Shear and Bending Moment Diagram

Summer 2020

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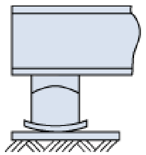
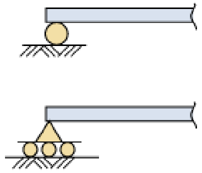
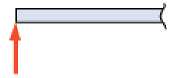
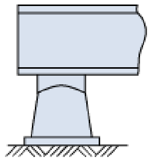
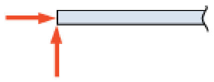
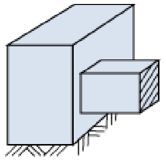
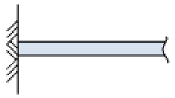
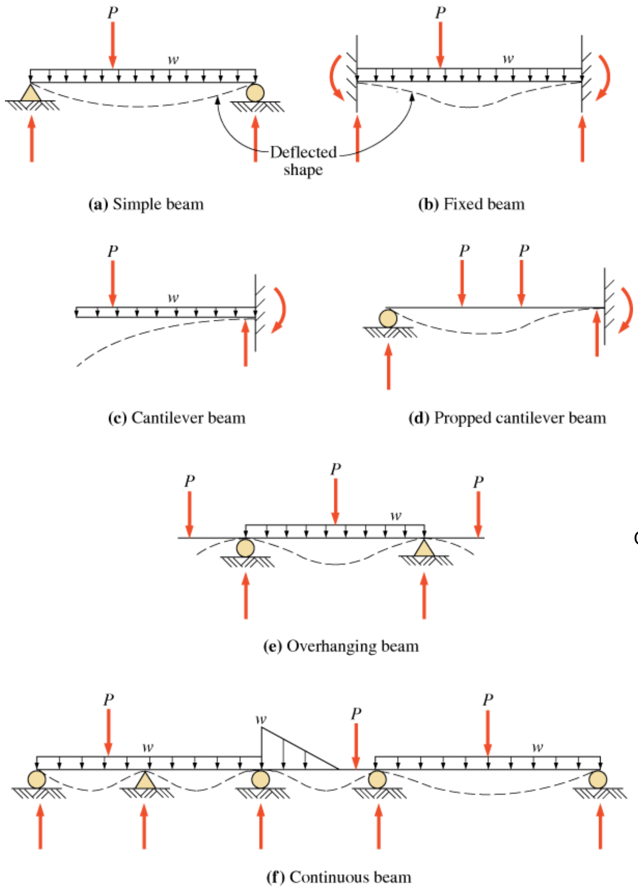
Type	Real Support	Idealized Support	Reactions Provided
Roller (a)			
Pin or knife edge (b)			
Fixed (c)			

