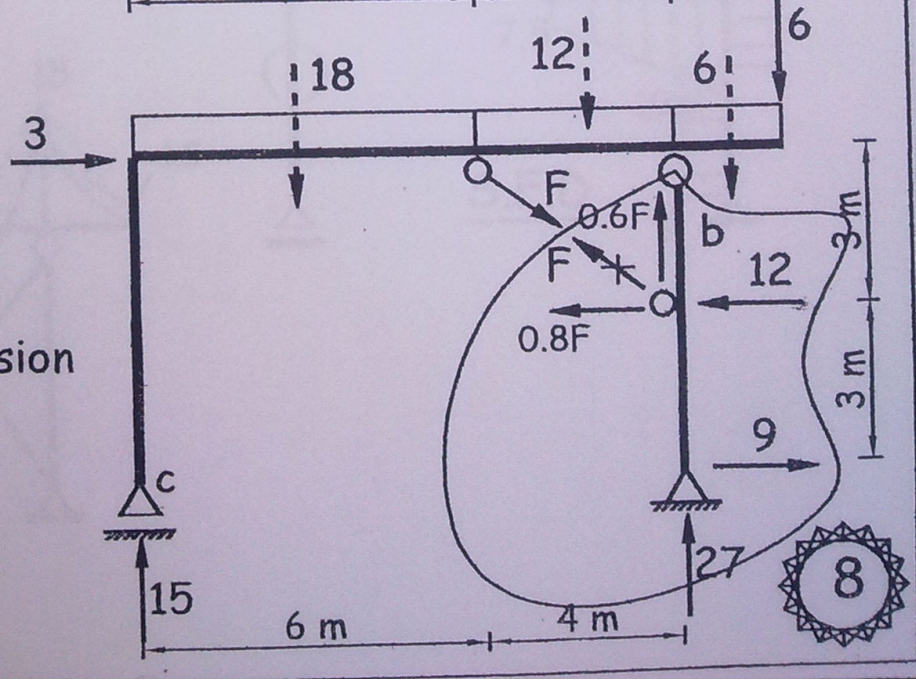


Step (2):

Get Link reactions

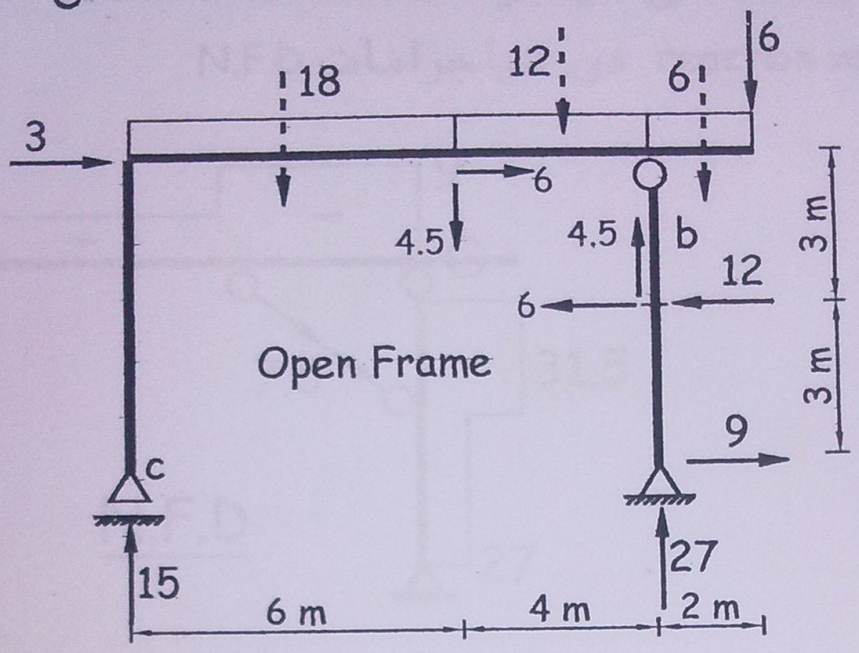
$\sum M_b = 0$ Down

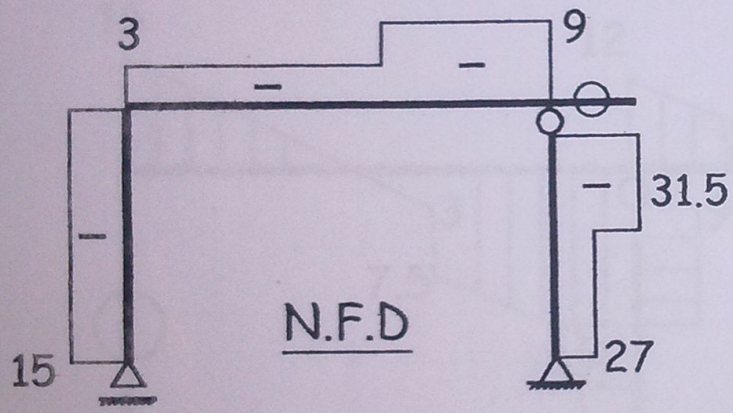
$\Longrightarrow$ **F = +7.5 t** Tension

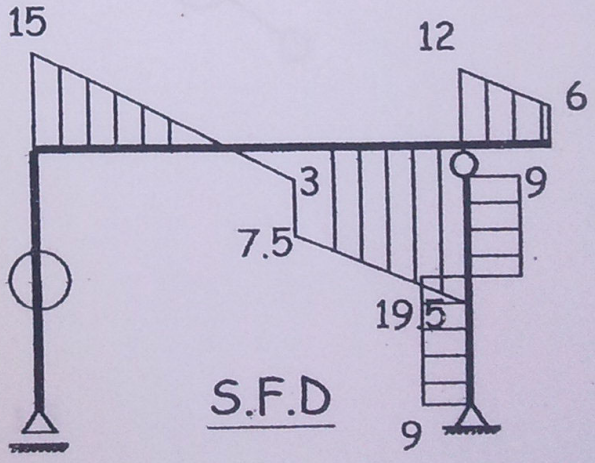


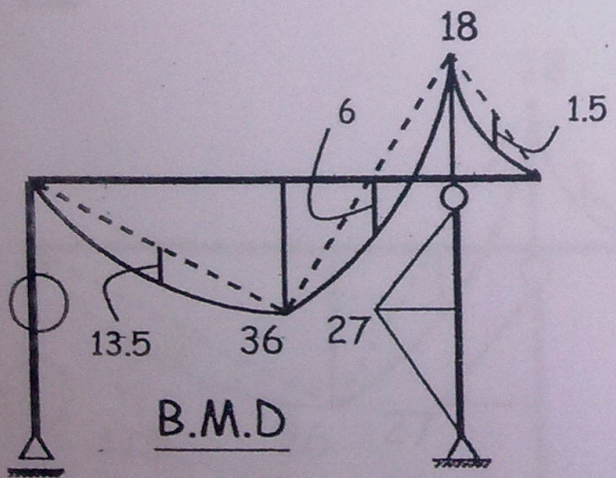
-p (3): Plot Link reactions on Frame (as external force)

نعتبر الـ Link reaction كأنه external force على الـ Frame





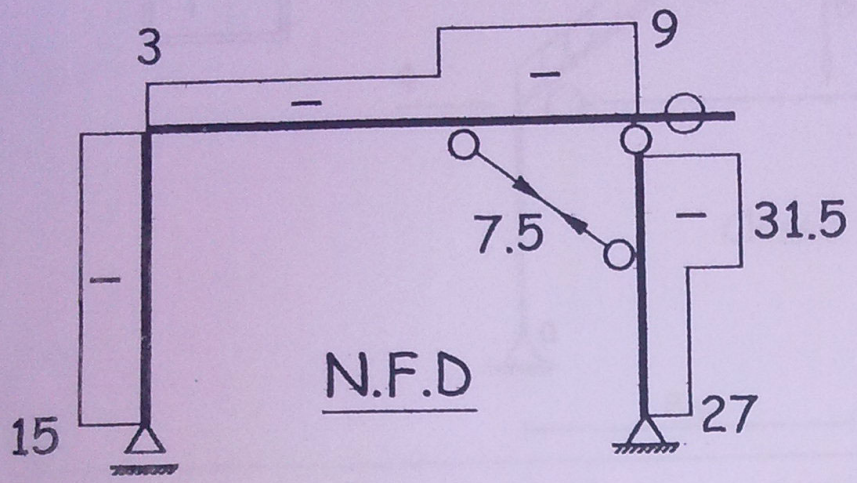


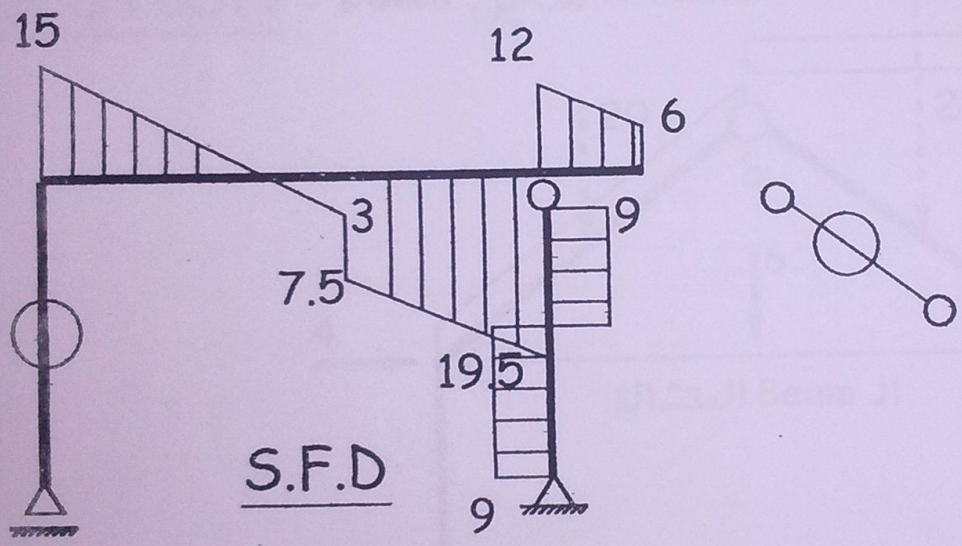


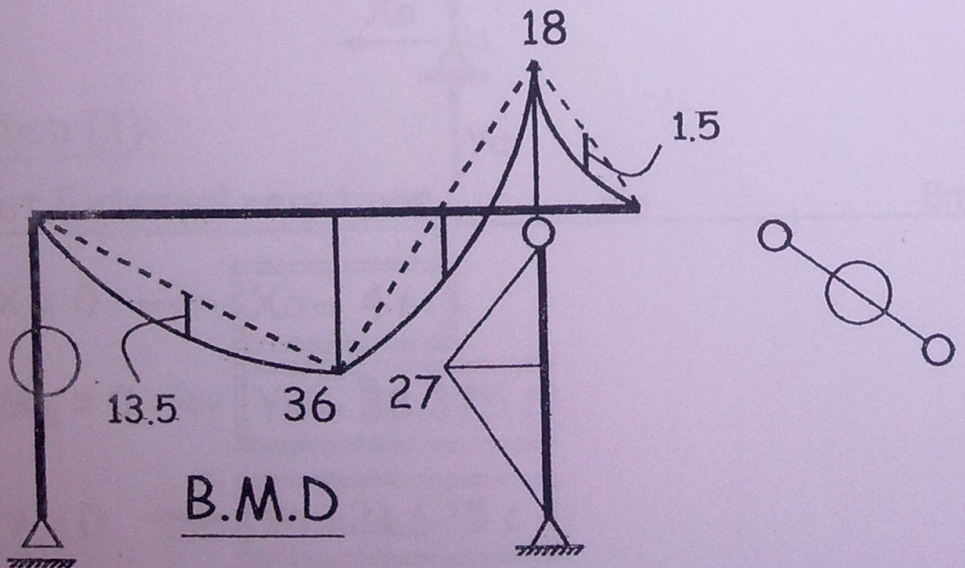
-p (4): يتم رسم الـ Link members فى نهاية المسألة

