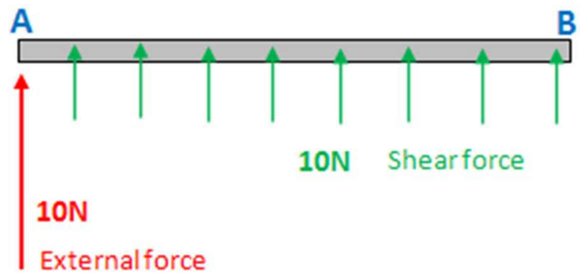
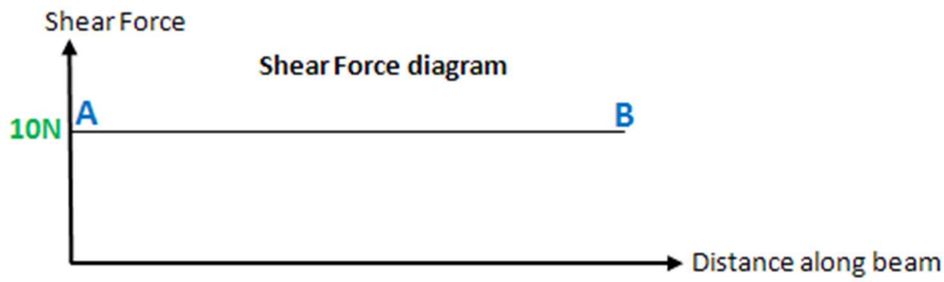
What is shear force?

Below a force of 10N is exerted at point A on a beam. This is an external force. However because the beam is a rigid structure, the force will be internally transferred all along the beam. This internal force is known as shear force. The shear force between point A and B is usually plotted on a shear force diagram. As the shear force is 10N all along the beam, the plot is just a straight line, in this example.





Basic bending moment diagram

M = Force x distance (distance is from next closest right endpoint)

Uniformly Distributed Load (UDL)

Diagram A:

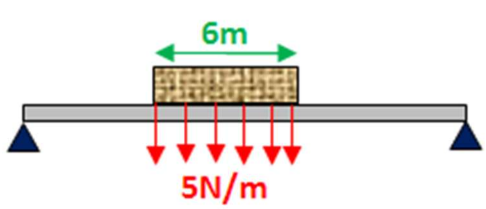
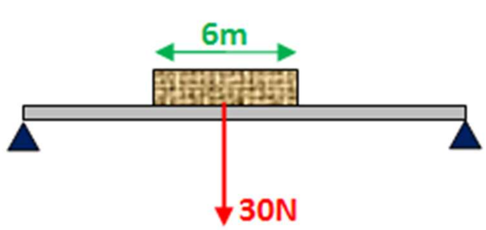
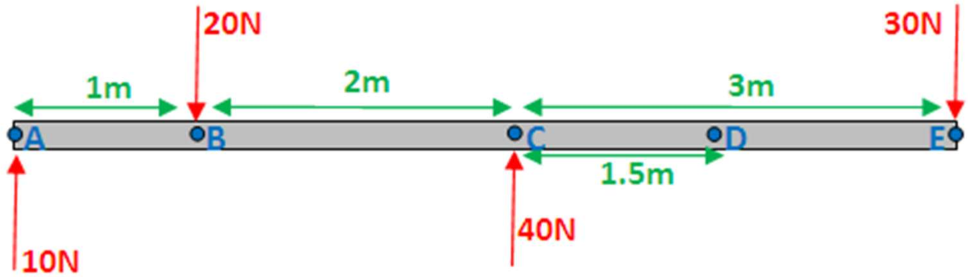
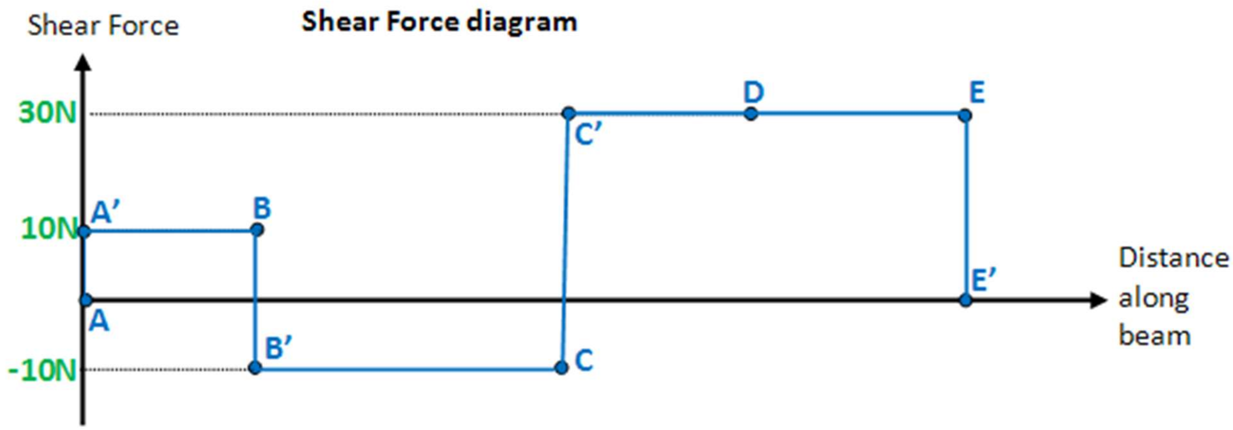