Simply Supported Beam

Cantilever Beam

Beam Types



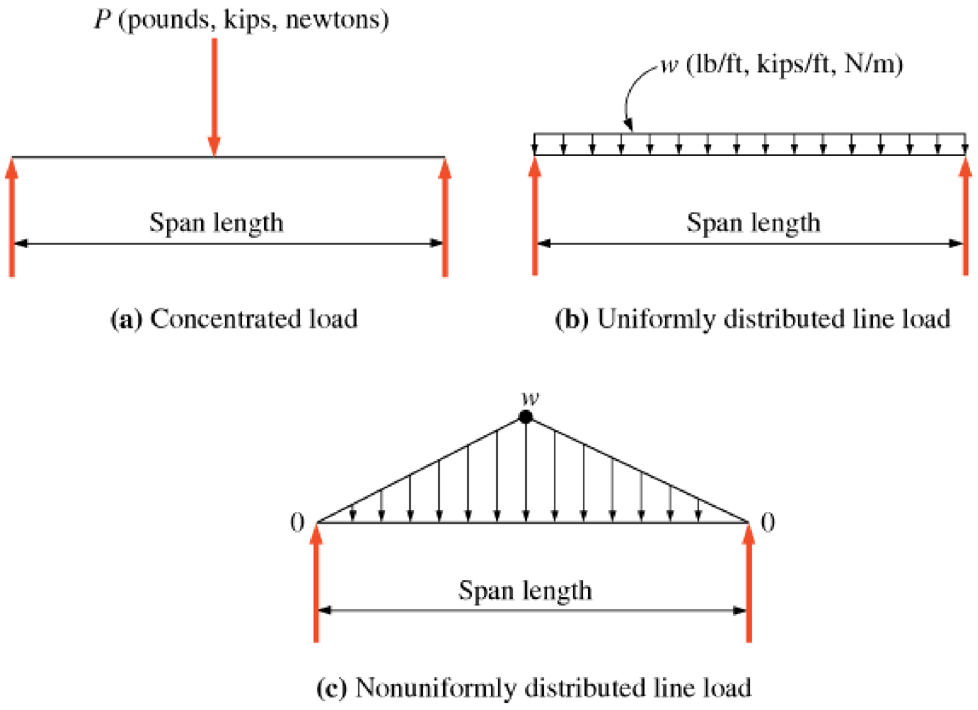
Concentrated Load

Cantilever beam-Diving board,
Balcony,
Aircraft Wing

Overhanging Beam-Brooklyn Bridge

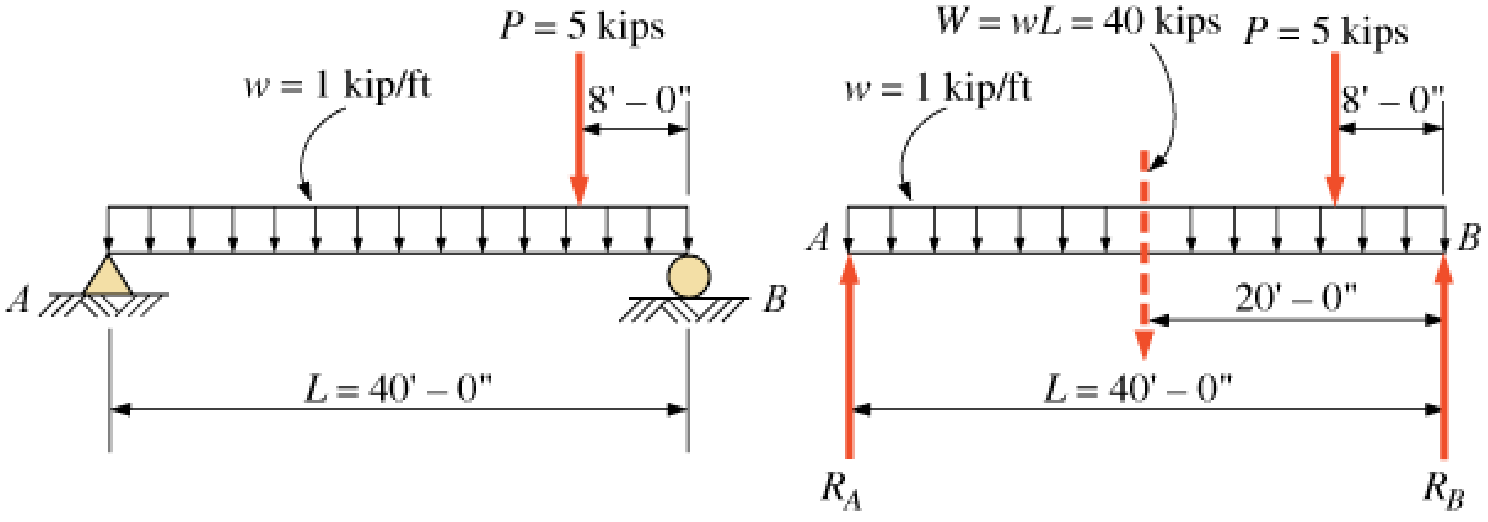
Bridge

Types of Loads



Steel beam
w=Weight of beam per unit length,

Lb/ft, N/m

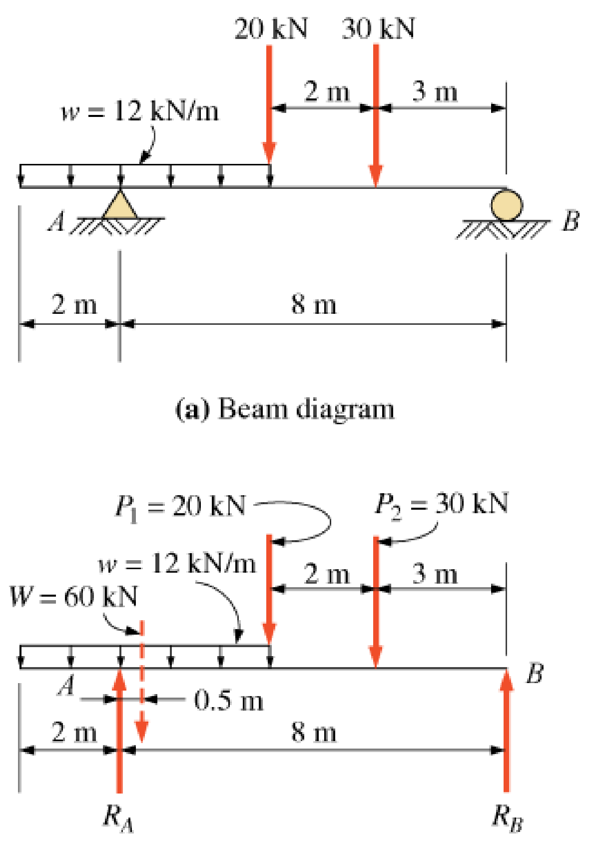


(a) Beam diagram **(b)** Load diagram

Take moment at point B, M_B Ra*40=40*20+5*8

So, Ra=21 kip