و وضع zero value فى دياجرامات S.F.D & B.M.D

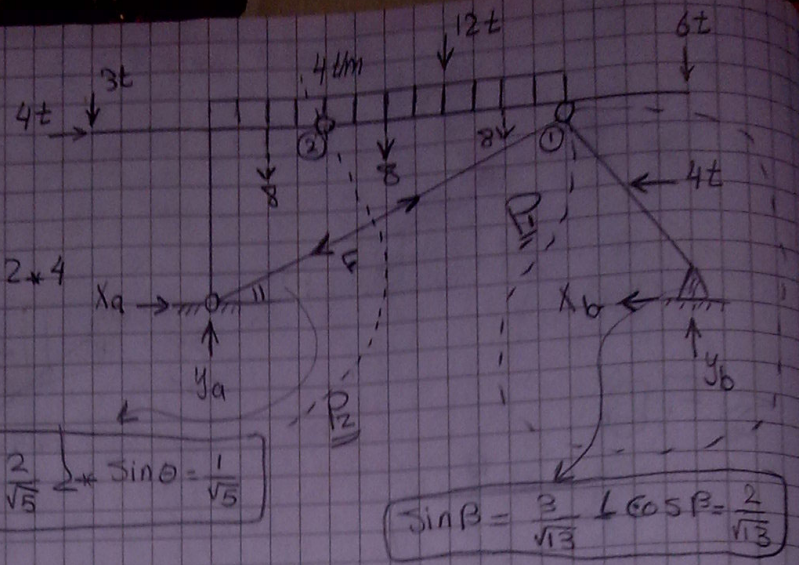
و وضع reaction value فى دياجرامات N.F.D







4



$\Sigma M @ (a) = 0$

$8y_b + 4*1.5 - 6*8 - 3*24 - 12*4 + 3*2 - 4*3 = 0$

$\boxed{y_b = 21\,t}$

$\cos\theta = \frac{2}{\sqrt{5}}$ ∠ $\sin\theta = \frac{1}{\sqrt{5}}$

$\sin\beta = \frac{3}{\sqrt{13}}$ ∠ $\cos\beta = \frac{2}{\sqrt{13}}$

$\Sigma M @ (b) = 0$

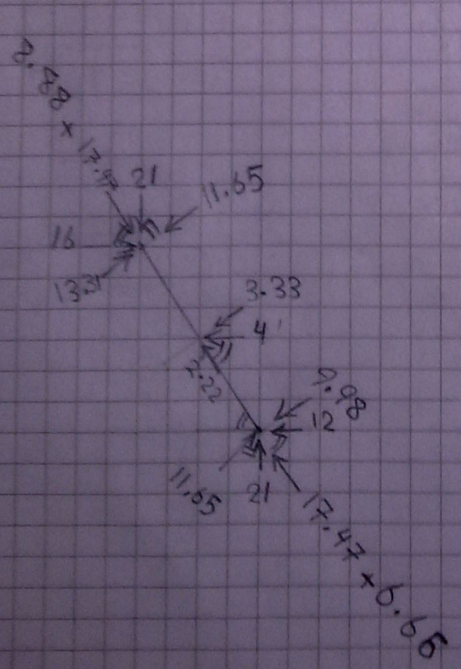
$-8y_a - 4*3 + 3*10 + 5*24 + 4*12 + 4*1.5 = 0 \Rightarrow \boxed{y_a = 24}$

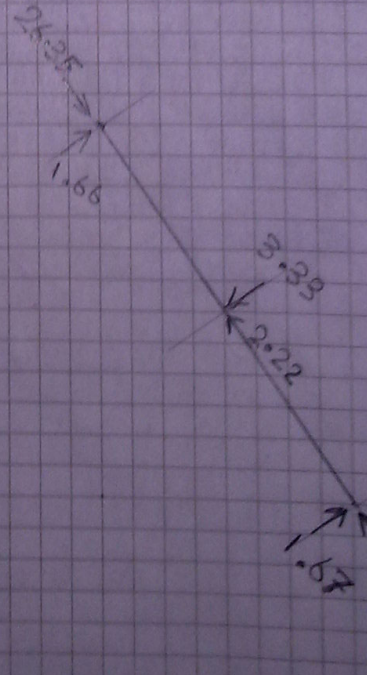
$@P_1 \Rightarrow \Sigma M \text{ at } ① = 0 \Rightarrow 2*21 - 3X_b - 4*1.5 = 0 \Rightarrow \boxed{X_b = 12\,t}$

$\Sigma X = 0 \Rightarrow \boxed{X_a = 12\,t}$

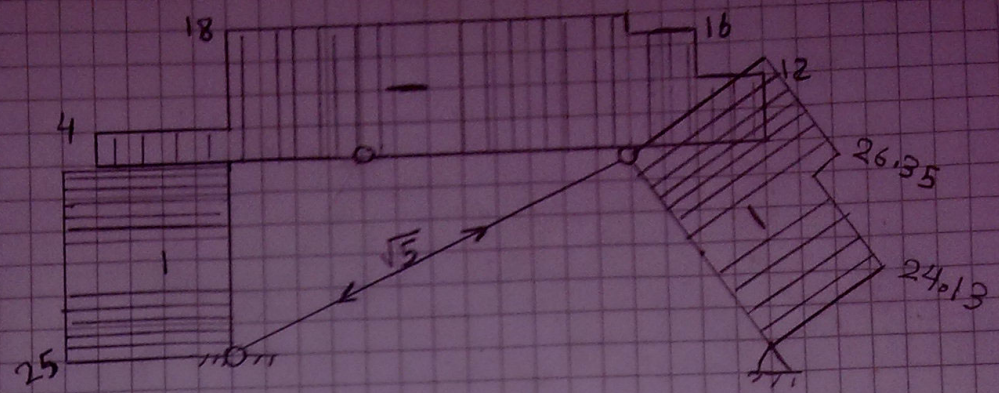
$\Sigma M @ (2) \text{ "L"} = 0 \Rightarrow 3*4 - 24*2 + 12*3 + 8 + F\cos\theta*3 + F\sin\theta*2 = 0$