Diagram B:

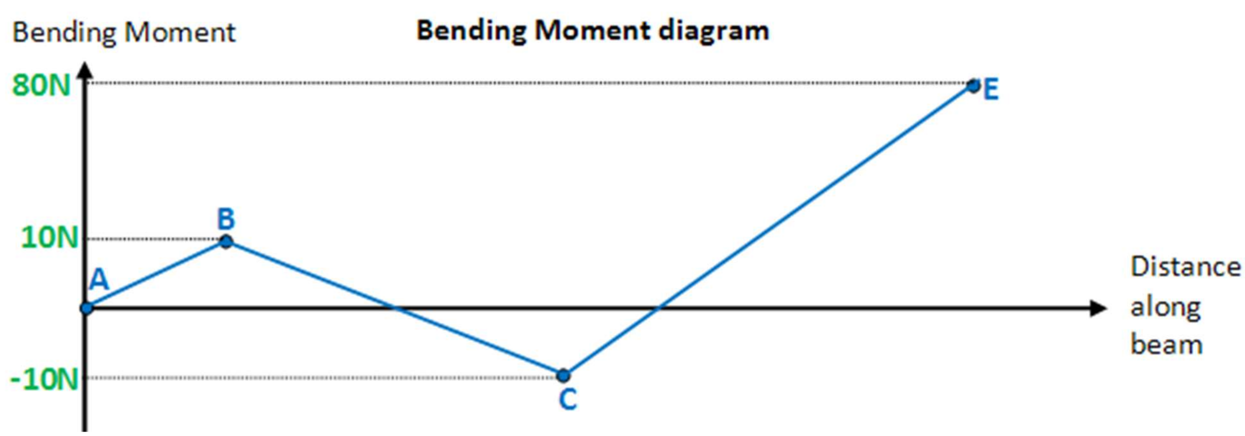


Problem 1





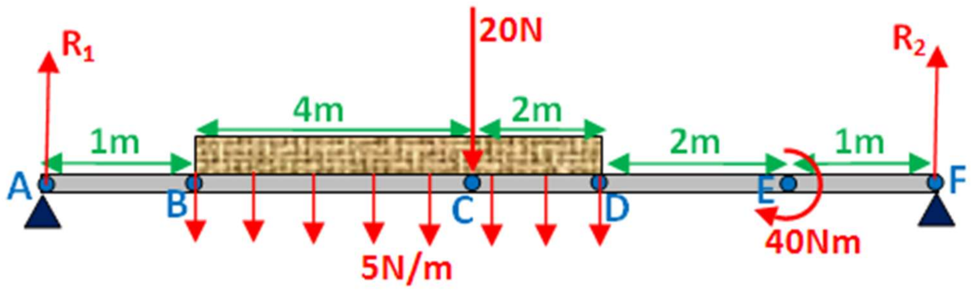
Force at A = 10, at B = 10 – 20 = -10, at C = 10 – 20 + 40 = 30, at E = 10 – 20 + 40 – 30 = 0



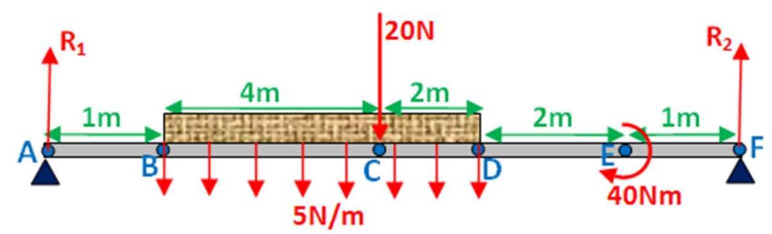
Moments: (taken from right endpoints)

at A = 0, at B = 10 * 1 = 10, at C = 10 * 30 – 20 *2 = -10, at E = 10 * 6 – 20 * 5 + 40 * 3 = 80

