M R
Ahmed Mahdy

فيزياء	استاتيكا
دوائر كهربية	الكـــترونيات
ميكانيكا الانشائات	هيدروليكا

مدرس خصوصي

اونلاين حضوري

يحصل الطالب علي

- مقاطع فيديوهات لشرح المقرر بشكل وافي
- ملخص للمادة Pdf للمذكرة والمراجعة
- محاضرات مباشرة علي برنامج زووم
- لمناقشة الأجزاء الغير مفهومة
- تواصل مستمر مع معلم المادة

للتواصل

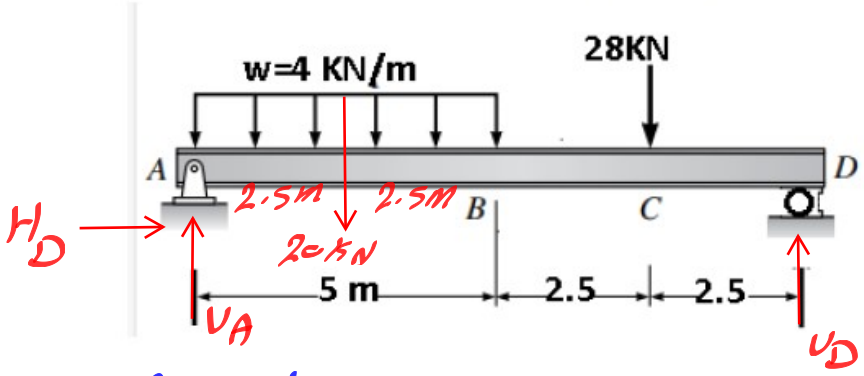
0567630097

0565657741

Assignment No (1-2)

Shear and Moment Diagrams for a Beam

1. Draw normal (axial) force, shear force and Bending moment Diagrams, (N.F.D, S.F.D and B.M.D) by using two methods.



① check for determancy

$r = c + 3$

$3 = 0 + 3$ ok

② reactions

$\Sigma f_x = H_D = 0$

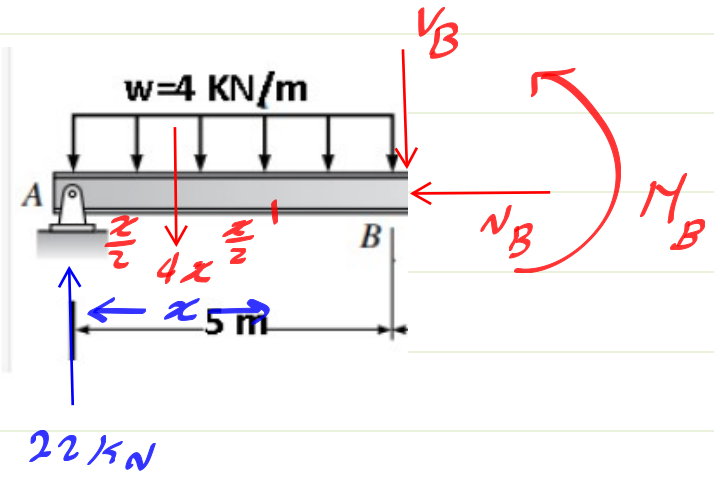
$\Sigma M_A = 20 * 2.5 + 28 * 7.5 - V_D * 10 = 0$