$F = \sqrt{5} \Rightarrow \boxed{2.236\,t = F}$

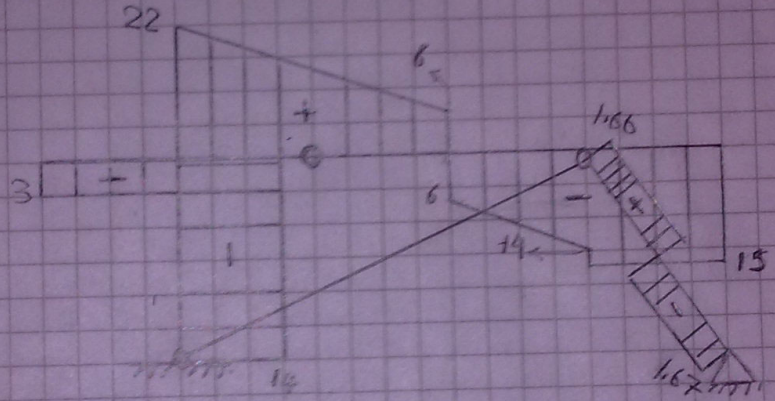




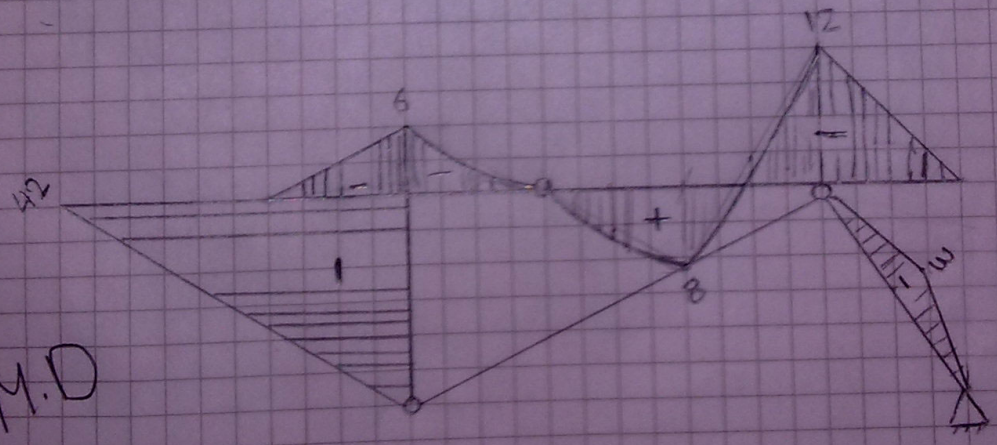
N.F.D



S.F.D

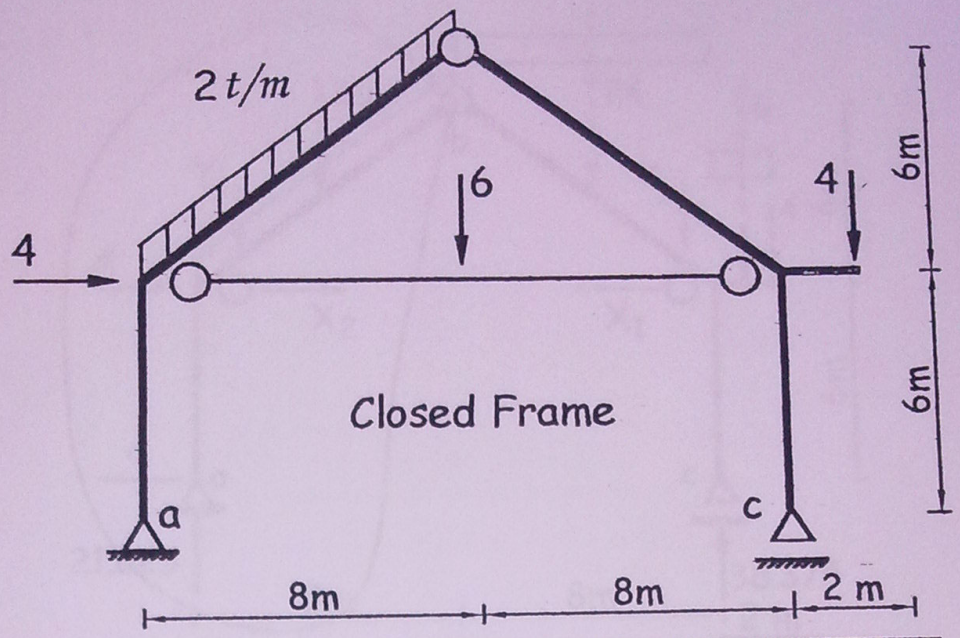


B.M.D

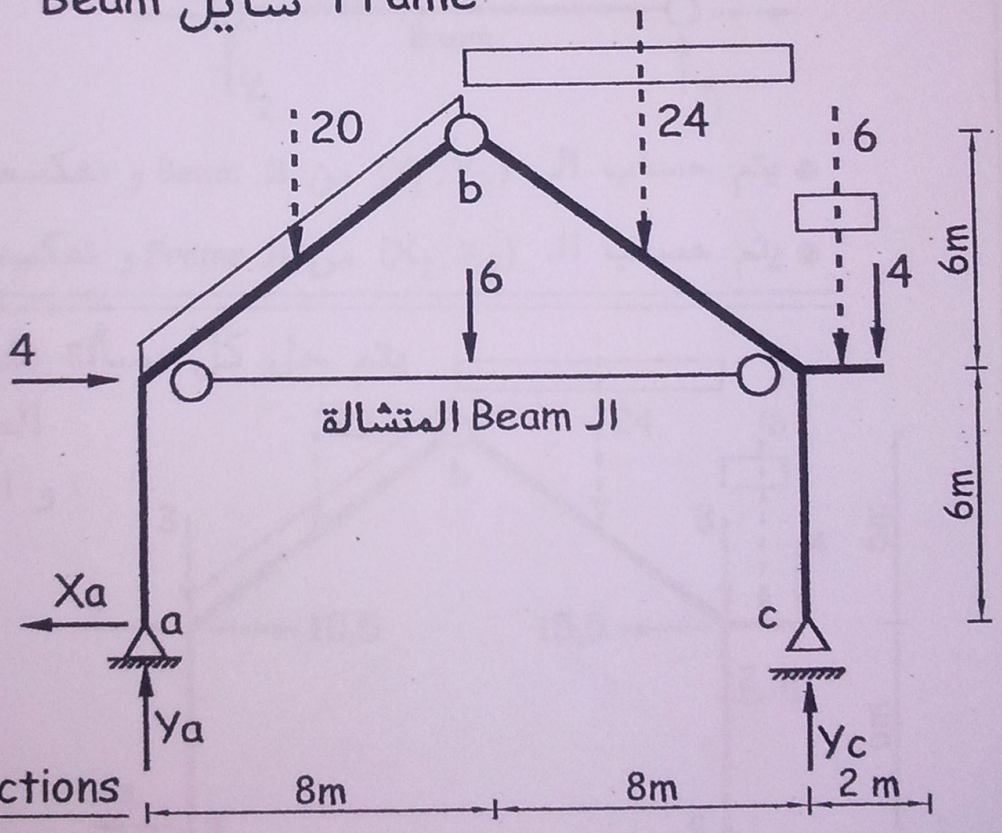


ROBLEM(2):

معم



SOLUTION Beam شايل Frame



Step (1):

Get External reactions

$\sum X = 0 \Longrightarrow$ $Xa = 4\,t$

$\sum M_a = 0 \Longrightarrow$ $Yc = 38.375\,t$

$\sum Y = 0 \Longrightarrow$ $Ya = 21.625\,t$

Step (2): Divide the structure into beam & Frame

∴ From Beam :

$\sum M_e = 0$

$\Rightarrow \boxed{Y_1 = 3\,t}$

$\sum Y = 0$

$\Rightarrow \boxed{Y_2 = 3\,t}$

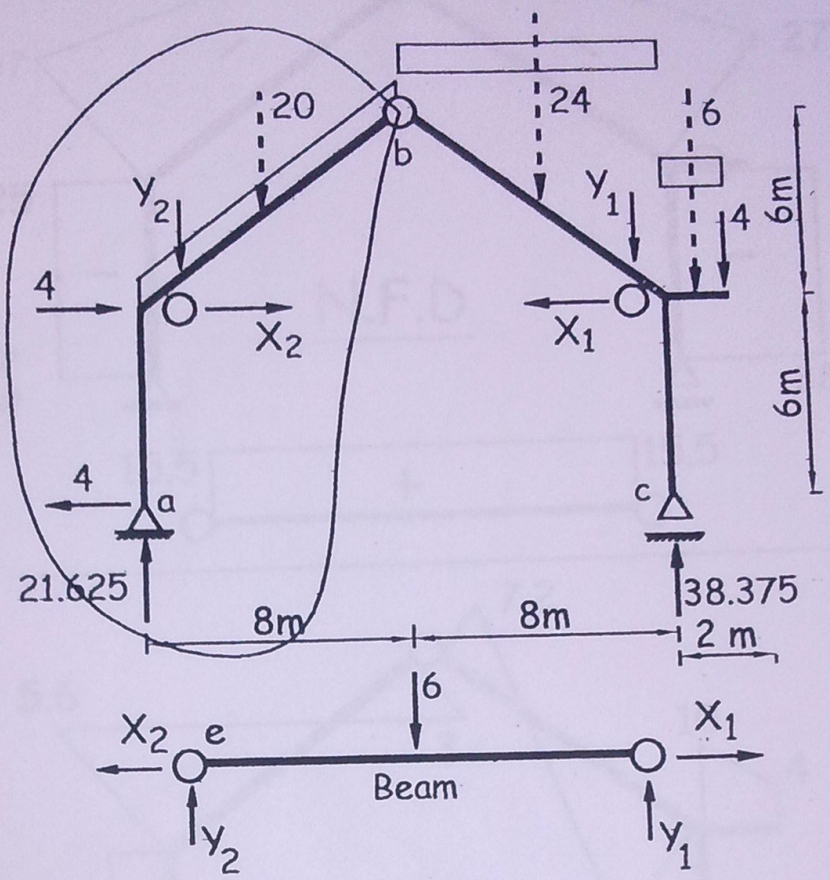
∴ From Frame :

$\sum M_b = 0$ Left

$\Rightarrow \boxed{X_2 = 15.5\,t}$

$\sum X = 0$

$\Rightarrow \boxed{X_1 = 15.5\,t}$

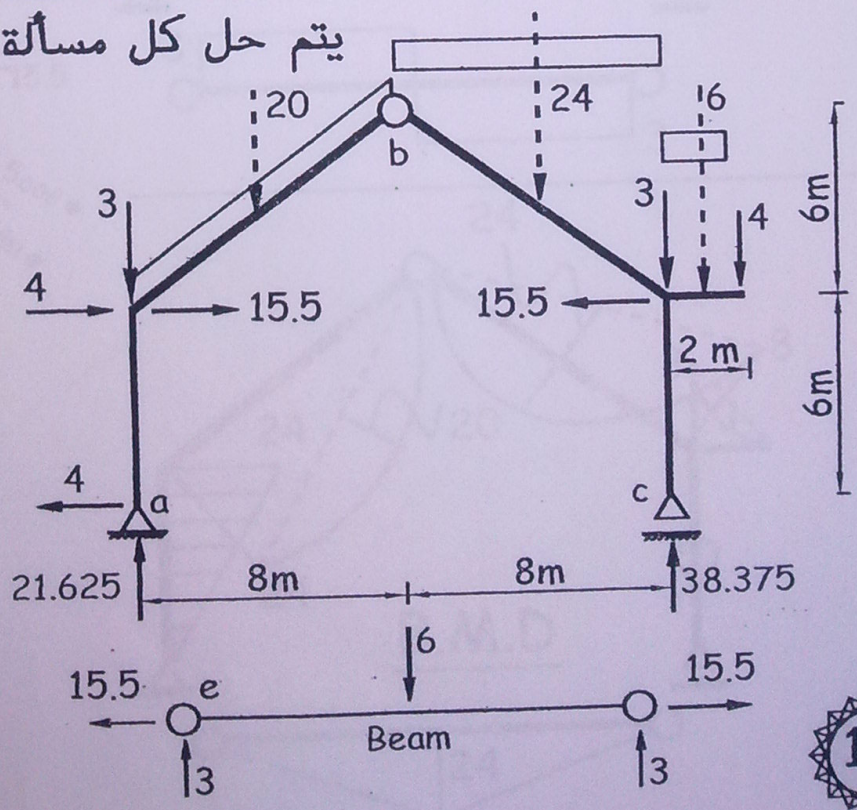


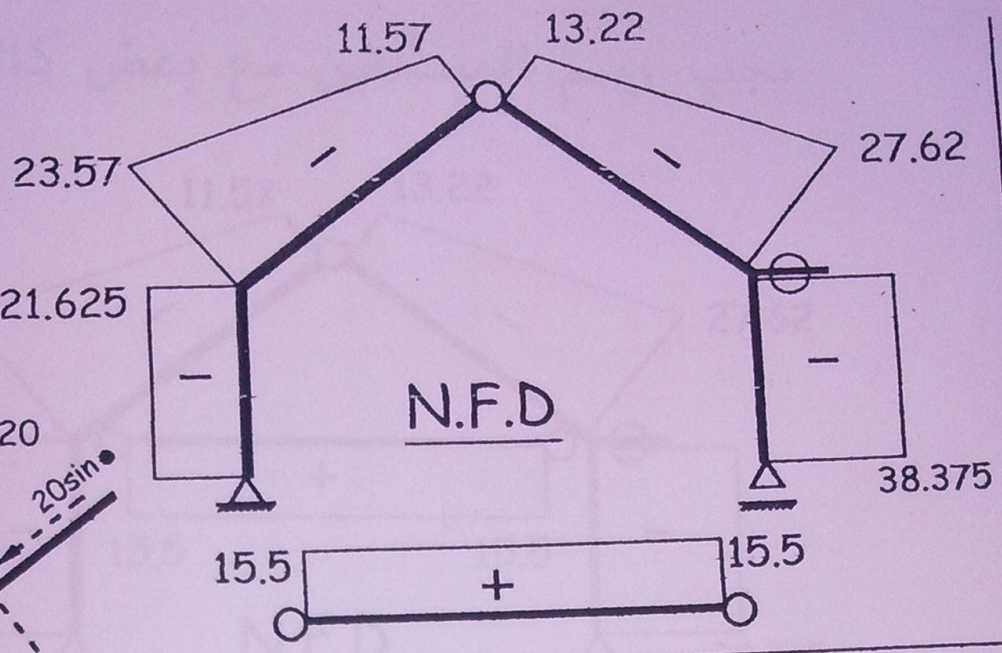
- يتم حساب الـ (Y_1, Y_2) من الـ Beam و نعكسهم على Frame
- يتم حساب الـ (X_1, X_2) من الـ Frame و نعكسهم على Beam