Take all the forces in Y dir--- Ra+Rb=40+5, So Rb=45-21=24 kip



(a) Beam diagram

(b) Load diagram

Moment=load*vertical distance

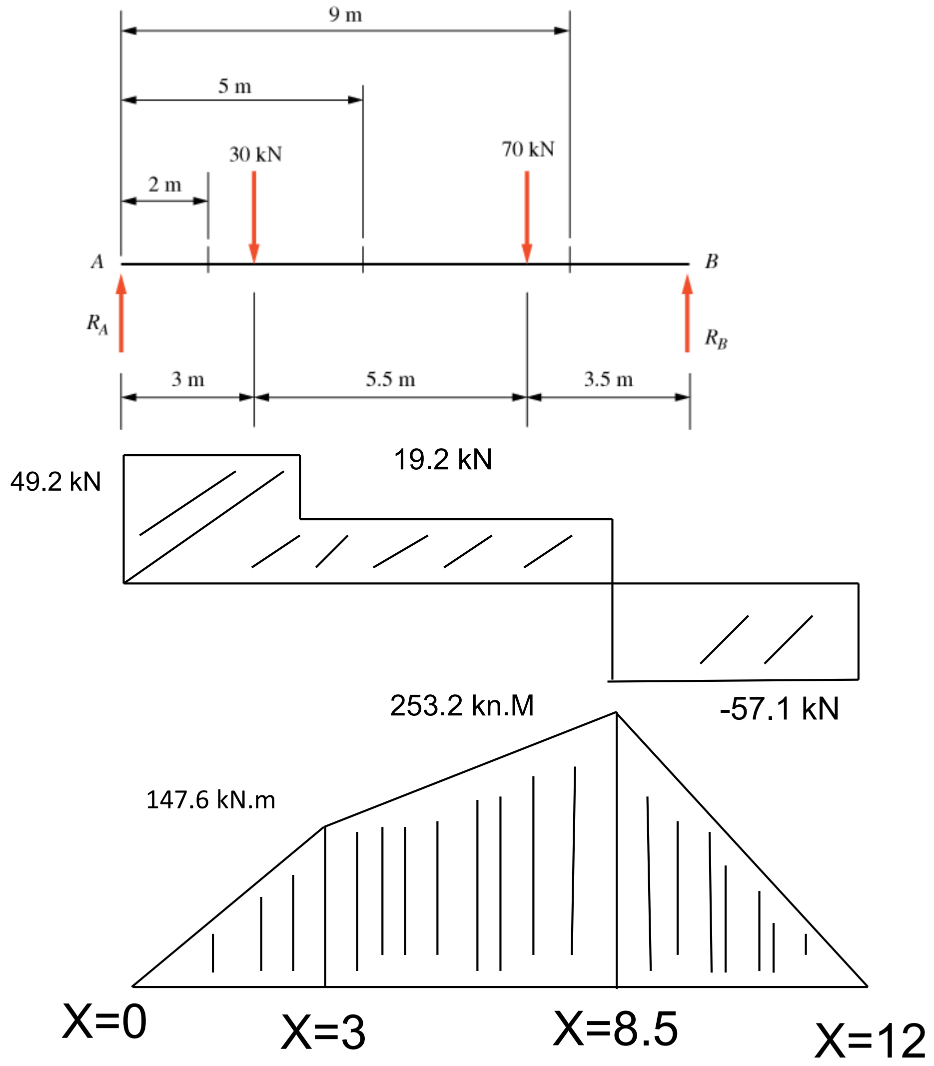
Take Moment at point B,

-Ra*8+60*7.5+20*5+30*3=0

Ra=80 kN=80,000 N

Rb=?=30 kN

We Will learn
Reaction,
Shear &
Moment Diagram



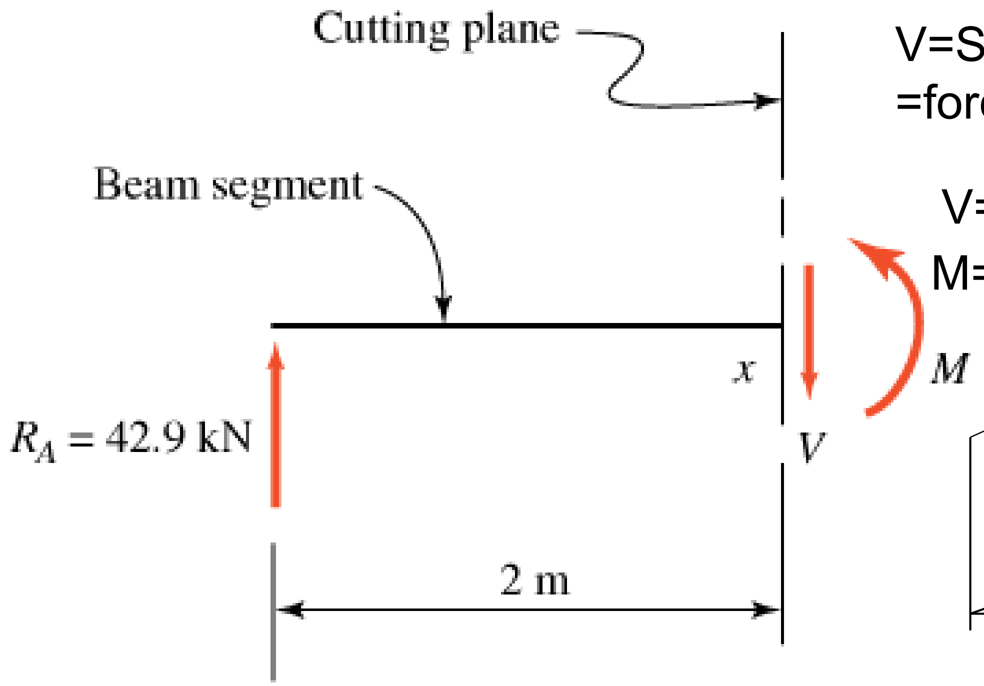
Shear Diagram

Ra=49.2 kN

M at 3 m--49.2*3=147.6 kN.M
M at 8.5 m… 49.2*8.5-30*5.5=253.2 kn.M
M at 12 m… =0