$V_D = 26\ kN \uparrow$

$\Sigma f_y = V_A - 20 - 28 + 26 = 0$

$V_A = 22\ kN \uparrow$

(3) for the section between A and B



$$\Sigma f_x = N = 0$$

$$\Sigma f_y = 22 - 4x - V_B = 0 \Rightarrow V_B = 22 - 4x$$

$$\Sigma M_B = -M_B - 4x\frac{x}{2} + 22x = 0$$

$$M_B = 22x - 2x^2$$

at $x = 0$

$\Rightarrow V_B = 22$ kN

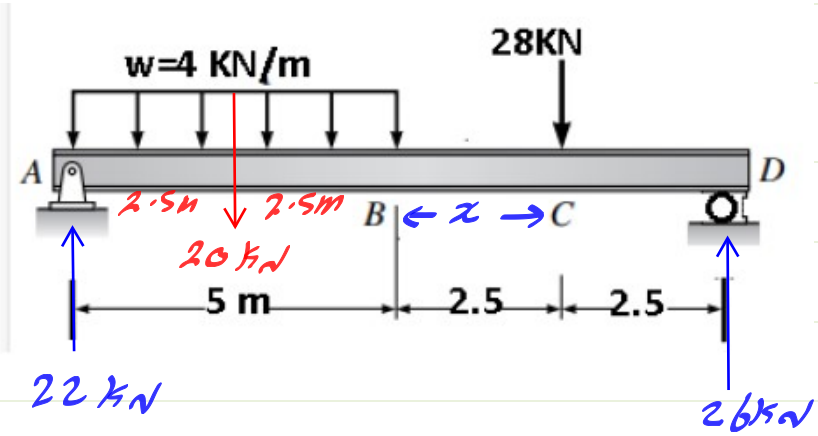
$M_B = 0$

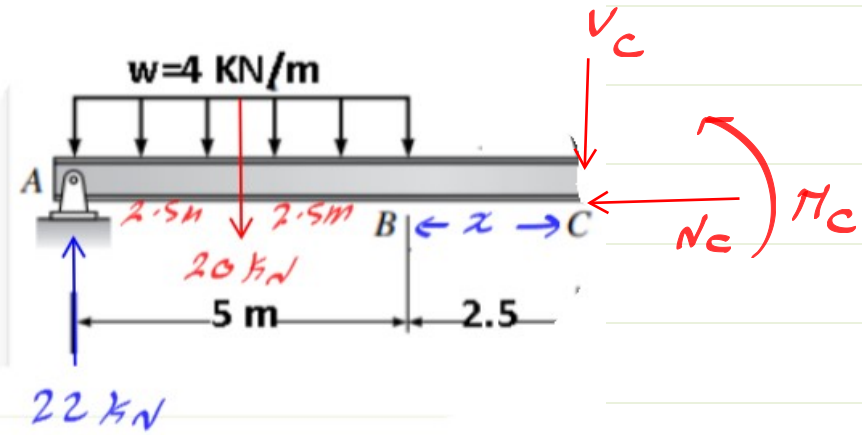
at $x = 5$ m

$\Rightarrow V_B = 22 - 4*5 = 2$ kN

$M_B = 22*5 - 2*5^2 = 60$ kN.m

④ for the section between B and C





$\Sigma f_x = N_c = 0$

$\Sigma f_y = 22 - 20 - V_c = 0 \Rightarrow V_c = 2\ kN$