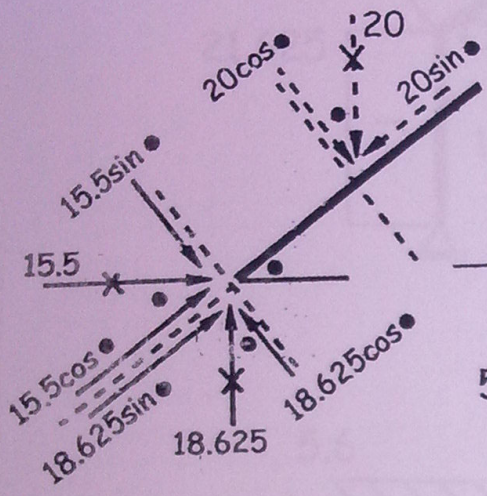
يتم حل كل مسألة على حدة كأنها مسألتين

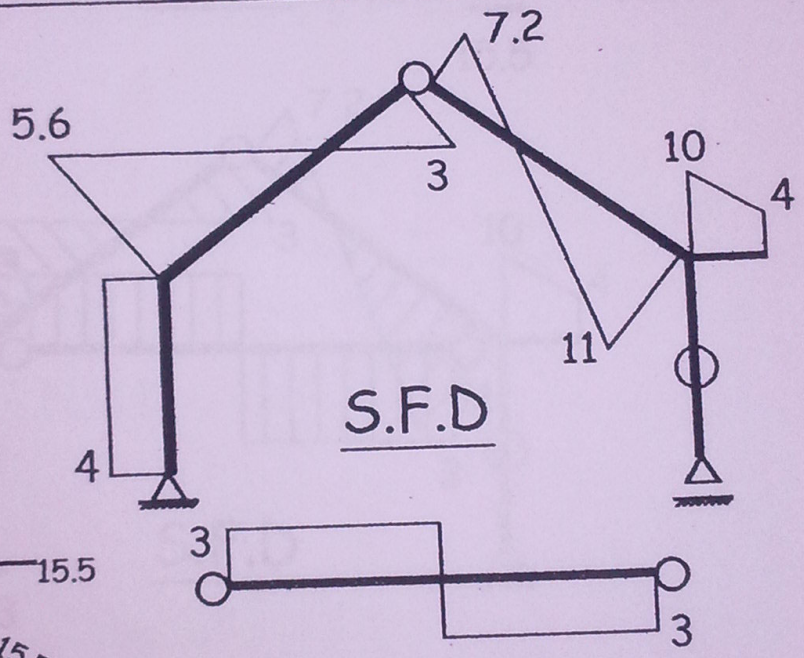
المسألة الاولى Frame

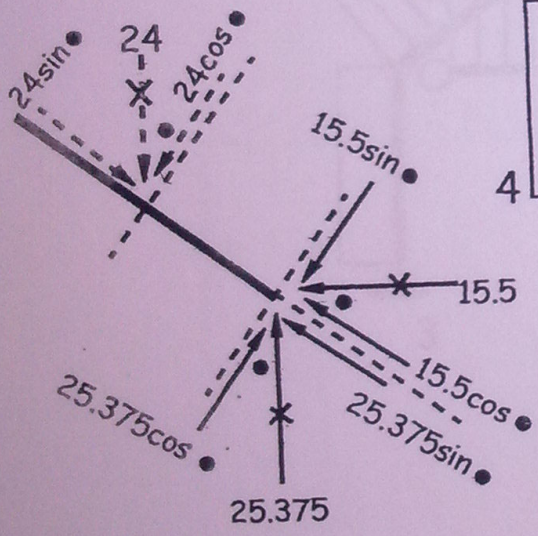
و المسألة الثانية Beam





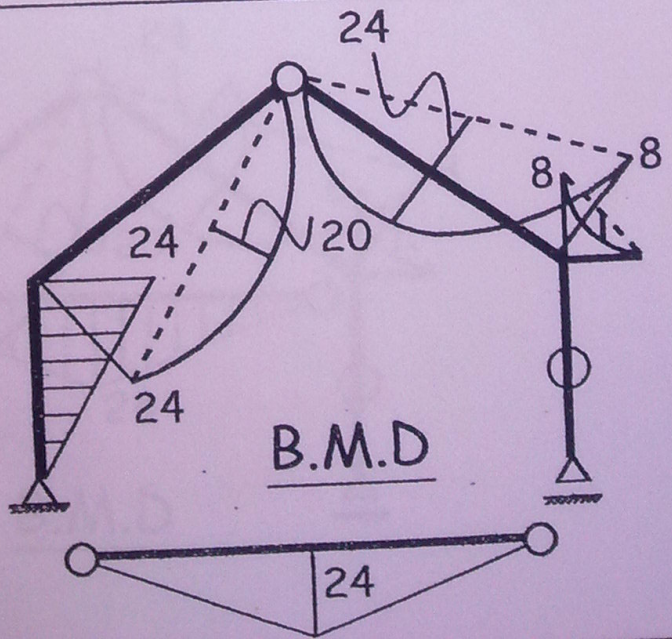




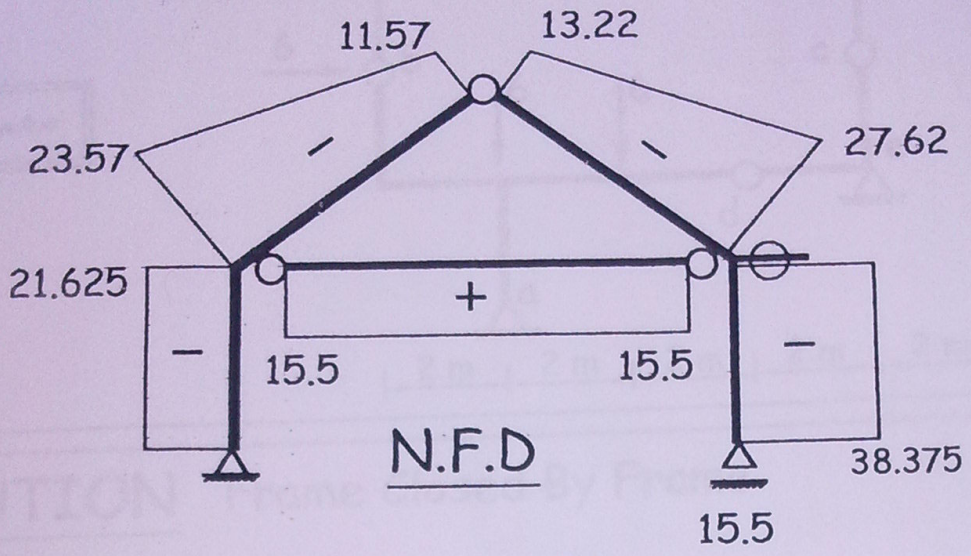


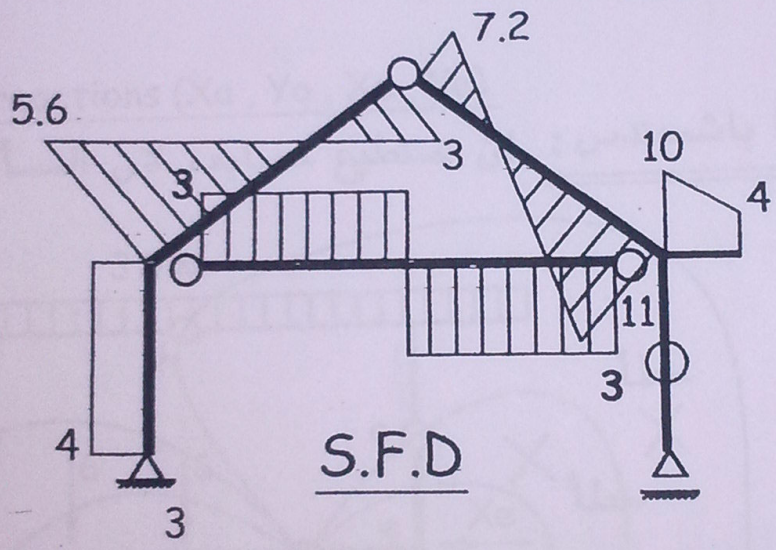
$\cos\theta = 0.8$

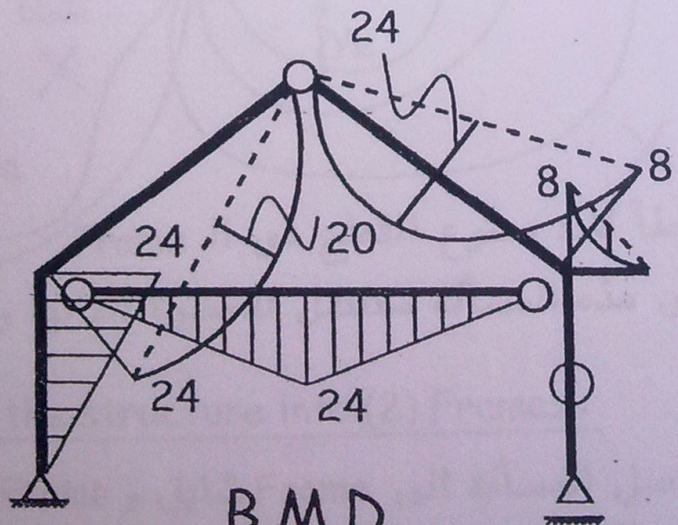
$\sin\theta = 0.6$



يجب رسم المسألتين مع بعض كالاتى

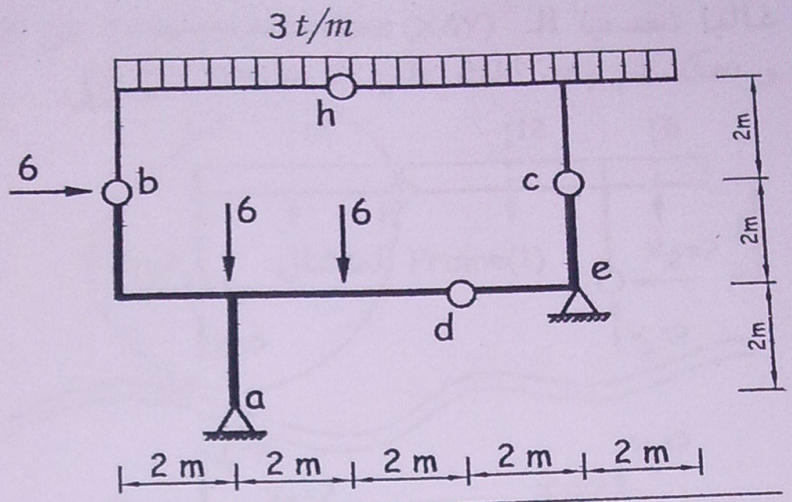






OBLEM(3):

