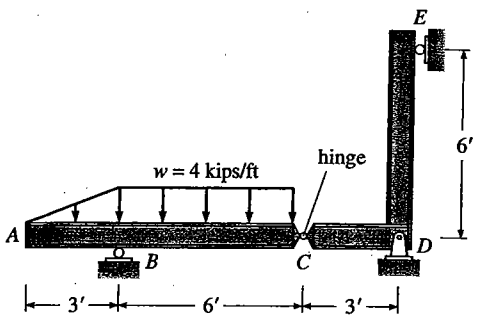
TLK/JRM/LLL CVEN 345 Sect. 501, 502 & 503 Feb. 28, 2005
EXAM 1

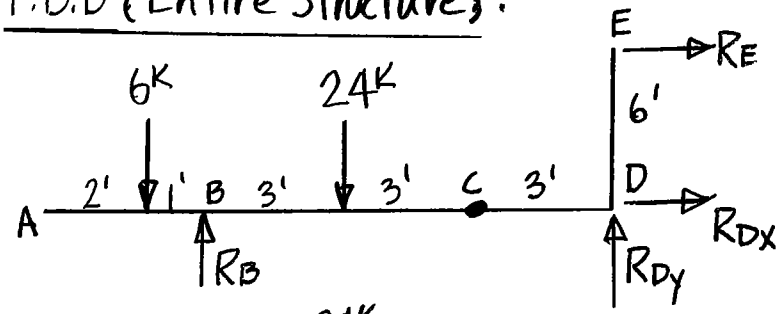
NAME: Solutions Seat No. _____
Student UIN _____

CLOSED BOOK AND NOTES. Your work should be legible, neat and presented in a logical, stepwise manner. You need only to present your solution (i.e. – Given, Required, not necessary). However, **YOU MUST SHOW ALL YOUR WORK TO RECEIVE FULL CREDIT FOR A PROBLEM. CLEARLY BOX OR UNDERLINE YOUR ANSWERS.**

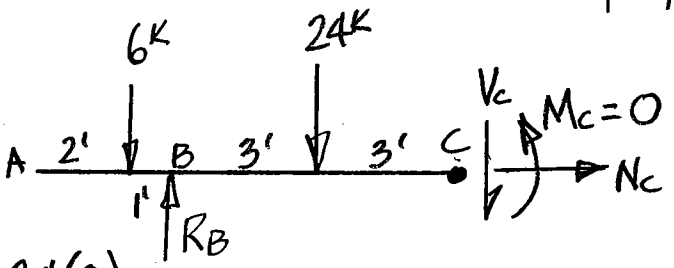
Problem: 1 (25 pts)
Draw the F.B.D. and compute the external reactions for the structure shown below.



F.B.D (Entire Structure):



F.B.D. of Segment ABC:



$\circlearrowleft + \sum M_C = 0;\quad R_B(6) - 6(7) - 24(3) = 0$

$R_B = 19.0^K \uparrow$

For entire structure:

$+\uparrow \sum F_y = 0;\quad 19 - 6 - 24 + R_{DY} = 0 \Rightarrow R_{DY} = 11.0^K \uparrow$

$\circlearrowleft + \sum M_B = 0;\quad -(6)(1) + 24(3) - 11(9) + R_E(6) = 0$

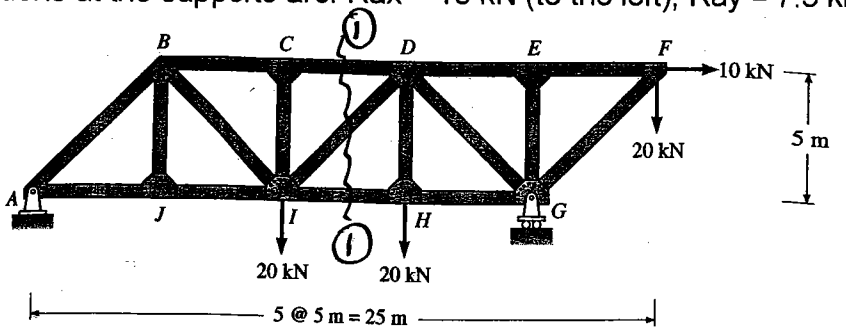
$R_E = 5.50^K \rightarrow$

$\rightarrow + \sum F_x = 0;\quad 5.50 + R_{DX} = 0 \Rightarrow R_{DX} = -5.50^K$

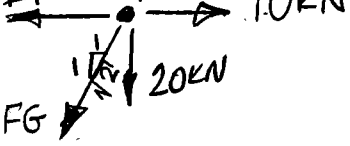
$R_{DX} = 5.50^K \leftarrow$

Problem: 2 (25 pts)

Compute the force in members FE, FG, CI, CD and DI of the bridge truss loaded as shown. You may use both the method of sections and method of joints. Note the reactions at the supports are: Rax = 10 kN (to the left); Ray = 7.5 kN (up); Rgy = 52.5 kN (up).



