Total = 80 points

4–45. Draw the shear and moment diagrams for the beam.

12 kN/m

30 kN·m

A

B

5 m

5 m

Prob. 4–45

Sol:

12kN/m

30kN/m

48kN

12kN

5m

5m

V(kN)

48

X

4m

-12

Points 5

M(kN.m)

96

90

60

Points 5

X
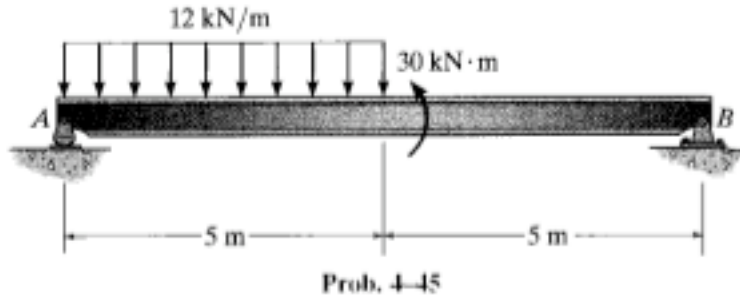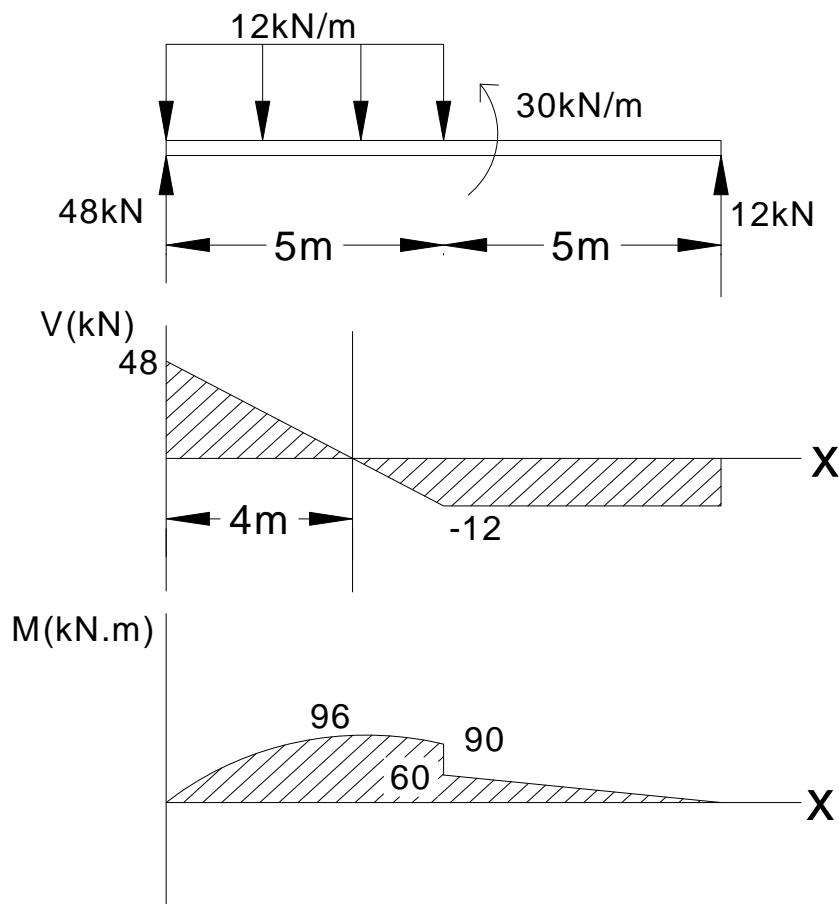
4–57. The boards ABC and BCD are loosely bolted together as shown. If the bolts exert only vertical reactions on the boards, determine the reactions at the supports and draw the shear and moment diagrams for each board.
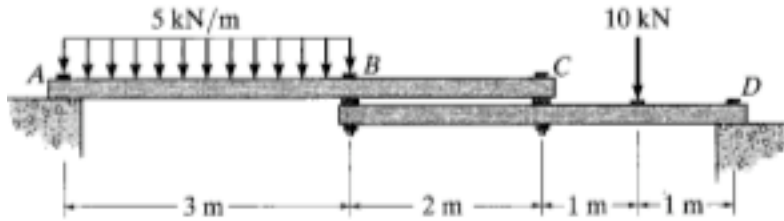
Sol:

Using the FBDs of members ABC and BCD:

$\circlearrowleft +\Sigma M_A = 0;$ $\quad\quad C_Y(5) - B_Y(3) - 15(1.5) = 0$

$\circlearrowleft +\Sigma M_D = 0;$ $\quad\quad C_Y(2) - B_Y(4) + 10(1.0) = 0$
$\quad\quad\quad\quad\quad\quad\quad\quad\quad C_Y = 8.571\text{kN} \quad\quad\quad B_Y = 6.786\text{kN} \quad\quad\quad\quad\quad\quad$ Ans $\quad$ (Points 3)

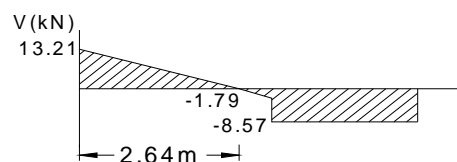$\uparrow + \Sigma F_Y = 0;$ $\quad\quad A_Y - 15 + 8.571 - 6.786 = 0$
$\quad\quad\quad\quad\quad\quad\quad\quad\quad A_Y = 13.21\text{kN} \quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad$ Ans $\quad$ (Point 1)

$+\uparrow \Sigma F_Y = 0;$ $\quad\quad D_Y - 10 - 8.571 + 6.786 = 0$
$\quad\quad\quad\quad\quad\quad\quad\quad\quad D_Y = 11.78\text{kN} \quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad$ Ans $\quad$ (Point 1)
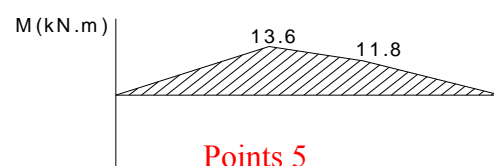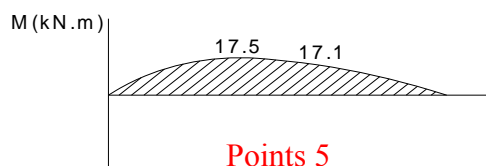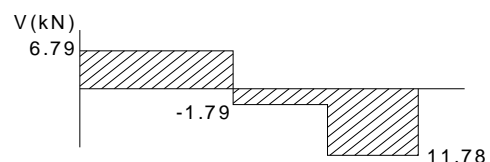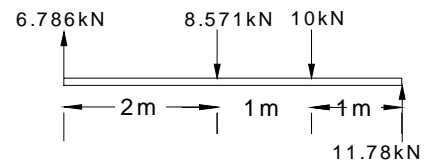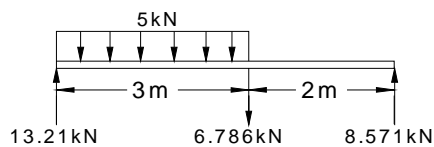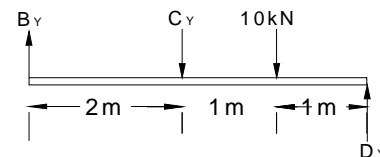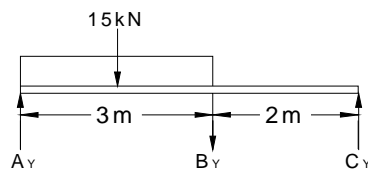
Points 5

Points 5

4-66. Draw the shear and moment diagrams for each member of the frame. Assume the frame is pin connected at A, B, and C.