مهم جدا

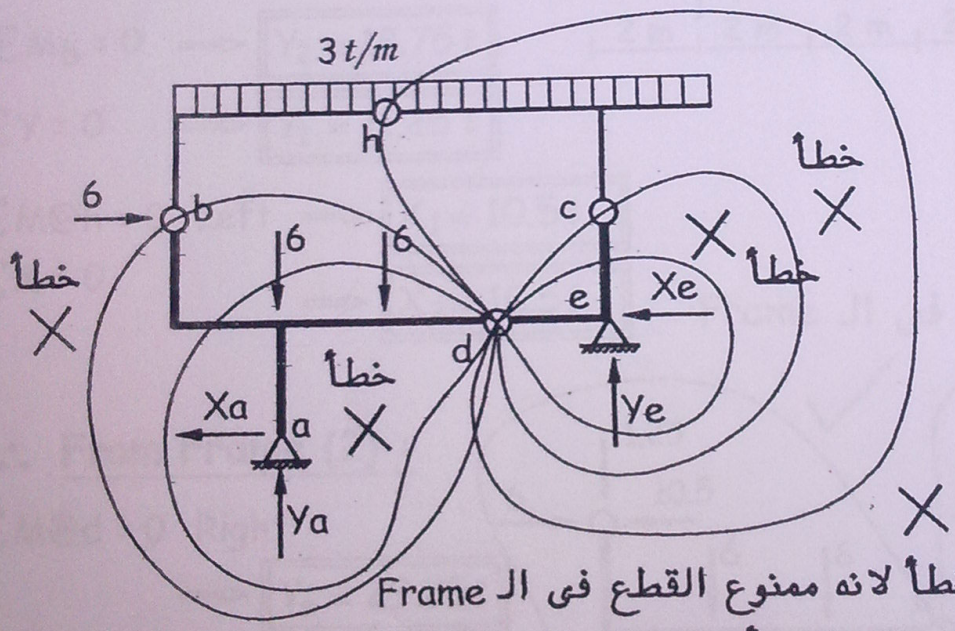


SOLUTION Frame Closed By Frame

Step (1):

Get External reactions (Xa , Ya , Xe , Ye)

⚠ خد بالك يا باشمهندس : لن نستطيع حسابهم لان المسألة Closed



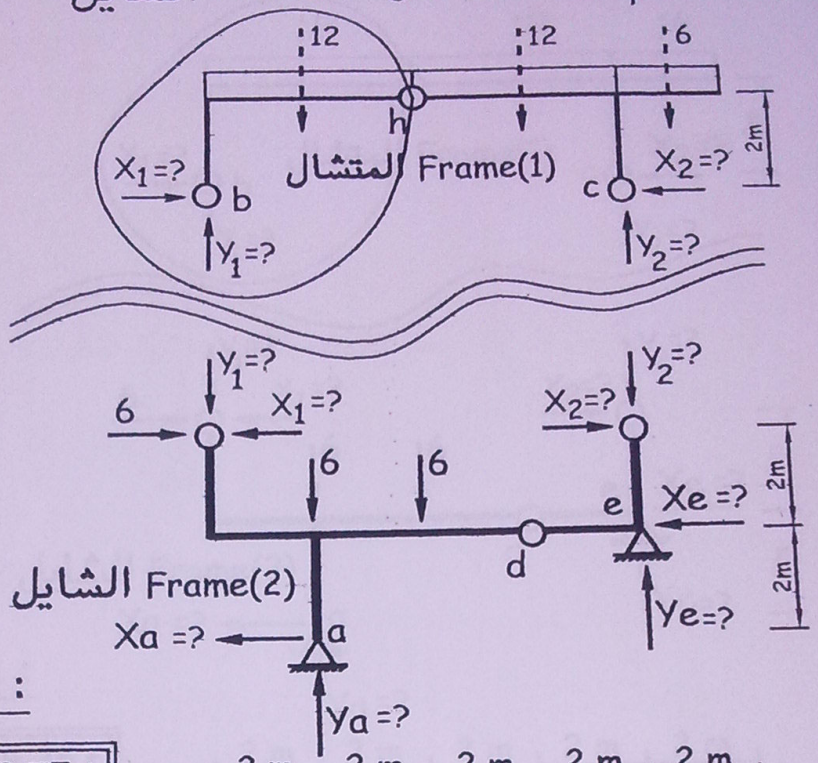
خطأ لانه ممنوع القطع فى الـ Frame

فى هذه المسألة سننتقل للخطوة الثانية و هى

Step (2): Divide the structure into (2) Frames :

نفصل المسألة الى Frame شايل و Frame متشال مع ملاحظة ظهور Internal reactions (X&Y) متبادلة بينهما و يجب حسابهم

غالبا نحسب الـ Internal reactions (X&Y) من الـ Frame المتشال او
و نعكسهم بعد ذلك على الـ Frame الشايل



∴ From Frame (1) :

$\sum M_b = 0 \Rightarrow \boxed{Y_2 = 18.75\,t}$

$\sum Y = 0 \Rightarrow \boxed{Y_1 = 11.25\,t}$

$\sum M@h = 0$ Left $\Rightarrow \boxed{X_1 = 10.5\,t}$

$\sum X = 0 \Rightarrow \boxed{X_2 = 10.5\,t}$

✓ لم نقطع فى الـ Frame

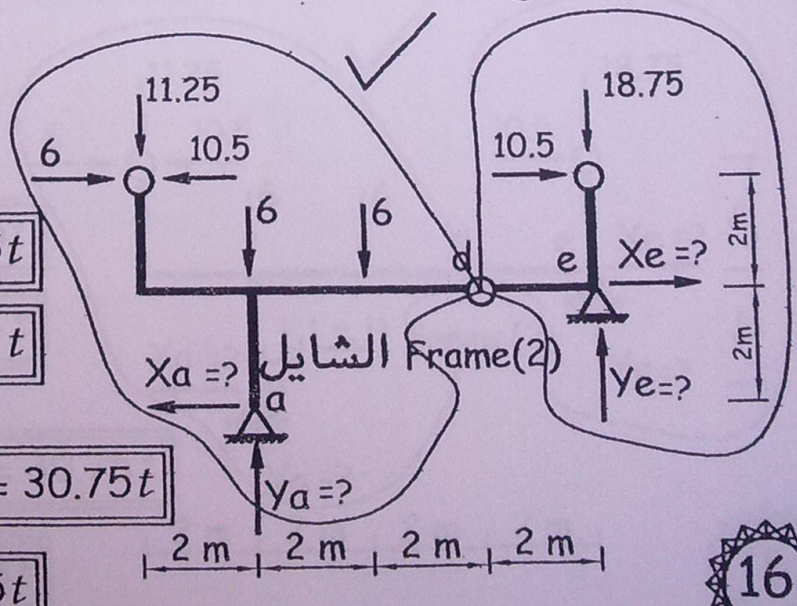
∴ From Frame (2) :

$\sum M@d = 0$ Right $\Rightarrow \boxed{Y_e = 29.25\,t}$

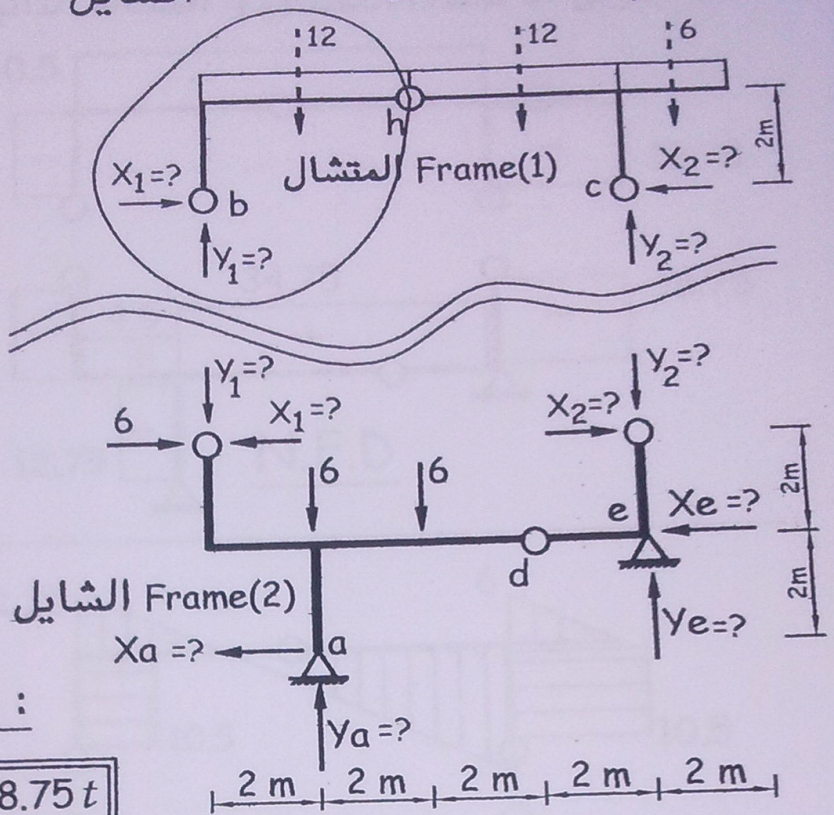
$\sum Y = 0 \Rightarrow \boxed{Y_a = 12.75\,t}$

$\sum M@d = 0$ Left $\Rightarrow \boxed{X_a = 30.75\,t}$

$\sum X = 0 \Rightarrow \boxed{X_e = 24.75\,t}$



عالبا نجسب الـ Internal reactions (X&Y) من الـ Frame المتشال
و نعكسهم بعد ذلك على الـ Frame الشايل