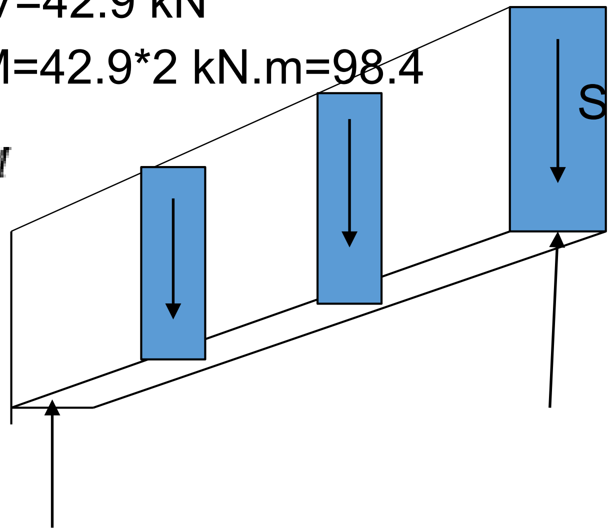
Moment Diagram

V=Shear force
=force acting parallel to the beam section



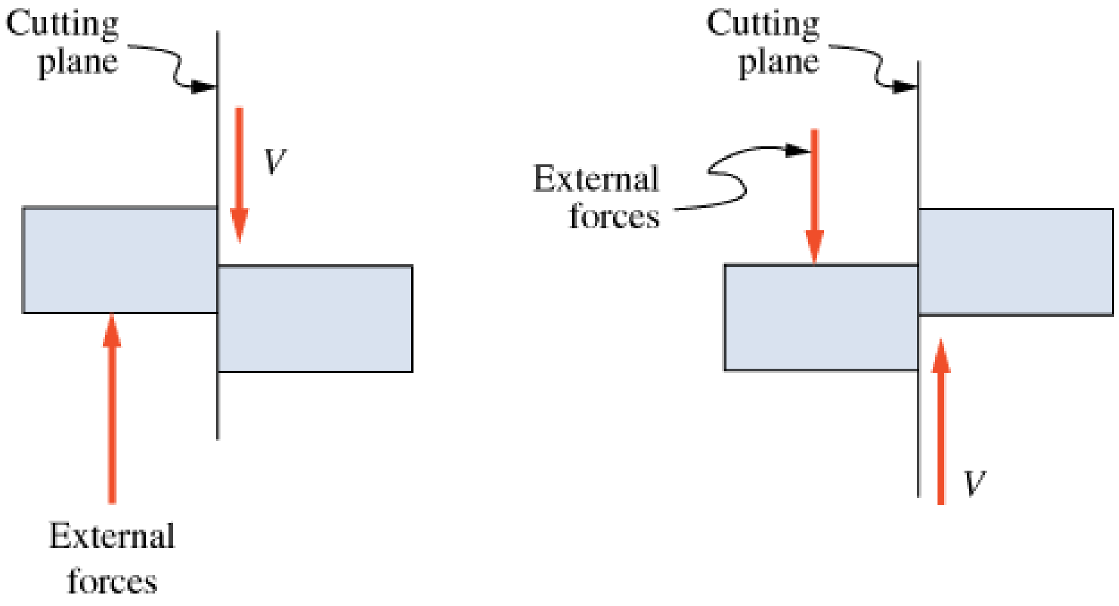
V=42.9 kN

M=42.9*2 kN.m=98.4



Shear Force Diagram= Shear force along the length

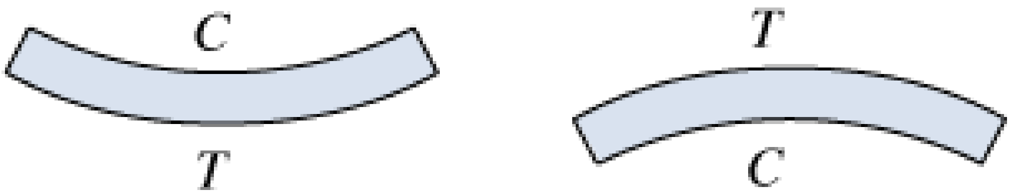
Shear force , V is internal force; internal resistance to external force



(a) Positive internal shear (+)

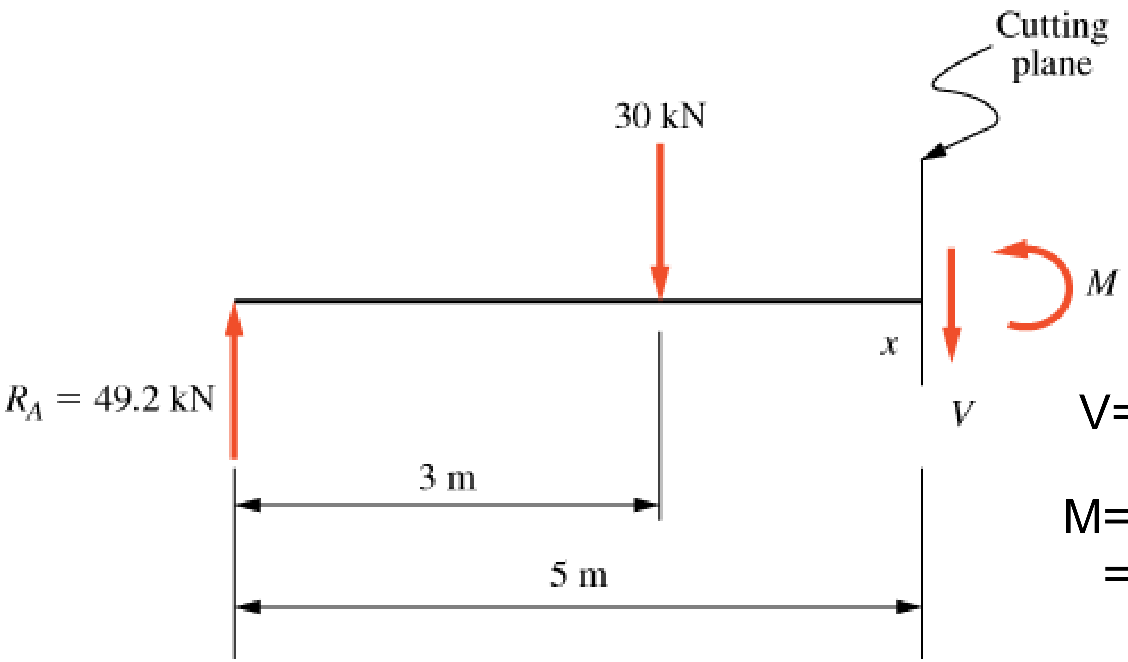
(b) Negative internal shear (−)