$\Sigma M_c = -M_c - 20(x + 2.5) + 22 * (x + 5) = 0$

$M_c = 2x + 60$

at $x = 0$

$V_c = 2,\ M_c = 60$

at $x = 2.5$

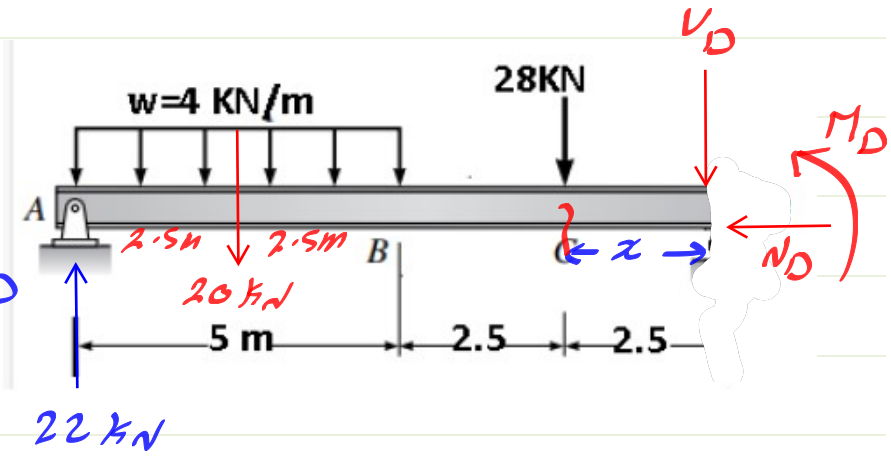
$V_c = 2,\ M_c = 2 * 2.5 + 60 = 65$

(5) for the section C D

$\Sigma f_x = N_D = 0$

$\Sigma f_y = 22 - 20 - 28 - V_D$

$V_D = -26\ kN$



$\Sigma M_D = -M_D - 28x - 20(x+5) + 22(x+7.5) = 0$

$M_D = -28x - 20(x+5) + 22(x+7.5)$

at $x = 0$

$V_D = -26\ kN$

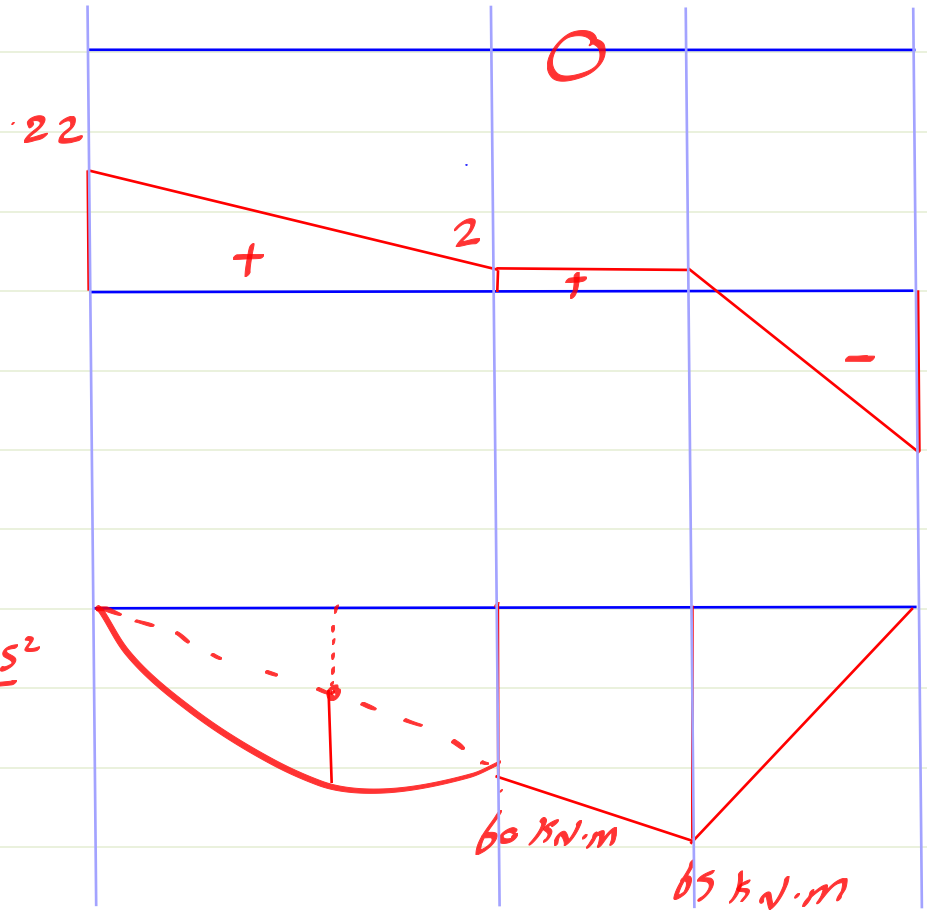
$M_D = -20*5 + 22*7.5 = 65\ kN$

at $x = 2.5$

$V_D = -26\ kN$

$M_D = -28*2.5 - 20*7.5 + 22*10 = 0$