∴ **From Frame (1) :**

$\Sigma M_b = 0 \Rightarrow \boxed{Y_2 = 18.75\,t}$

$\Sigma Y = 0 \Rightarrow \boxed{Y_1 = 11.25\,t}$

$\Sigma M@h = 0$ Left $\Rightarrow \boxed{X_1 = 10.5\,t}$

$\Sigma X = 0 \Rightarrow \boxed{X_2 = 10.5\,t}$

✓ لم نقطع فى الـ Frame

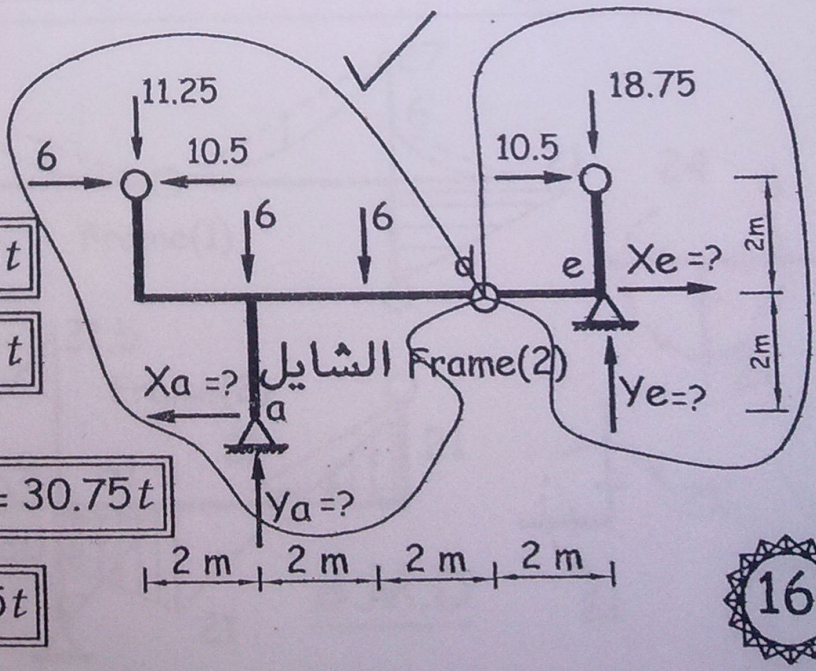
∴ **From Frame (2) :**

$\Sigma M@d = 0$ Right $\Rightarrow \boxed{Y_e = 29.25\,t}$

$\Sigma Y = 0 \Rightarrow \boxed{Y_a = 12.75\,t}$

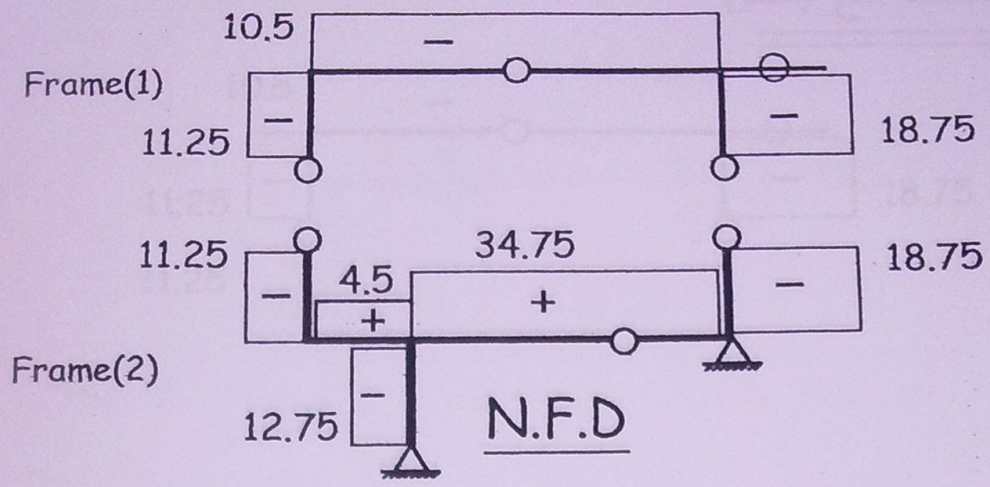
$\Sigma M@d = 0$ Left $\Rightarrow \boxed{X_a = 30.75\,t}$

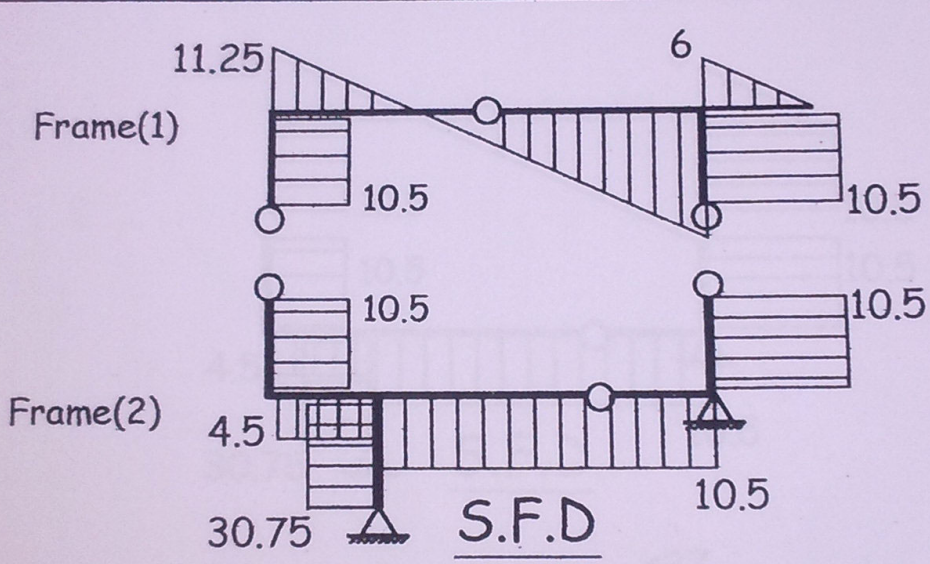
$\Sigma X = 0 \Rightarrow \boxed{X_e = 24.75\,t}$

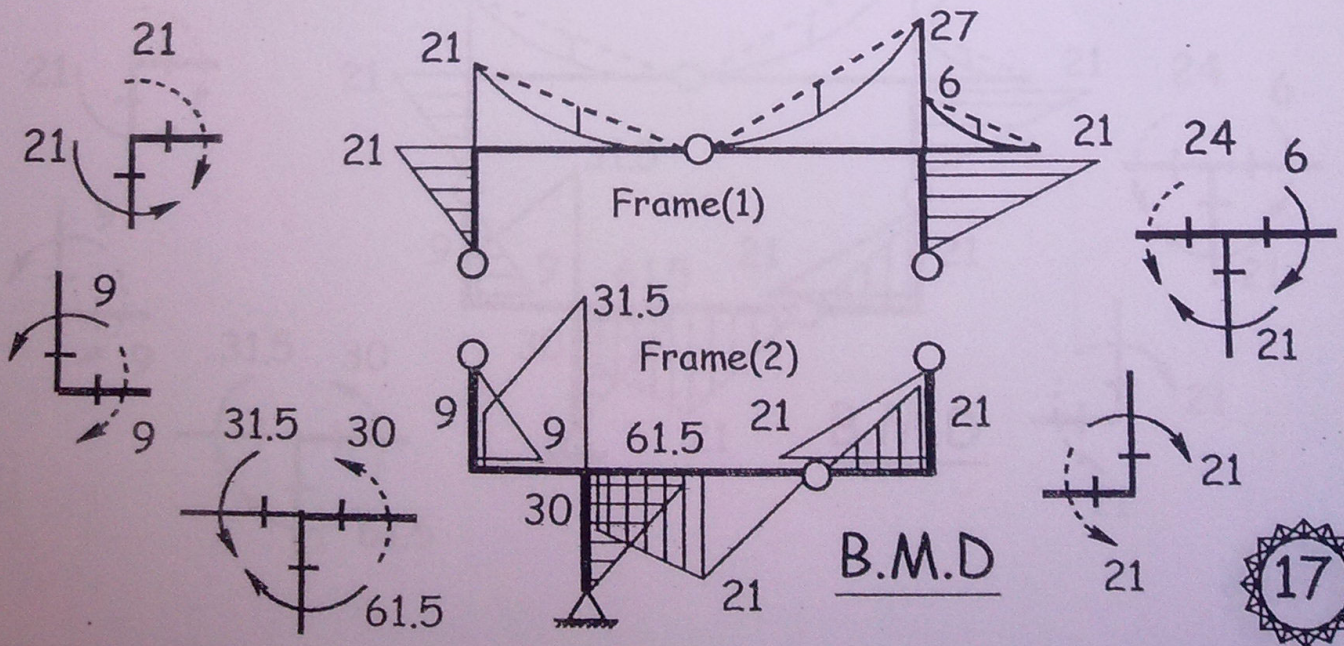


(3): يتم رسم كل مسألة على حدة كأنها مسألتين

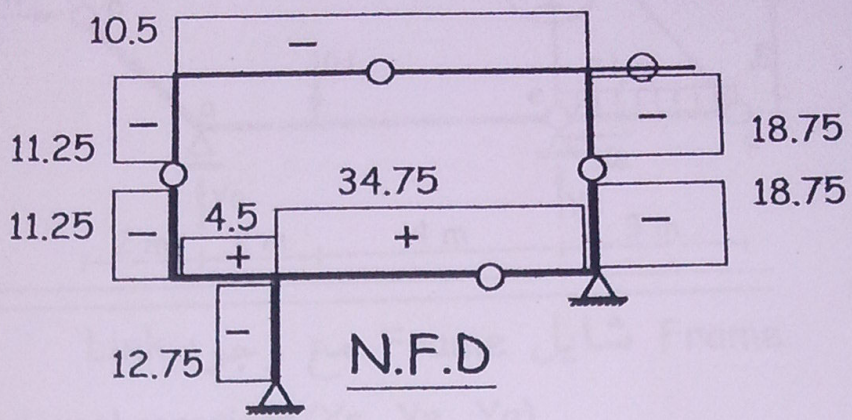
المسألة الاولى الـ Frame المتشال و المسألة الثانية الـ Frame الشايل