Now consider bending moment



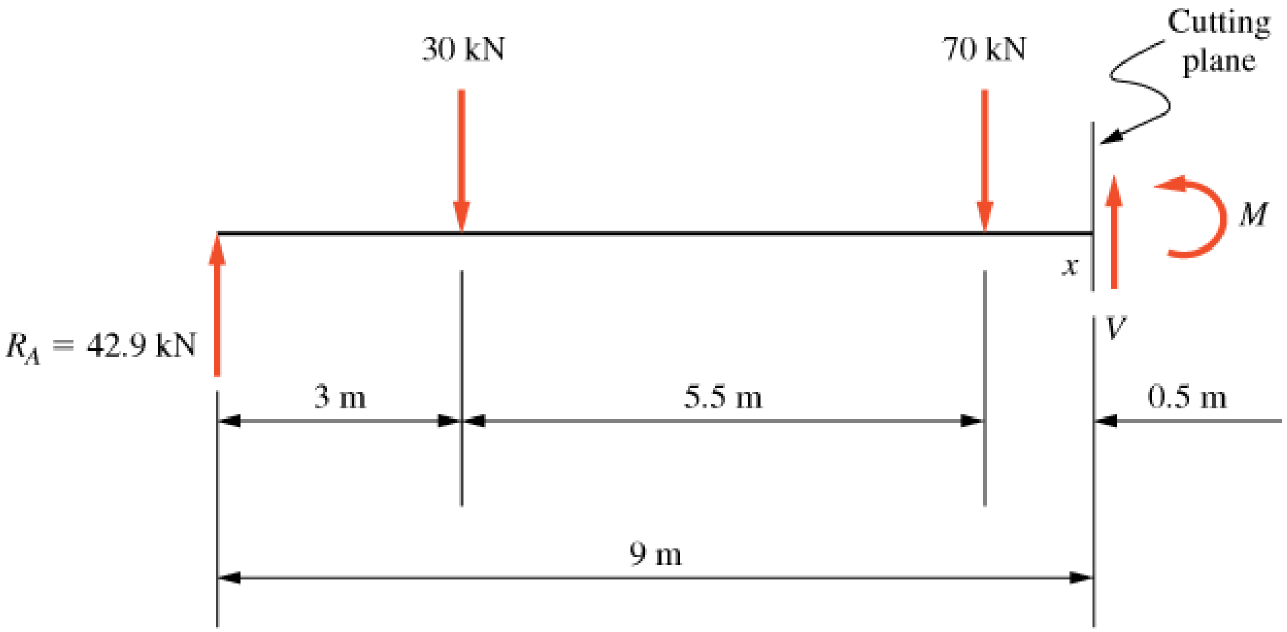
(a) Positive internal bending moment

(b) Negative internal bending moment



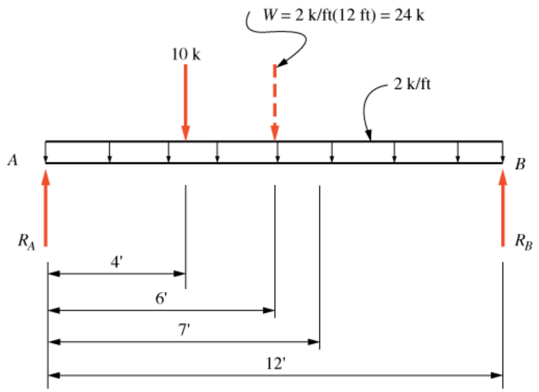
V=49.2-30=19.2 kN

M=49.2*5-30*2
=186 KN.M



$V = 42.9 - 30 - 70$
$= -57.1$ kN

$M = 171.1$ kN.m

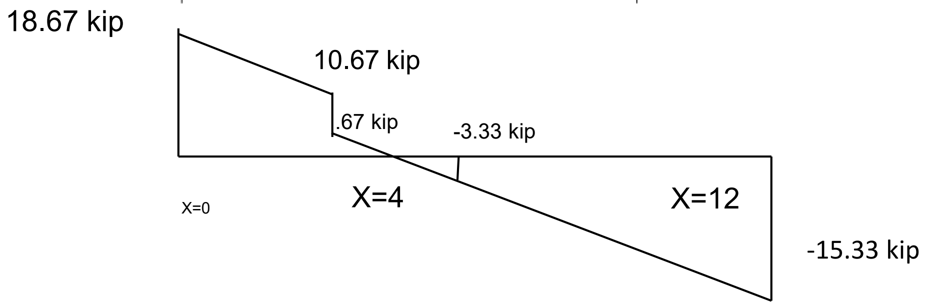


w=2 kip/ft

Load Diagram

Find Shear and Moment Diagram

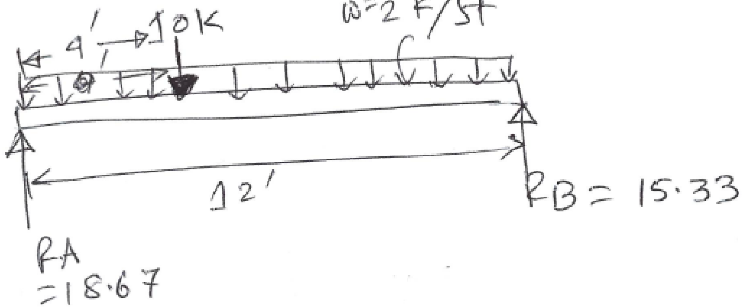
Take moment at A,
Rb=(10*4+24*6)/12=15.33 Kip
Ra=18.67 kip

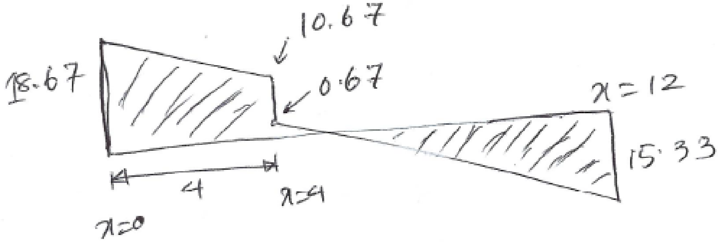


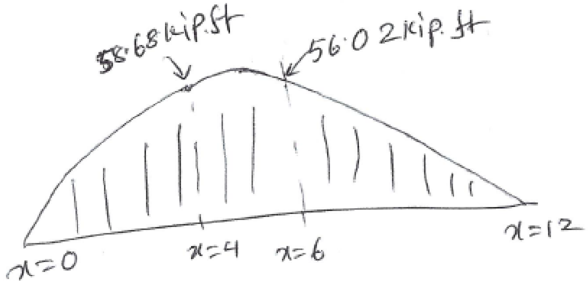
V at left of x=4 … 18.67-w*x=18.67-2*4
=10.67 kip
Right of x =4… 10.67-10=.67 kip
V at x= 6… 18.67-10-w*x=-3.33 kip

M at left of x =4..18.67*4-w.x^2/2
=58.68 kip.ft

Shear and Moment Diagram in the next page







$$M_{x=4} = R_A \cdot x - \frac{w x^2}{2}$$

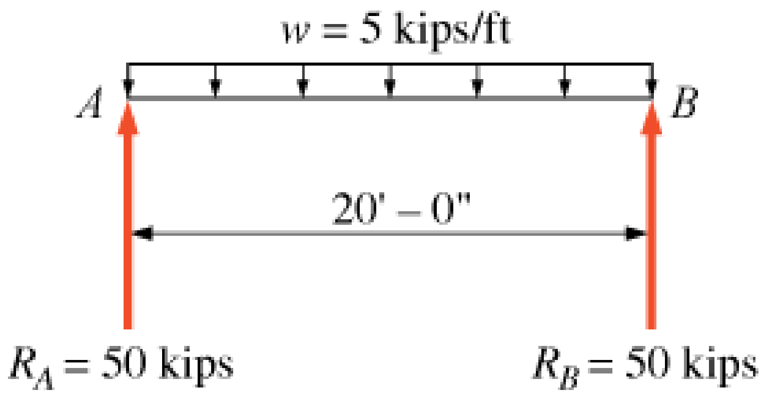
$$= 18.67 \times 4 - \frac{2 \times 16}{2}$$