Prob. 4-66

Sol:

$\circlearrowleft +\Sigma M_A = 0;$ $-15(2) - 10(4) + B_Y (6) = 0$
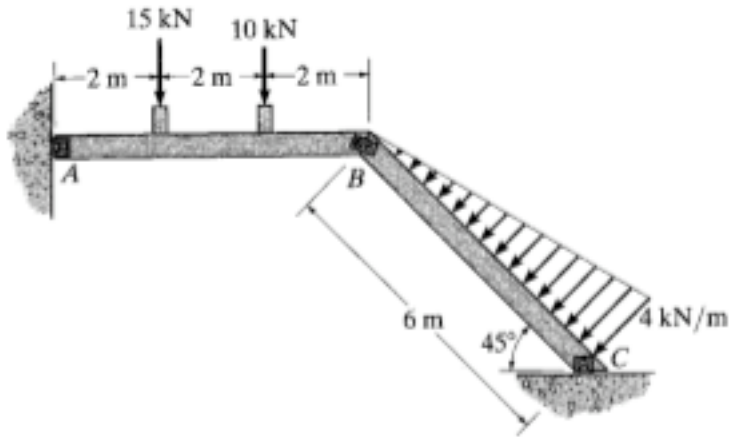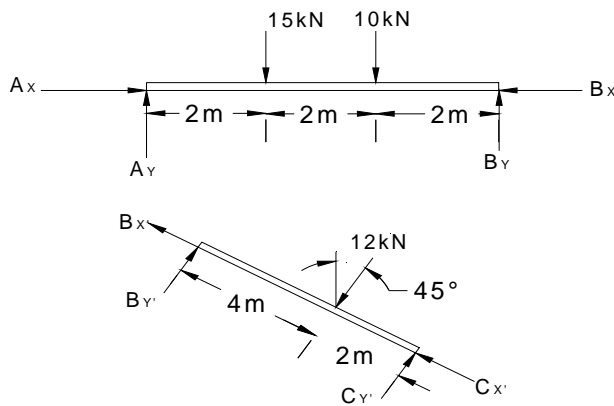$B_Y = 11.667kN$ Ans (Points 2)

$+\uparrow \Sigma F_Y = 0;$ $A_Y - 25 + 11.667 = 0$
$A_Y = 13.3kN$ Ans (Point 1)

$\circlearrowleft +\Sigma M_C = 0;$ $12(2) - B_{Y'} (6) = 0$
$B_{Y'} = 4kN$ Ans (Point 1)

$+\nearrow \Sigma F_Y = 0;$ $4 - 12 + C_Y = 0$
$C_{Y'} = 8kN$ Ans (Point 1)

15kN   10kN

Ax ——————————————— Bx

|←— 2m —→|←— 2m —→|←— 2m —→|

13.3kN   11.67kN

4kN/m

Bx ——————————————— Cx

|←— 2m —→|←— 2m —→|←— 2m —→|

4kN   8kN

V(kN)

-13.3kN

-1.67kN

-11.7kN

V(kN)

4

3.46

-8

M(kN.m)

26.7   23.3

AB

M(kN.m)