F.B.D. of Joint F:

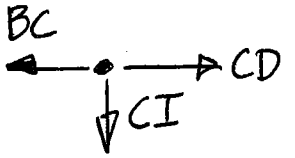


$+\uparrow \Sigma F_y = 0;\ -FG(1/\sqrt{2}) - 20 = 0$

$FG = 28.28^{KN}\ C$

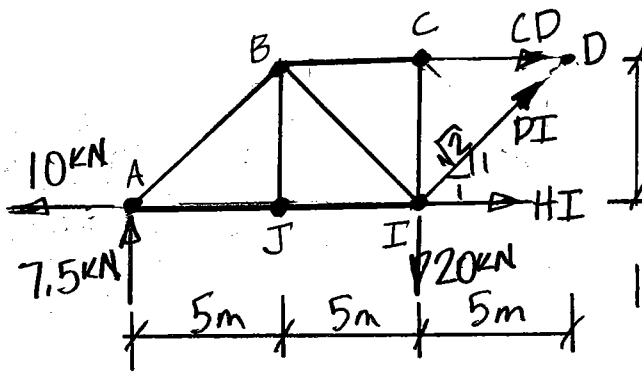
$\pm \Sigma F_x = 0;\ -EF + 28.28(1/\sqrt{2}) + 10 = 0 \Rightarrow EF = 30.0^{KN}\ T$

F.B.D. of Joint C:



$+\uparrow \Sigma F_y = 0;\ CI = 0$

F.B.D @ Section ①-①:



$+\uparrow \Sigma F_y = 0;\ 7.5 - 20 + DI(1/\sqrt{2}) = 0$

$DI = 17.68^{KN}\ T$

$+\circlearrowleft \Sigma M_D = 0;$

$10(5) + 7.5(15) - 20(5) - HI(5) = 0$

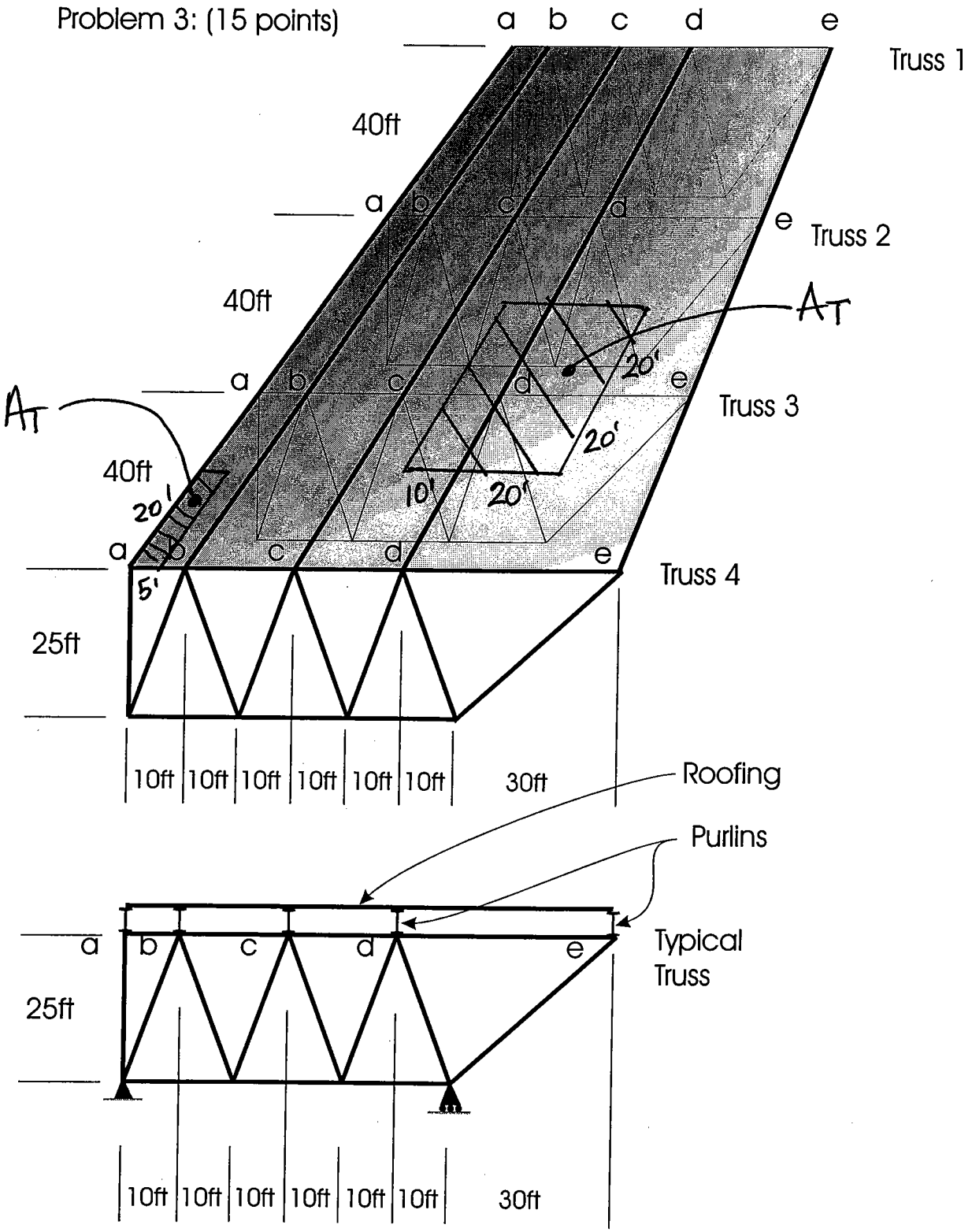
$HI = 12.5^{KN}\ T$

$\rightarrow \Sigma F_x = 0;\ -10 + 12.5 + CD + 17.68(1/\sqrt{2}) = 0$

$CD = -15.0^{KN}$

$CD = 15.0^{KN}\ C$

Problem 3: (15 points)



The roof system shown has a roofing dead load of 15#/ft^2. The roofing only touches the purlins, which then load the truss joints. Determine the loading on the following two (2) truss joints, showing all work: Truss 4, Joint a, and Truss 3, Joint d.

Problem: 3

Truss 4, Joint a: $A_T = (20' \times 5') = \underline{100 ft^2}$

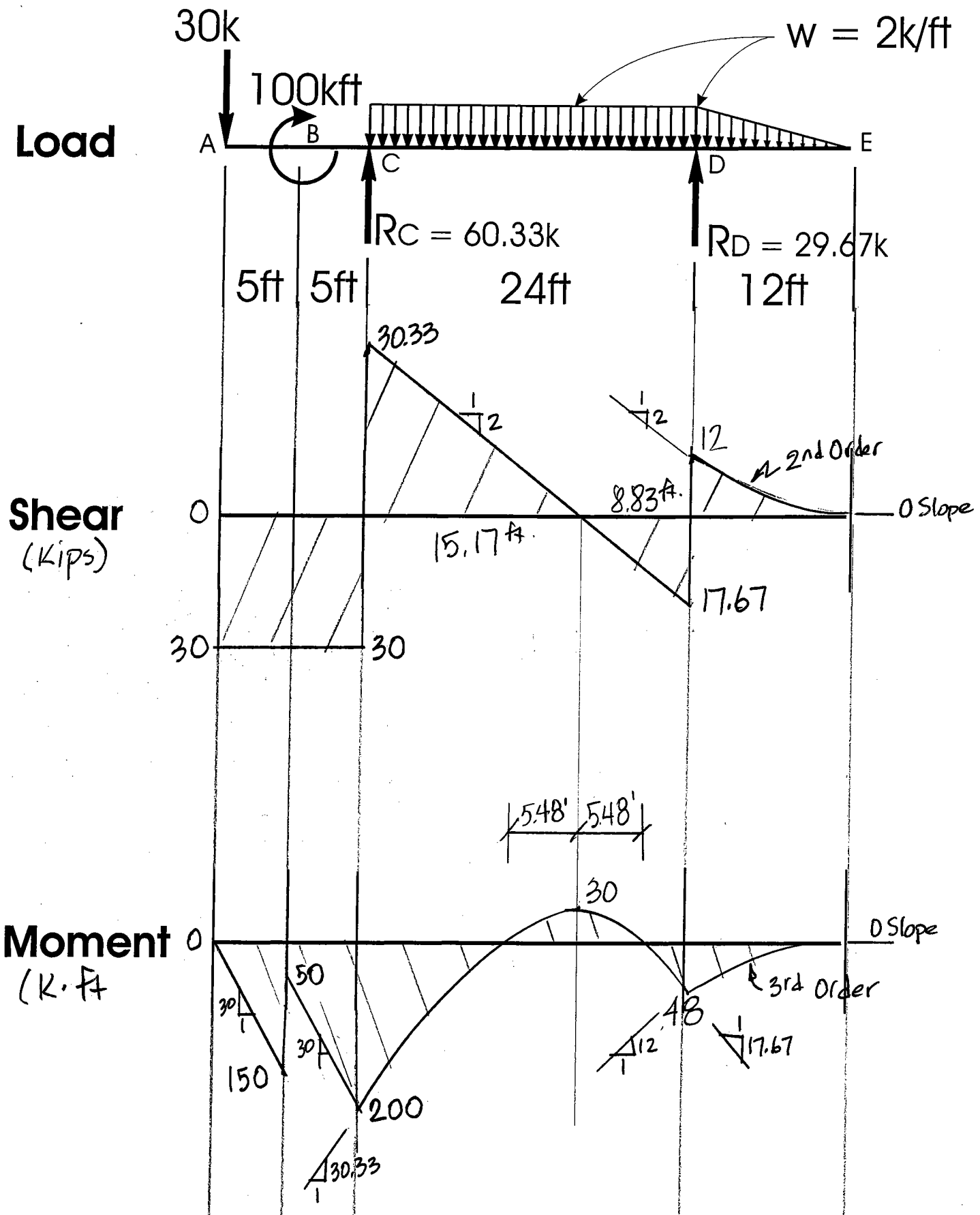
$P_L = (15 lb/ft^2)(100 ft^2) = 1500 lb = \underline{1.50^k}$ ——●