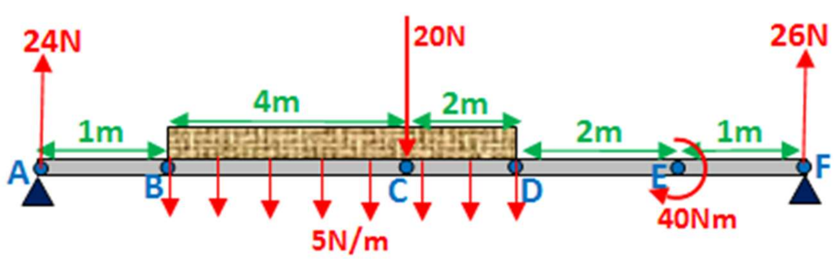
Problem 2



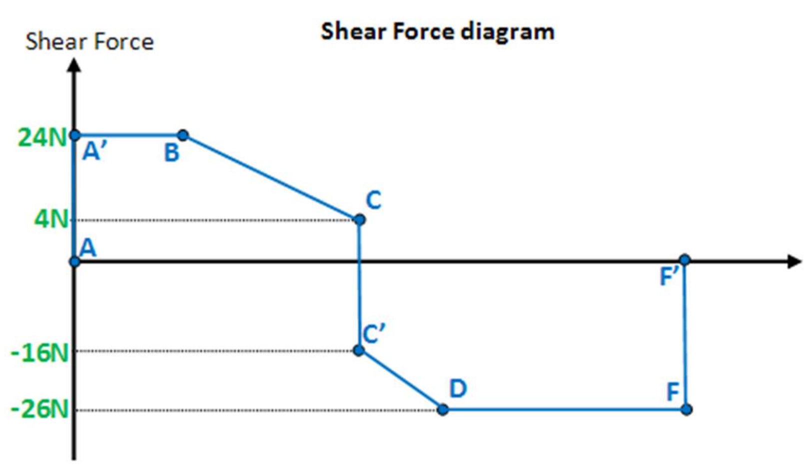
First, we simplify UDL:



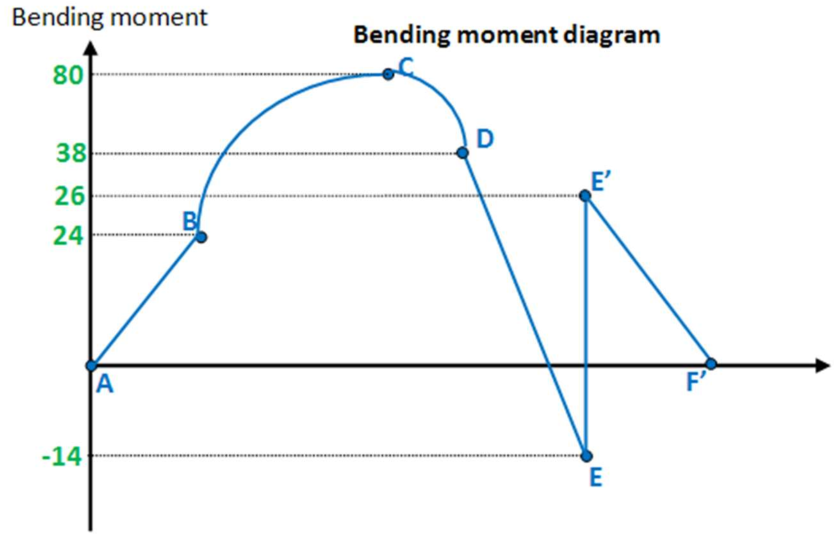
Second, we find Reactions R1 and R2:



Shear Force Diagram: (we go adding forces from right to left)



Bending Moment Diagram (we take distance from right endpoints)

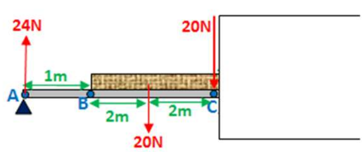


Moments:

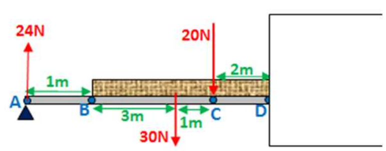
at A = 0, at B = 24*1 = 24, at C = 24*5 – 20*2 = 80, at D = 24*7 – 30 *3 – 20*2 = 38,

before E = 24*9 – 30*5 – 20*4 = -14, **after** E = 24*9 – 30*5 – 20*4 + 40 =26,

at F = 24 * 10 – 30*6 - 20*5 + 40 = 0



Bending moment at C: 24·5 - 20·2 = 80Nm



Bending moment at D: 24·7 - 30·3 - 20·2 = 38Nm