9.24

BC
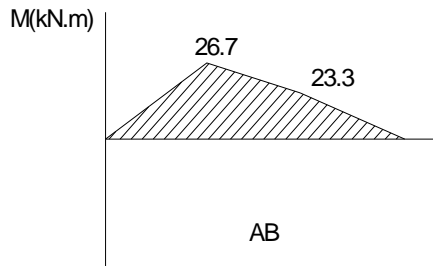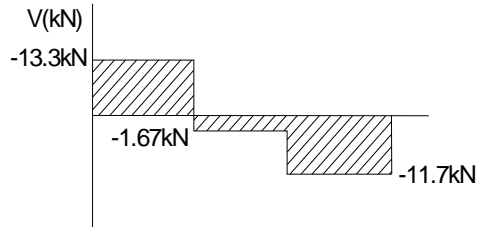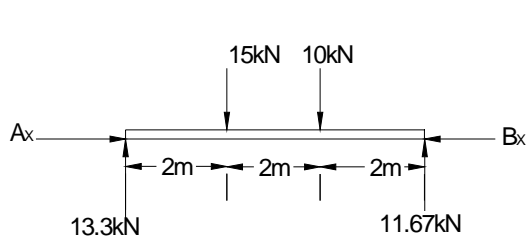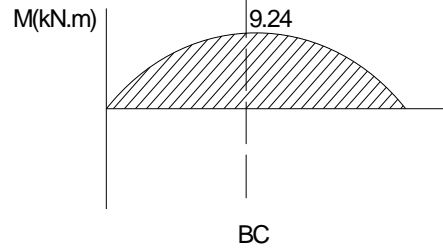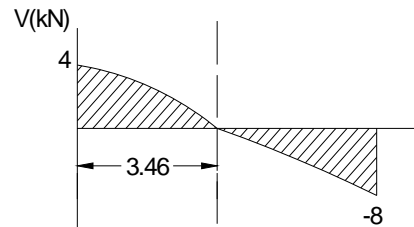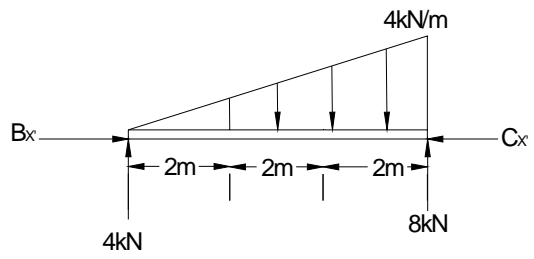
Points 5   Points 5

*4-64. Draw the shear and moment diagrams for each of the three members of the frame. Assume the frame is pin connected at A, C, and D and there is a fixed joint at B.

50 kN

40 kN

|—1.5 m—|———2 m———|—1.5 m—|

B

C

15 kN/m

4 m

6 m

D

A

(25 pts)

Sol:

50 kN   40 kN

180 kNm

45 kN

1.5 m   2 m   1.5 m
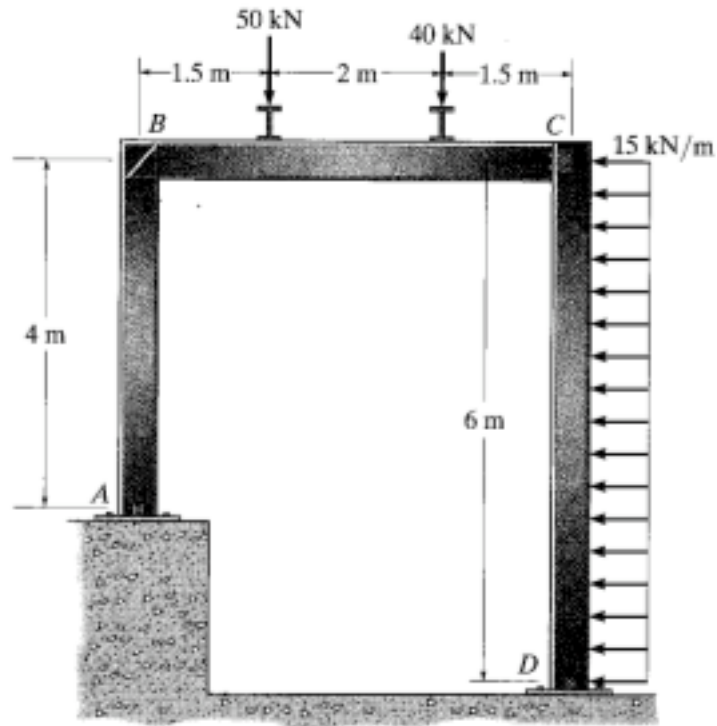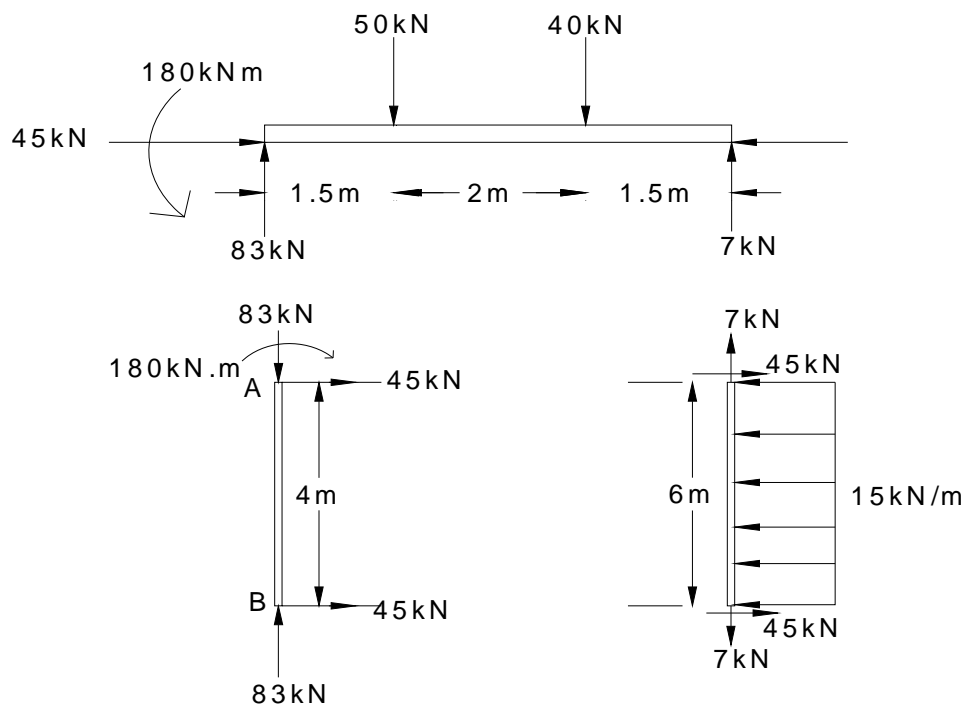
83 kN   7 kN