$$= 58.68$$

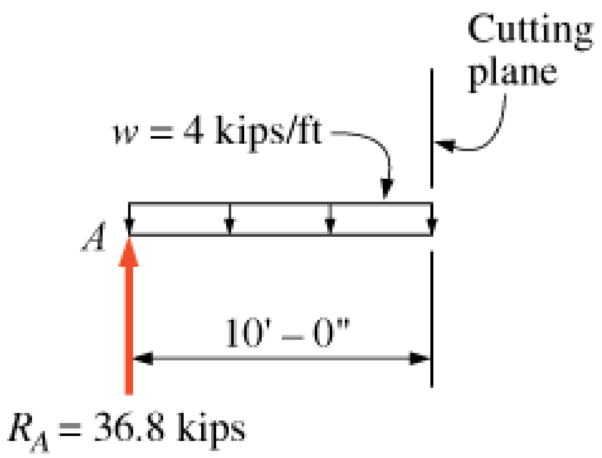
$$M(x=6) = R_A * x - 10(x-4) - \frac{w x^2}{2}$$

$$= 18.67 \times 6 - 10 \times 2 - \frac{2 \times 6^2}{2}$$

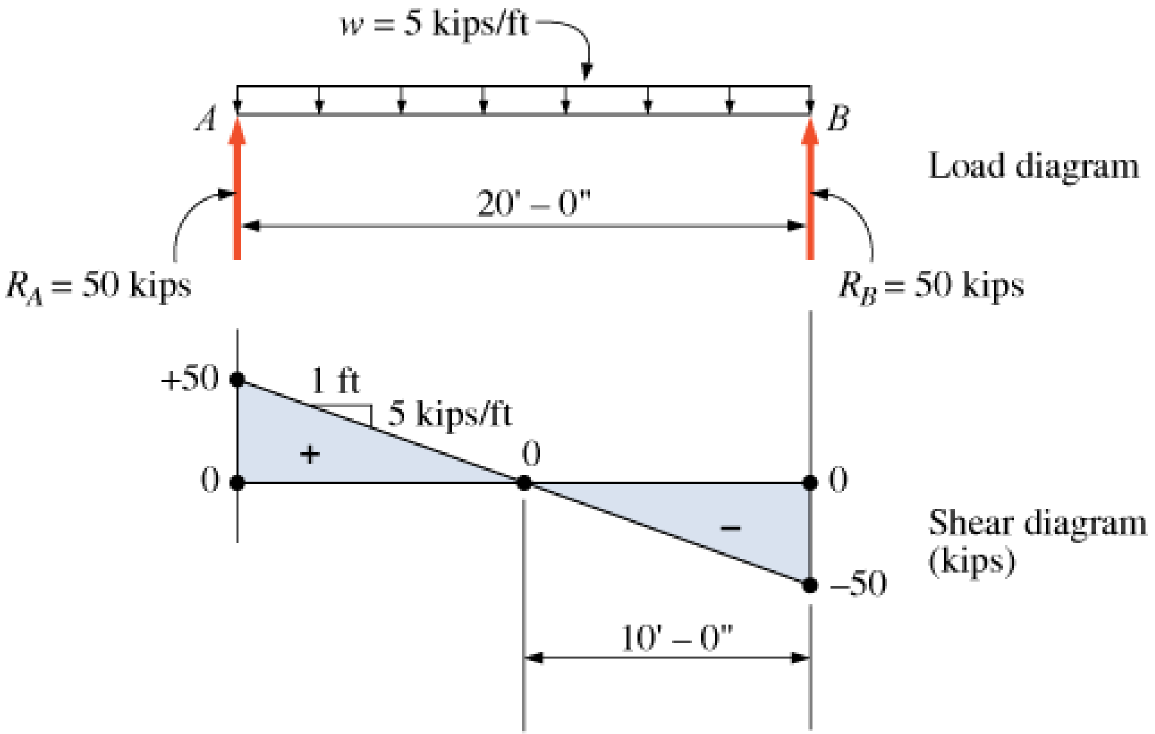
$$= 56.02 \text{ Kip.ft}$$



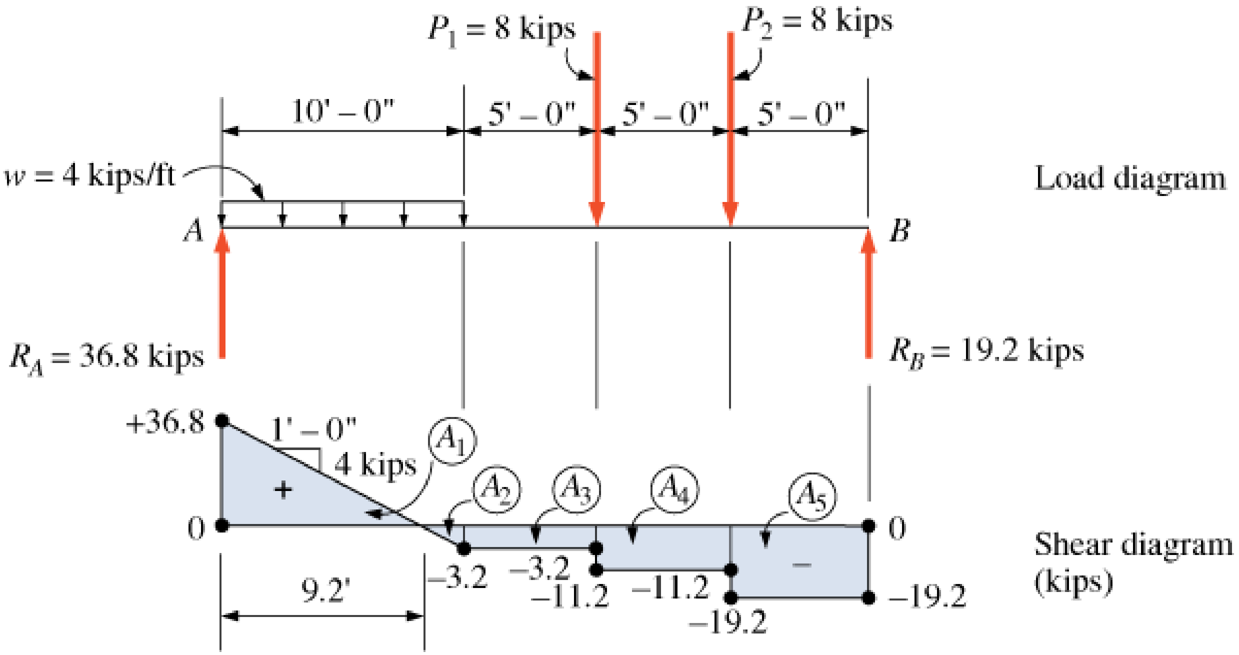
w = 5 kips/ft
A
B
20' – 0"
R_A = 50 kips
R_B = 50 kips