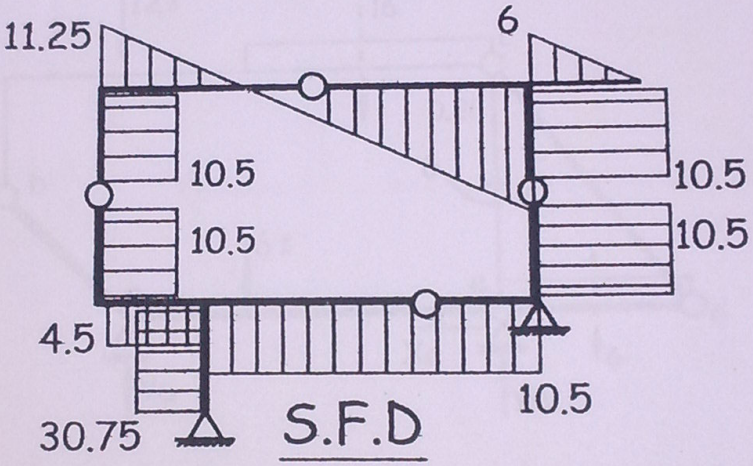


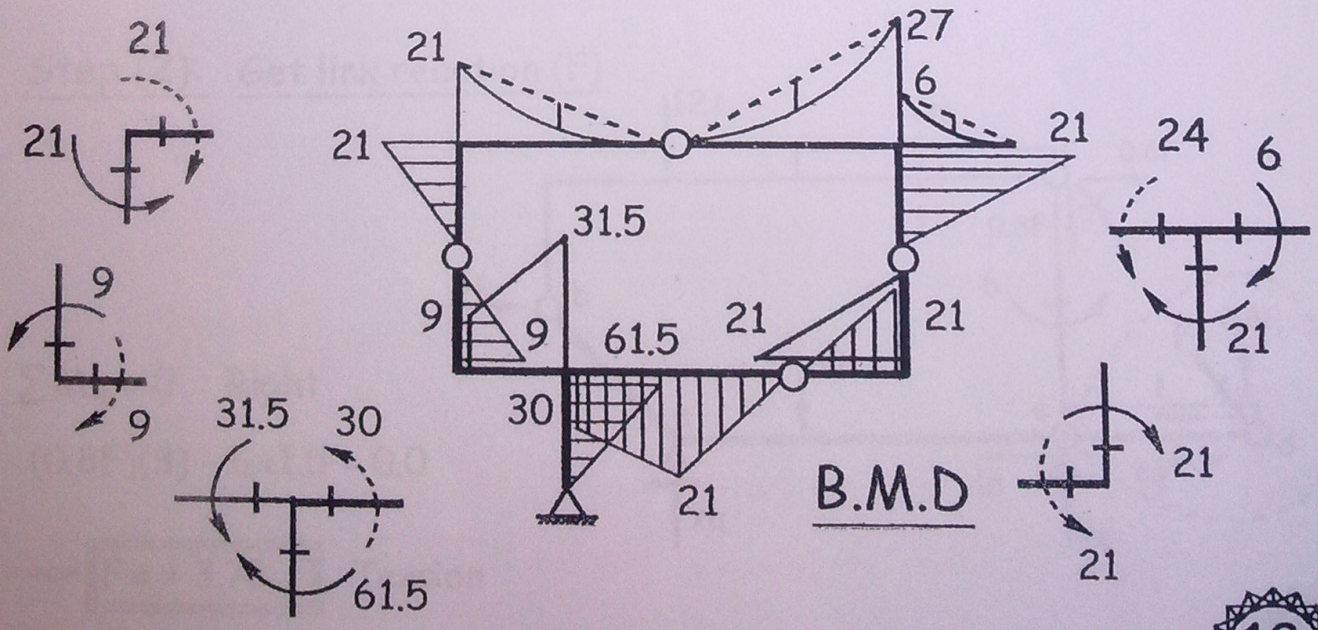




من الممكن رسم كل مسألة على حدة و لكن من المفضل رسمهما مع بعض

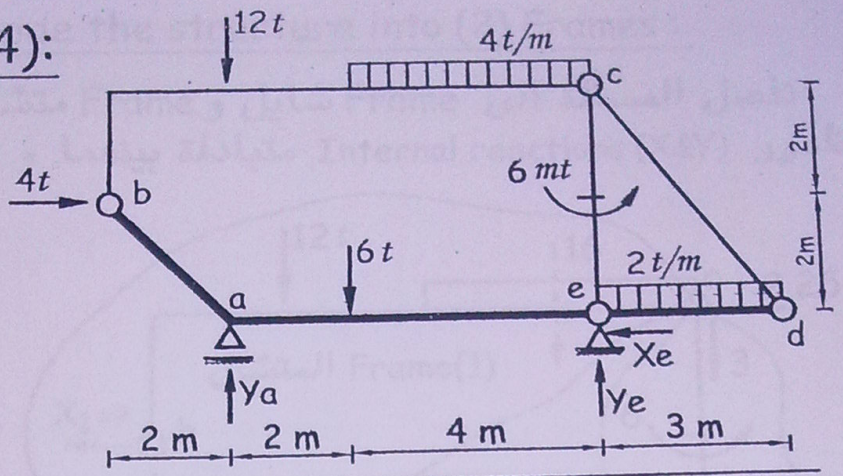






OBLEM(4):

معم



SOLUTION

Frame شايل Frame مع وجود Link

Step (1): Get External reactions (Xe , Ye , Ya)

$\sum X = 0$

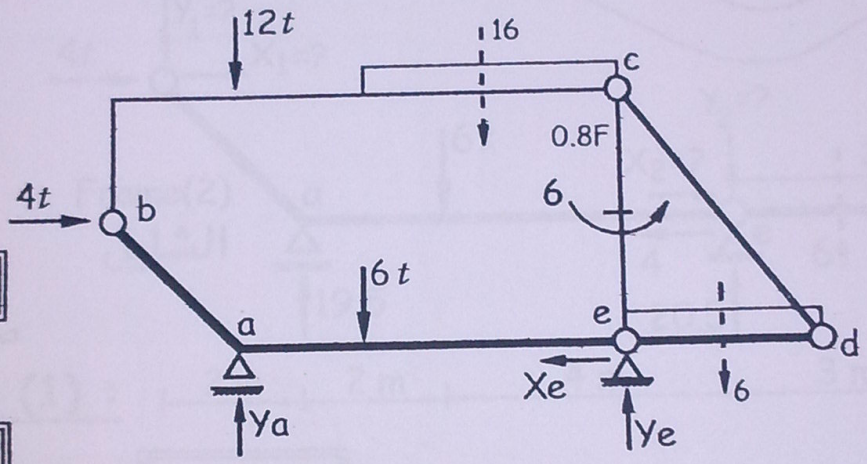
$\Rightarrow$ $Xe = 4\,t$

$\sum M_a = 0$

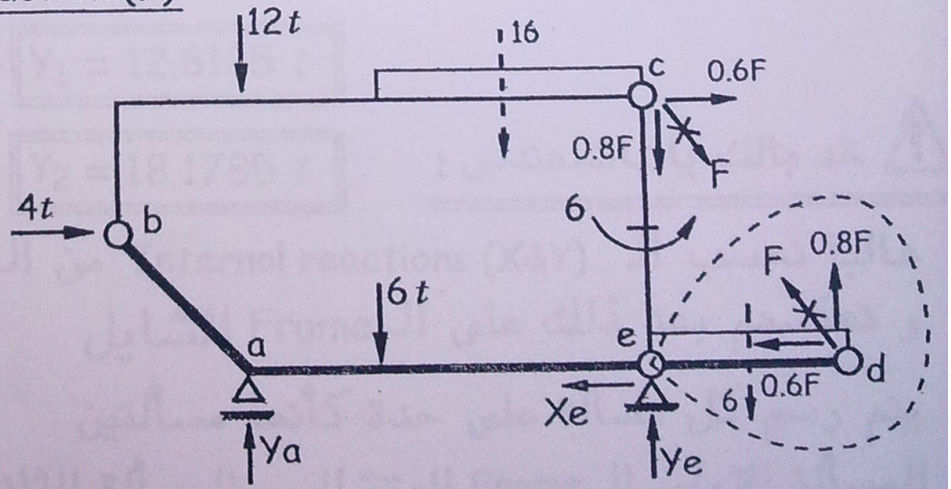
$\Rightarrow$ $Ye = 20.5t$

$\sum Y = 0$

$\Rightarrow$ $Ya = 19.5\,t$



Step (2): Get link reaction (F)



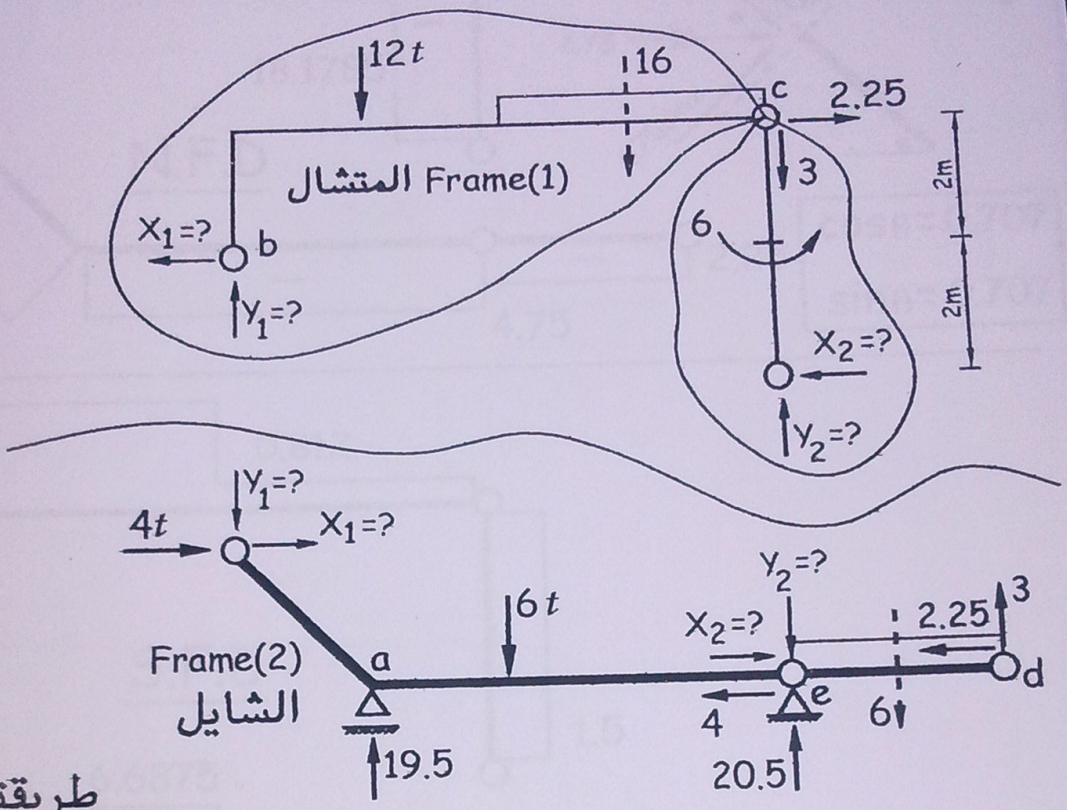
$\sum M_e = 0$ Right

$(0.8F)(3) - 6 \times 1.5 = 0.0$

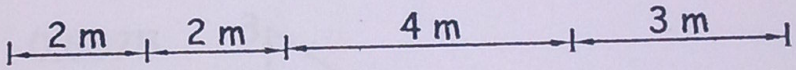
$\Rightarrow$ $F = +3.75\,t$ Tension

(3): Divide the structure into (2) Frames :

نفصل المسألة الى Frame شايل و Frame متشال مع ملاحظة
ظهور Internal reactions (X&Y) متبادلة بينهما و يجب حسابهم



طريقة التفكير



∴ From Frame (1) :