83 kN   7 kN

180 kN.m   A   45 kN   45 kN

4 m   6 m   15 kN/m

B   45 kN   45 kN

83 kN   7 kN

Points 4

5/8

V(kN)

-45

V(kN)

33

-7

V(kN) 45

-45

M(kN.m)

-180

AB

M(kN.m)

1.68m

10.5

-55

BC

M(kN.m)

67.5

CD
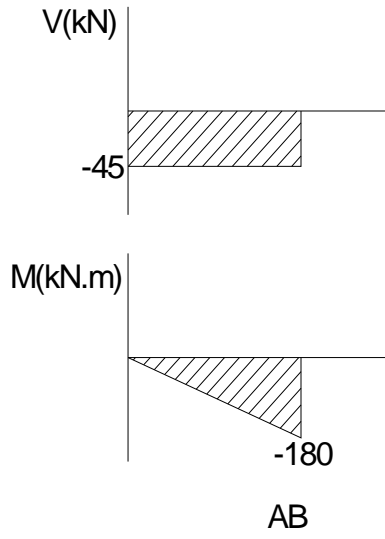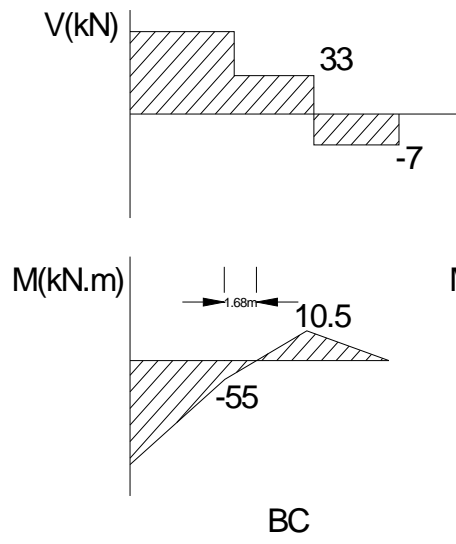
Points 7