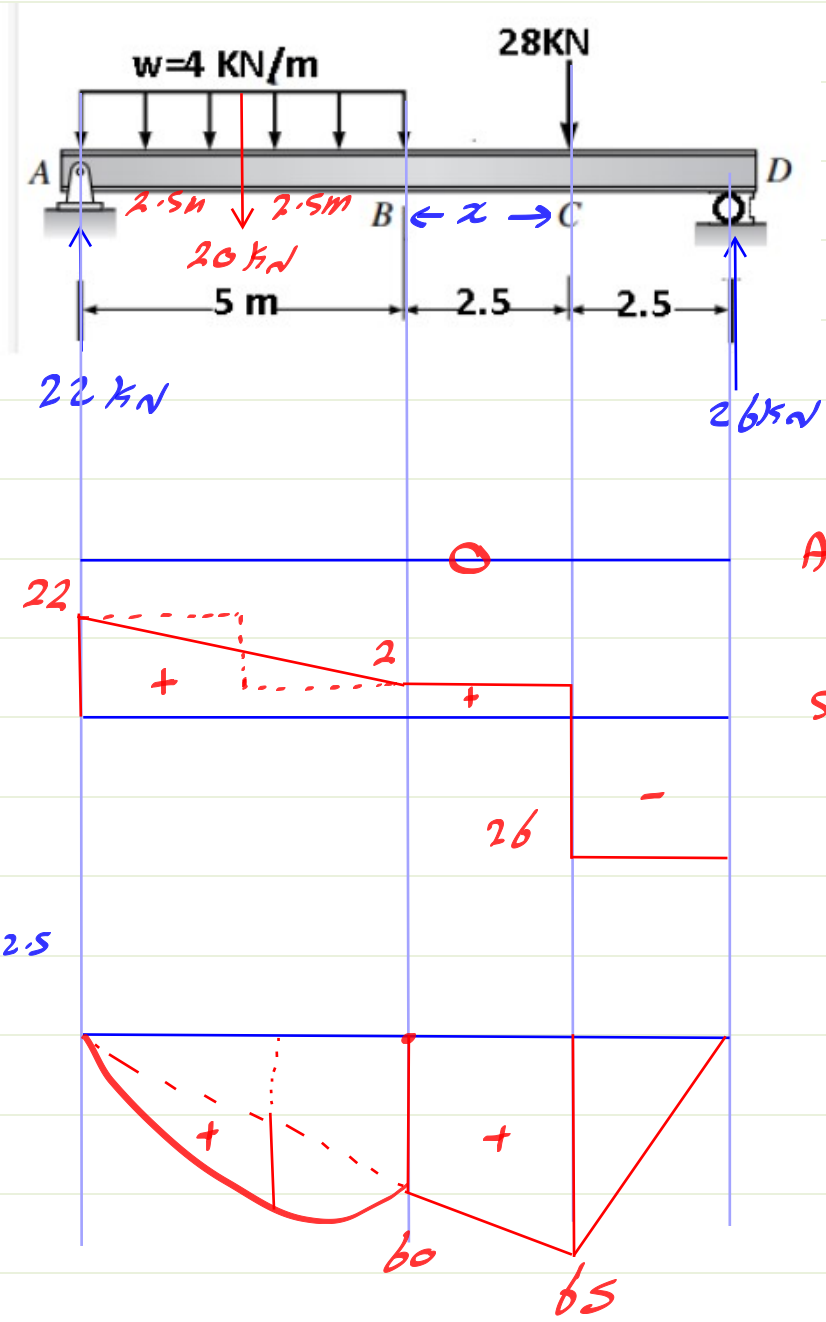
⑥ draw shear force, axial force and binding moment diagrams



$\frac{wL^2}{8} = \frac{4 \times 5^2}{8}$

$= 12.5$

another solution



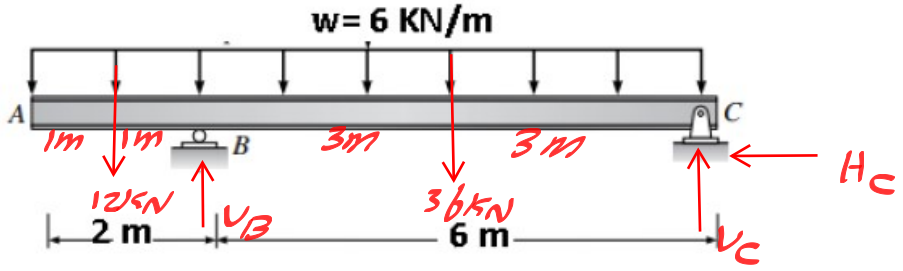
$M_B = 22 * 5 - 20 * 2.5$

$= 60\ kN.m$

$M_C = 26 * 2.5$

$= 65\ kN.m$

2. **Draw shear force, axial force and Bending moment Diagrams for the beam shown below by using two methods**



① check for deter mancy

$r = c + 3$

$3 = 0 + 3 \Rightarrow$ ok

② find the reactions

$\Sigma f_x = H_c = 0$

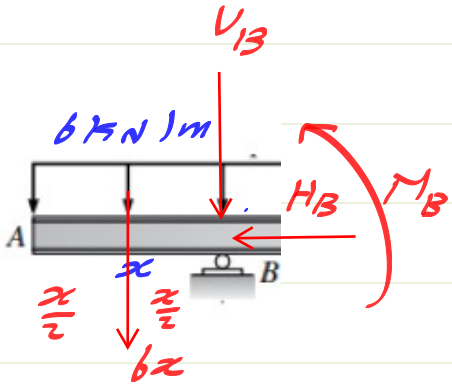
$\curvearrowleft \Sigma M_B = -12 * 1 + 36 * 3 - V_c * 6 = 0$