$\Sigma M_c = 0$ Down $\Longrightarrow$ $X_2 = 1.5t$

$\Sigma X = 0$ $\Longrightarrow$ $X_1 = 0.75\ t$

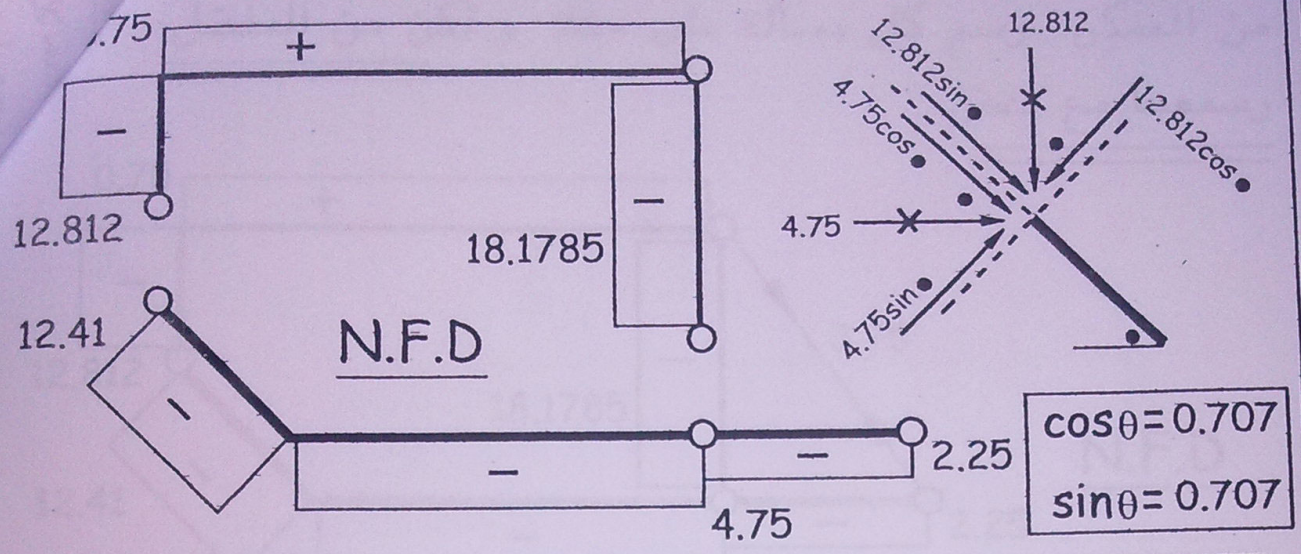
$\Sigma M@c = 0$ Left $\Longrightarrow$ $Y_1 = 12.8125\ t$

$\Sigma Y = 0$ $\Longrightarrow$ $Y_2 = 18.1785\ t$

⚠ خد بالك يا باشمهندس :

غالبا نحسب الـ Internal reactions (X&Y) من الـ Frame المتشال أولا
و نعكسهم بعد ذلك على الـ Frame الشايل

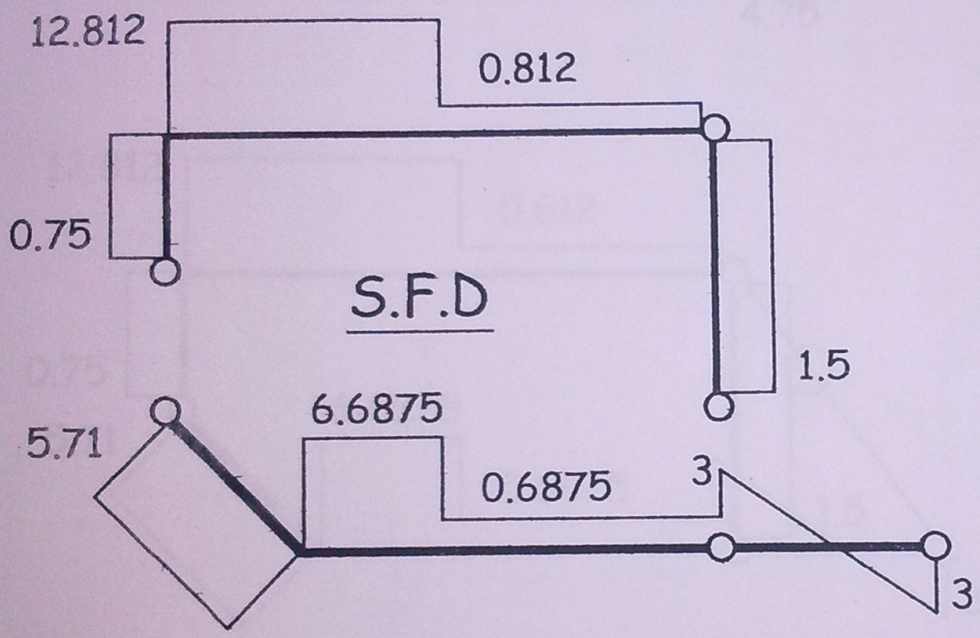
يتم رسم كل مسألة على حدة كأنها مسألتين
المسألة الاولى الـ Frame المتشال و المسألة الثانية الـ Frame الشايل



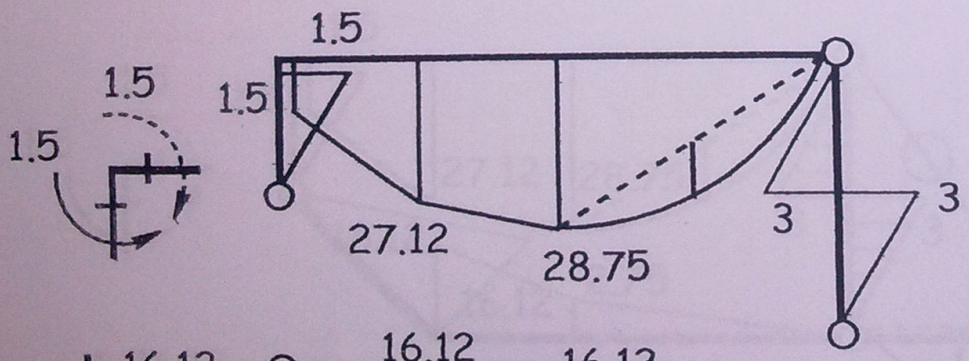
N.F.D

$\cos\theta = 0.707$

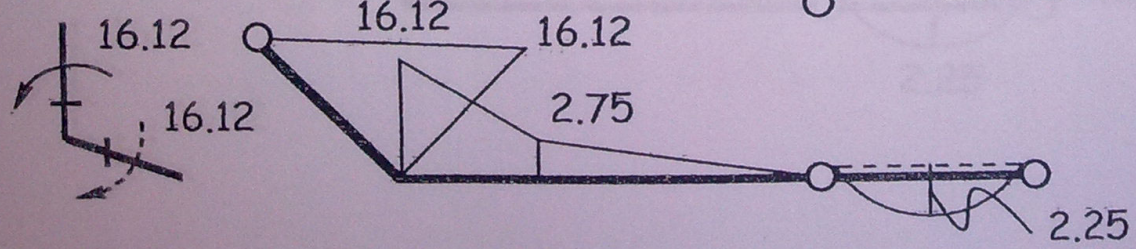
$\sin\theta = 0.707$



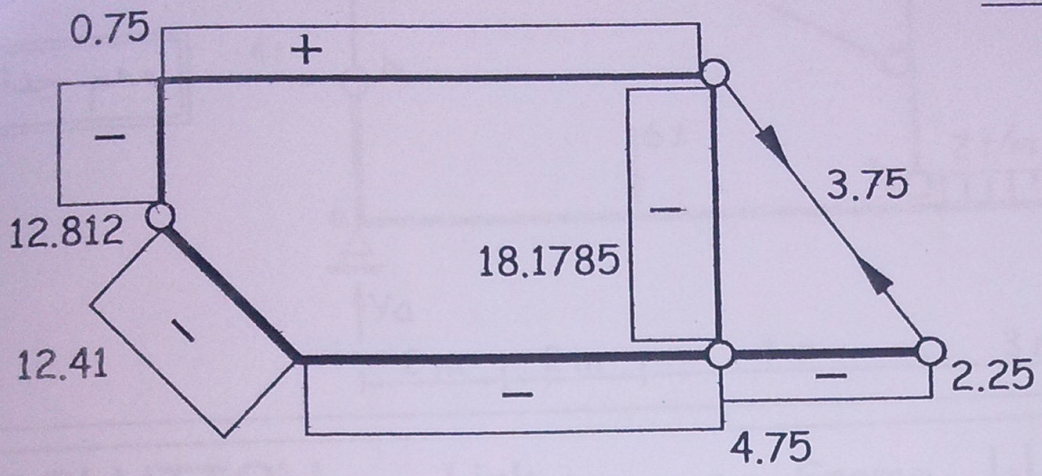
S.F.D



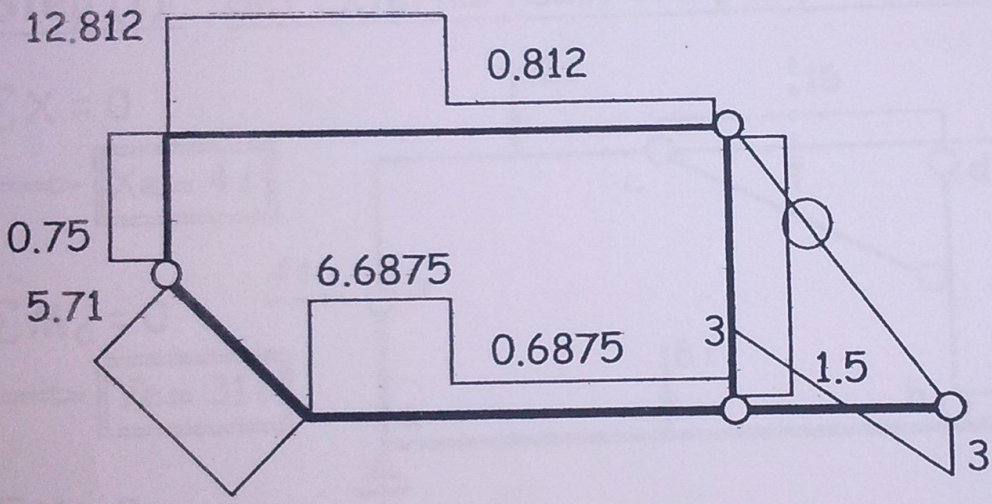
B.M.D



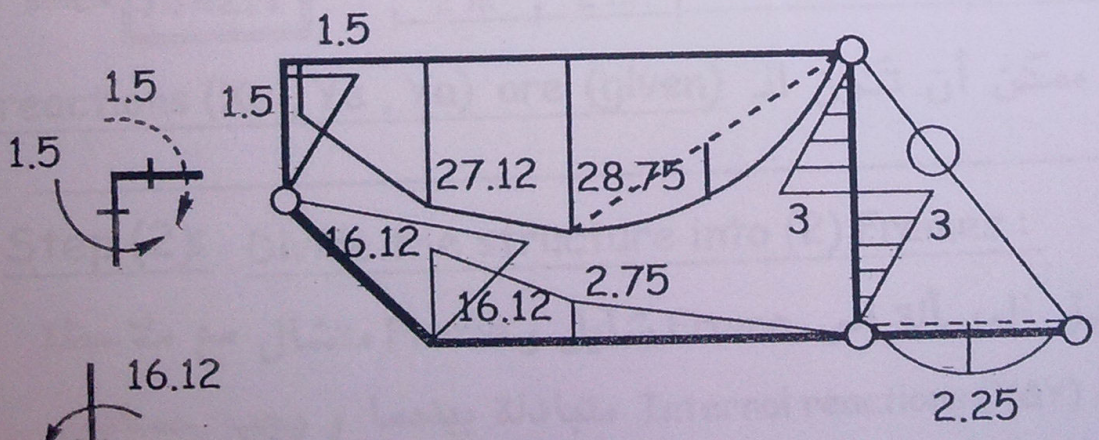
من الممكن رسم كل مسألة على حدة و لكن من المفضل رسمهما مع بعض



N.F.D



S.F.D



B.M.D