Truss 3, Joint d: $A_T = (20' + 10')(20' + 20') = \underline{1200 ft^2}$

$P_L = (15 lb/ft^2)(1200 ft^2) = 18{,}000 lb = \underline{18.0^k}$ ——●

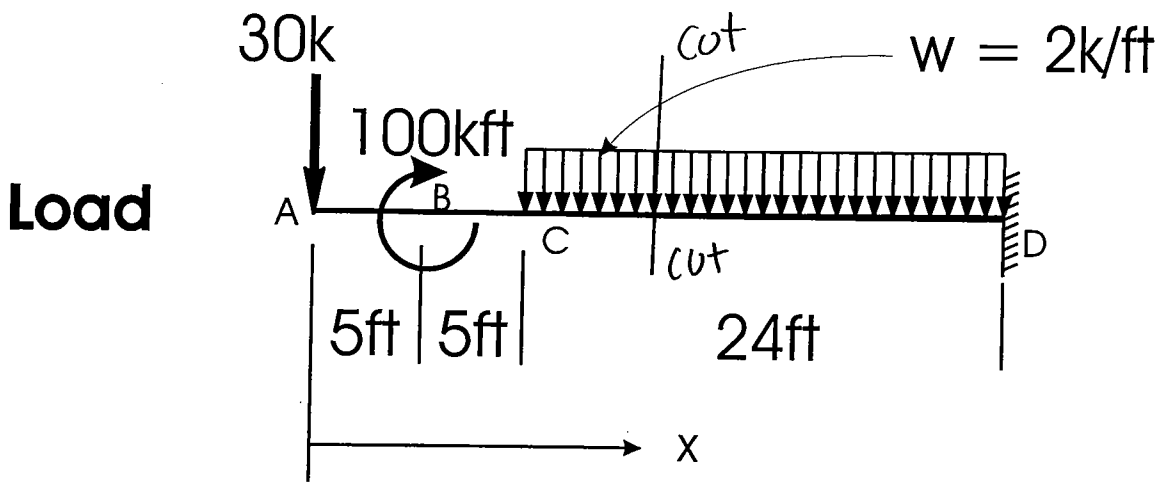
Note, for this framing system the roof deck only touches the purlins. The purlins only act in one direction thus two-way action is not possible. Any check of $L/s < \text{or} > 2$ in not valid! Only one-way action is possible for this framing system.

Problem 4: (25 points) Draw shear and moment diagrams for the beam shown.

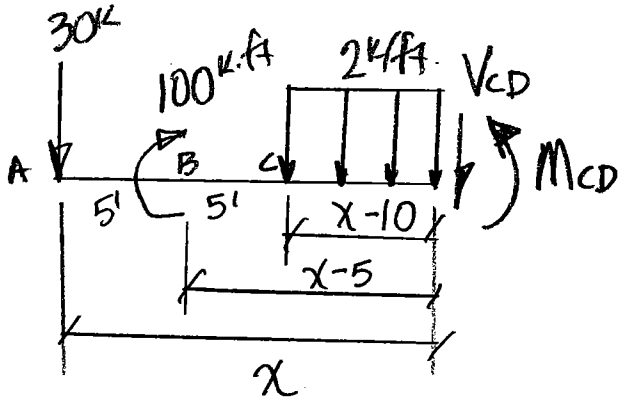


Problem 5: (10 points)

Write shear and moment equations for the following beam, for the region C-D. Use the x coordinate system shown only.



F.B.D. Segment CD:



$+\uparrow \Sigma F_y = 0;\ -30 - 2(x-10) - V_{CD} = 0$

$$V_{CD} = -2x - 10$$

$\circlearrowleft + \Sigma M_{@T} = 0;\ -30(x) + 100 - 2(x-10)\frac{(x-10)}{2} - M_{CD} = 0$

$M_{CD} = -30x + 100 - x^2 + 20x - 100$

$$M_{CD} = -x^2 - 10x$$