$V_c = 16\ kN \uparrow$

$\curvearrowleft \Sigma f_y = -12 + V_B - 36 + \cancel{V_c}^{16} = 0$

$V_B = 32 kN \uparrow$

③ section between A and B



$\Sigma f_x = H_B = 0$

$\curvearrowleft \Sigma f_y = -6x - V_B = 0$

$V_B = -6x$

$\curvearrowleft \Sigma M_B = -M_B - 6x(\frac{x}{2}) = 0$

$M_B = -3x^2$

at $x = 0$

$V_B = 0$, $M_B = 0$

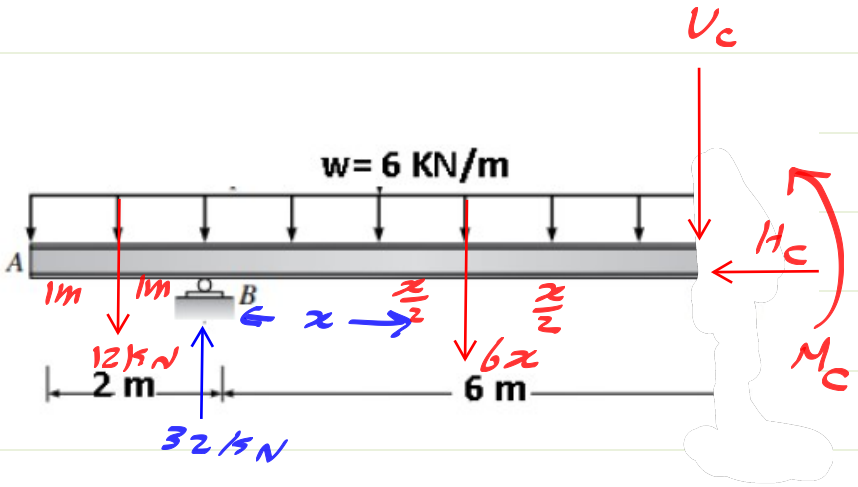
, at $x = 1$

$V_B = -6$, $M_B = -3$

at $x = 2$

$V_B = -12$, $M_B = -12$

④ for section between B and C



$\Sigma f_H = H_c = 0$

$\Sigma f_y = -12 + 32 - 6x - V_c = 0$

$V_c = 20 - 6x$

,

$\Sigma M_c = -M_c - 6x(\frac{x}{2}) + 32x - 12(x+1) = 0$

$M_c = -3x^2 + 32x - 12(x+1)$

at $x = 0$

$V_c = 20$, $M_c = -12$