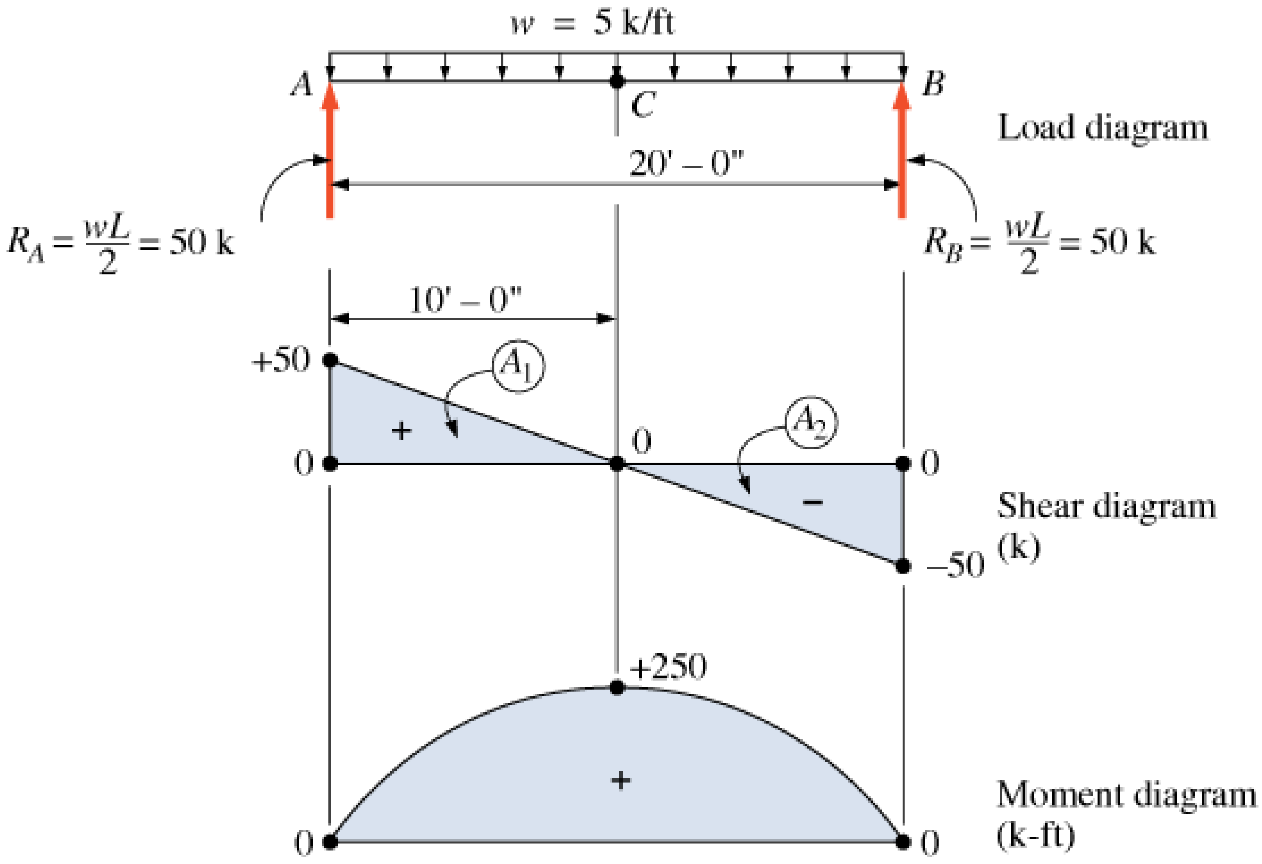
Cutting plane
w = 4 kips/ft
A
10' – 0"
R_A = 36.8 kips



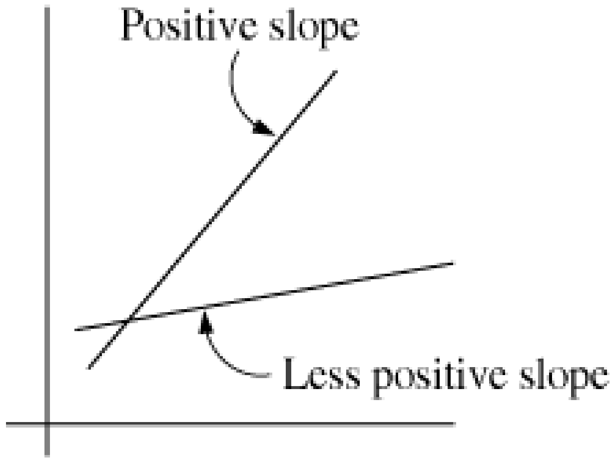
w = 5 kips/ft
A
B
Load diagram
20' – 0"
R_A = 50 kips
R_B = 50 kips
+50
1 ft
5 kips/ft
+
0
0
0
–
Shear diagram
(kips)
–50
10' – 0"