Points 7

Points 7

4-65. Draw the shear and moment diagrams for each member of the frame. Assume the joint at A is a pin and support C is a roller. The joint at B is fixed. The wind load is transferred to the members at the girts and purlins from the simply supported wall and roof segments.
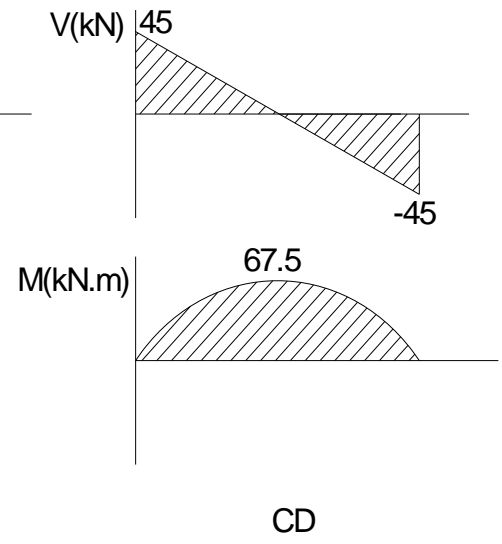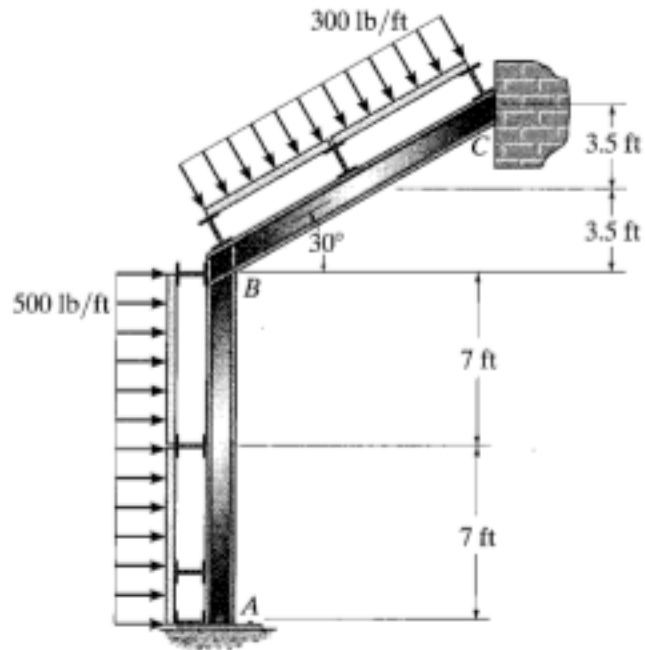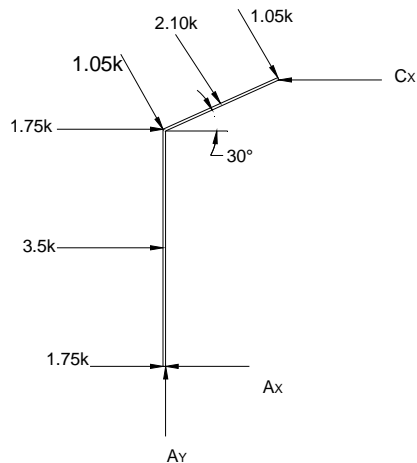

Prob. 4-65

Sol:

$\circlearrowleft +\Sigma M_A = 0;$

$-3.5(7) -1.75(14) - 4.20\cos30° \, (7\cos30°) -4.20\sin30° \, (14 +3.5) +C_X \, (21) = 0$

$C_X = 5.133\text{kN}$ (Point 1)

$\xrightarrow{+} \, \Sigma F_X = 0;$ $1.75 + 3.5 + 1.75 + 4.20 \sin30° - 5.133 - A_X = 0$

$A_X = 3.967\text{kN}$ (Point 1)

$+\uparrow \Sigma F_Y = 0;$ $A_Y - 4.20\cos30° = 0$

$A_Y = 3.64\text{kN}$ (Point 1)

BC

1.05k   2.1k   1.05k

6.533

7'   7'

1.633k   2.567k

V(k)
1.583
-1.52

M(k.ft)   10.6
6.533

(Points 6)

AB

1.75k   3.5k   1.75k

6.533k.ft

7'   7'

3.967k   3.03k

V(k)
2.26
-1.28

M(k.ft)   15.5
6.53

(Points 6)