at $x = 3$

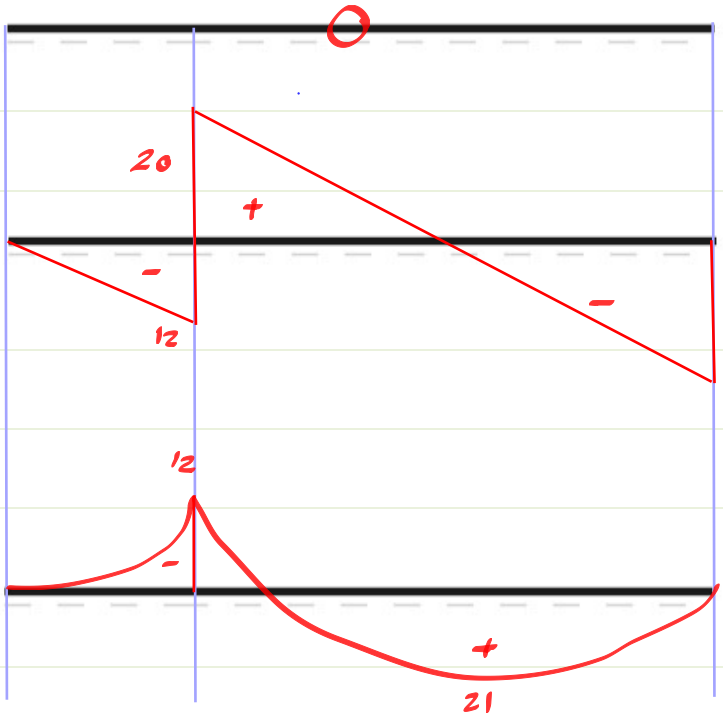
$V_c = 20 - 6 * 3 = 2$

$M_c = -3 * 9 + 32 * 3 - 12(3+1) = 21$

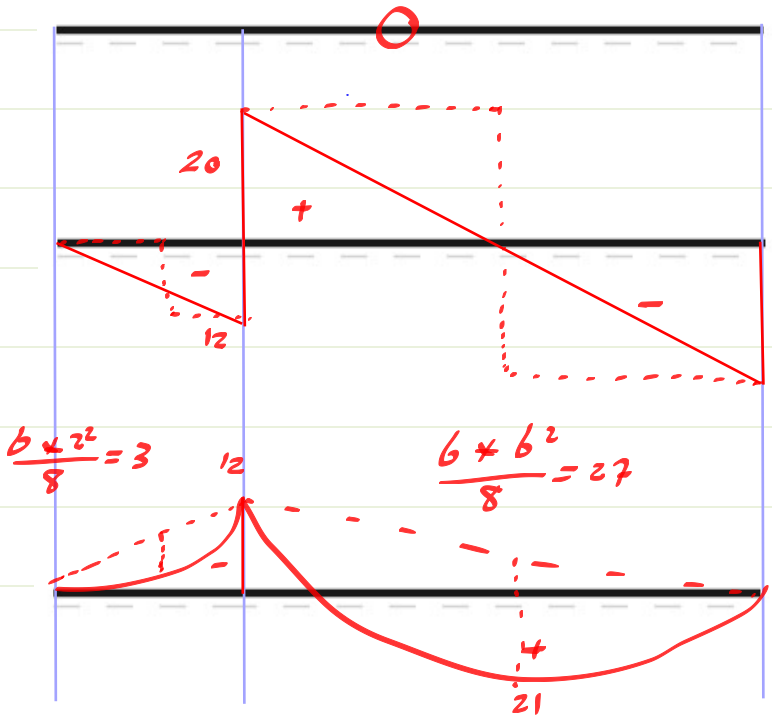
at $x = 6$

$V_c = 20 - 6 * 6 = -16$, $M_c = -3 * 36 + 32 * 6 - 12(6+1) = 0$

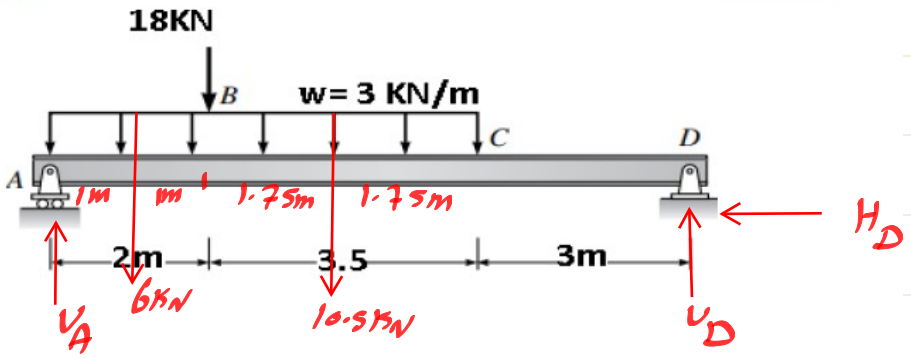
(5) draw shear force, axial force and Binding diagrams



another solution



3. For the beam determine the diagrams of internal reactions (normal force, shear force and bending moment diagrams, by using two methods



① check for determancy

$r = c + 3$

$3 = 0 + 3$ ok

② find the reactions

$\Sigma f_x = H_D = 0$

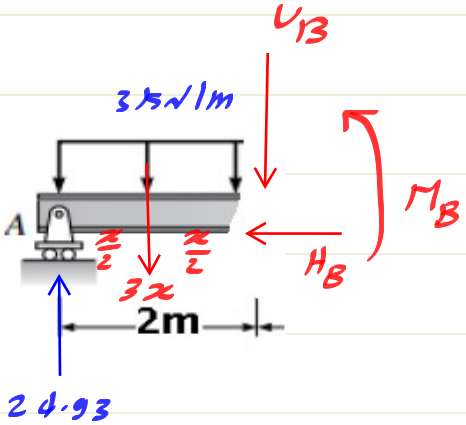
$\curvearrowleft \Sigma M_A = 6*1 + 18*2 + 10.5*3.75 - V_D*8.5 = 0$