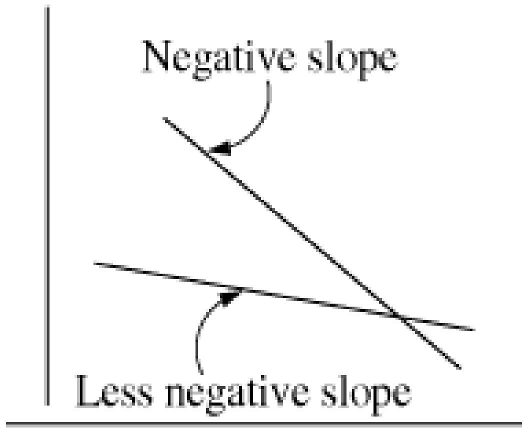


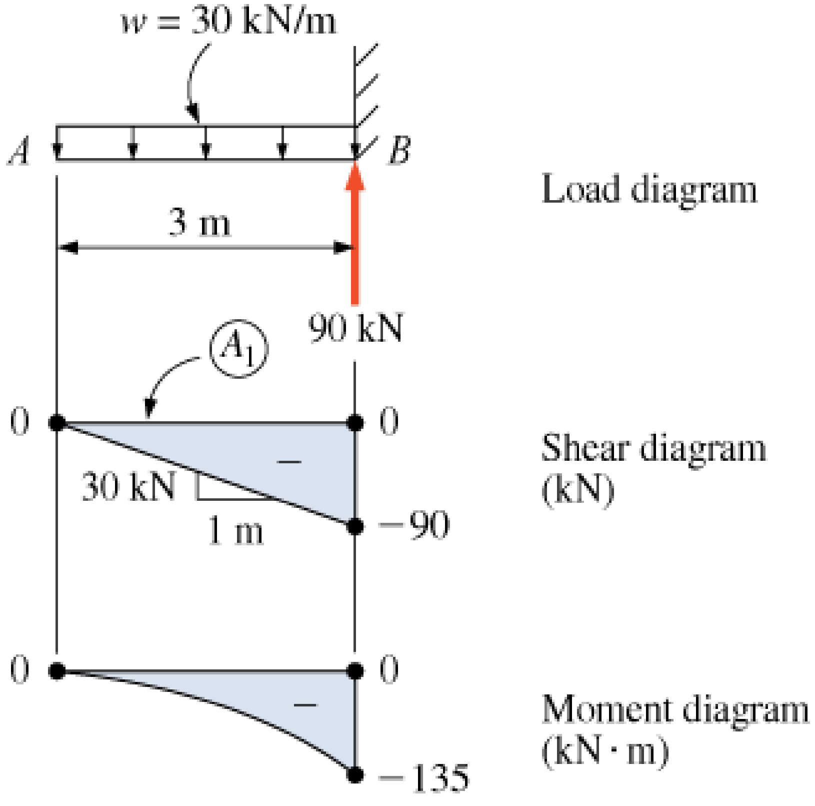
P1 = 8 kips
P2 = 8 kips
10' – 0"
5' – 0"
5' – 0"
5' – 0"
w = 4 kips/ft
Load diagram
A
B
RA = 36.8 kips
RB = 19.2 kips
+36.8
1' – 0"
4 kips
A1
A2
A3
A4
A5
+
0
0
–
Shear diagram
(kips)
9.2'
–3.2
–3.2
–11.2
–11.2
–19.2
–19.2



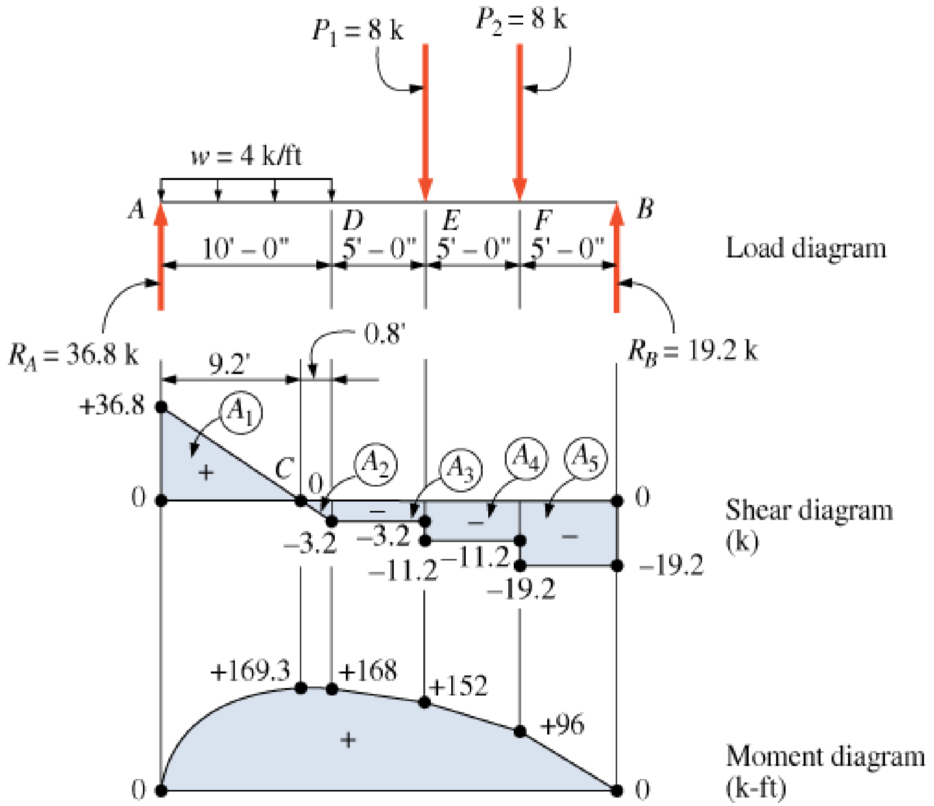
w = 5 k/ft
A
B
C
Load diagram
20' – 0"
$R_A = \frac{wL}{2} = 50$ k
$R_B = \frac{wL}{2} = 50$ k
10' – 0"
+50
A_1
A_2
0
+
–
–50
Shear diagram
(k)
+250
Moment diagram
(k-ft)


Positive slope
Less positive slope


Negative slope
Less negative slope



w = 30 kN/m
A
B
3 m
90 kN
Load diagram
A1
0
0
–
30 kN
1 m
−90
Shear diagram
(kN)
0
0
–
−135
Moment diagram
(kN · m)



$P_1 = 8$ k
$P_2 = 8$ k
$w = 4$ k/ft
A
B
D
E
F
10' – 0"
5' – 0"
5' – 0"
5' – 0"
Load diagram
$R_A = 36.8$ k
$R_B = 19.2$ k
9.2'
0.8'
+36.8
A_1
A_2
A_3
A_4
A_5
+
C
0
0
0
–3.2
–3.2
–11.2
–11.2
–19.2
–19.2
Shear diagram
(k)
+169.3
+168
+152
+96
+
0
0
Moment diagram
(k-ft)