$V_D = 9.57\ KN$

$\Sigma f_y = V_A - 6 - 18 - 10.5 + 9.57 = 0$

$V_A = 24.93\ KN$

③ section between A and B



$\Sigma f_x = H_B = 0$

$\Sigma f_y = 24.93 - 3x - V_B = 0$

$V_B = 24.93 - 3x$

$\curvearrowleft \Sigma M_B = -M_B - 3x\left(\frac{x}{2}\right) + 24.93*x = 0$

$M_B = -1.5x^2 + 24.93x$

at $x = 0$

$V_B = 24.93$, $M_B = 0$

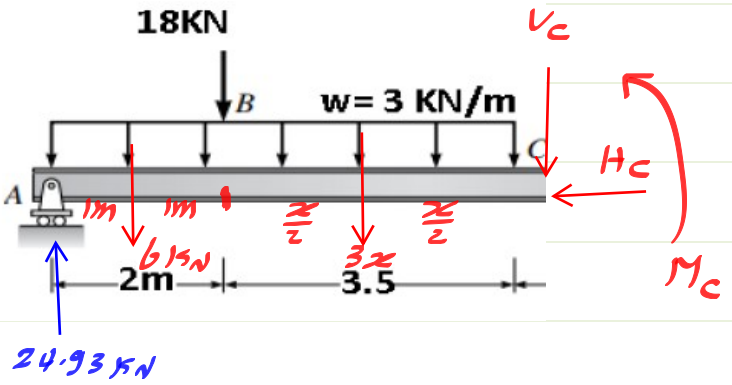
at $x = 1$

$V_B = 24.93 - 3*1 = 21.93$, $M_B = -1.5*1^2 + 24.93*1 = 23.41$

at $x = 2$

$V_B = 24.93 - 3*2 = 18.93$, $M_B = -1.5*2^2 + 24.93*2 = 43.86$

(4) at section BC



$\Sigma f_x = H_c = 0$

$\Sigma f_y = 24.93 - 6 - 18 - 3x - V_c = 0$

$V_c = 0.93 - 3x$

, $\Sigma M_c = -M_c - 3x(\frac{x}{2}) - 18x - 6(x+1) + 24.93(x+2) = 0$

$M_c = -1.5x^2 + 0.93x + 43.86$

at $x = 0$

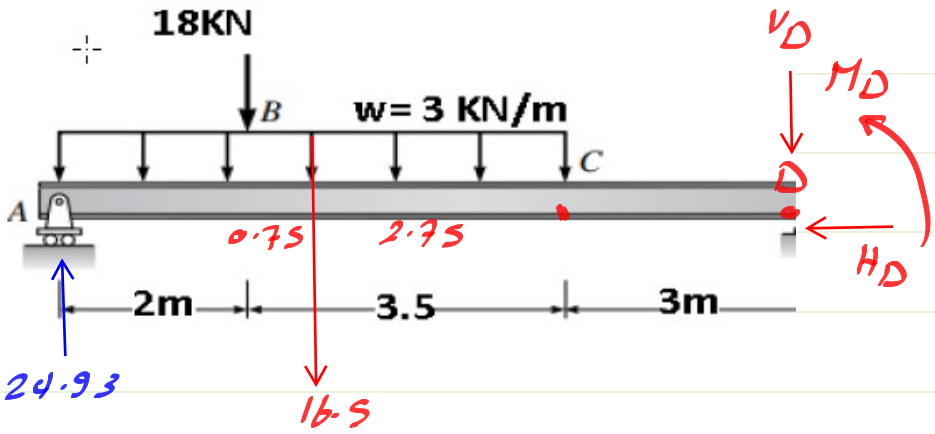
$V_c = 0.93$, $M_c = 43.86$

, at $x = 3.5$

$V_c = 0.93 - 3*3.5 = -9.57$

, $M_c = -1.5*3.5^2 + 0.93*3.5 + 43.86 = 28.74$

⑤ for section C D



$\Sigma f_x = -H_D = 0$

$\Sigma f_y = 24.93 - 18 - 16.5 - V_D = 0$

$V_D = -9.57$

$\Sigma M_D = -M_D - 16.5(x + 2.75) - 18(x + 3.5) + 24.93(x + 5.5) = 0$

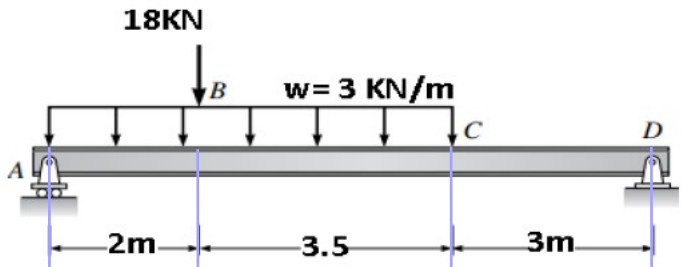
$M_D = -9.57x + 28.74$

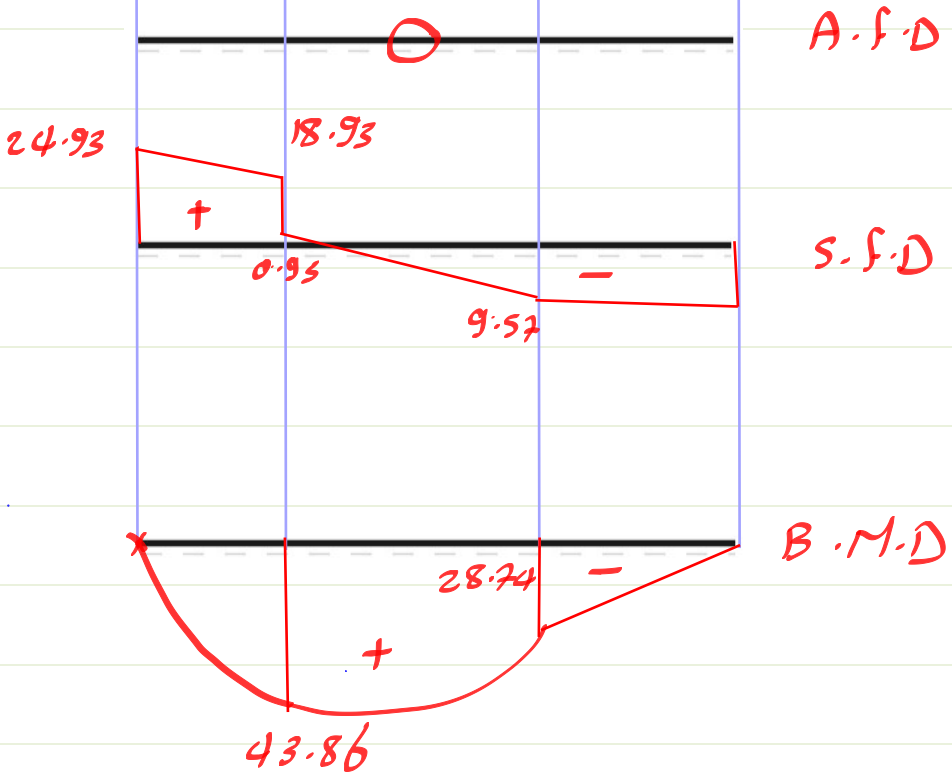
at $x = 0$

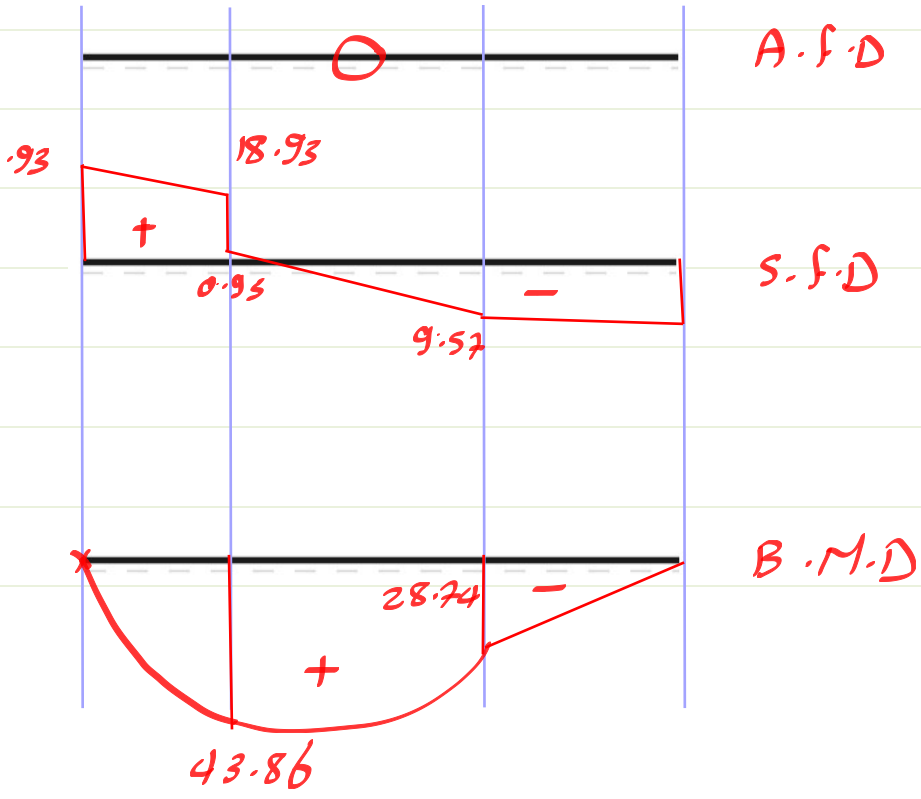
$V_D = -9.57$, $M_D = 28.74$

at $x = 3$

$V_D = -9.57$, $M_D = -9.57 * 3 + 28.74 \simeq 0$


18KN
B
w= 3 KN/m
C
D
A
2m
3.5
3m


A.F.D
24.93
18.93
+
0.95
S.F.D
9.57
B.M.D
28.74
43.86


A.F.D
.93
18.93
+
0.95
S.F.D
9.57
B.M.D
28.74
43.86