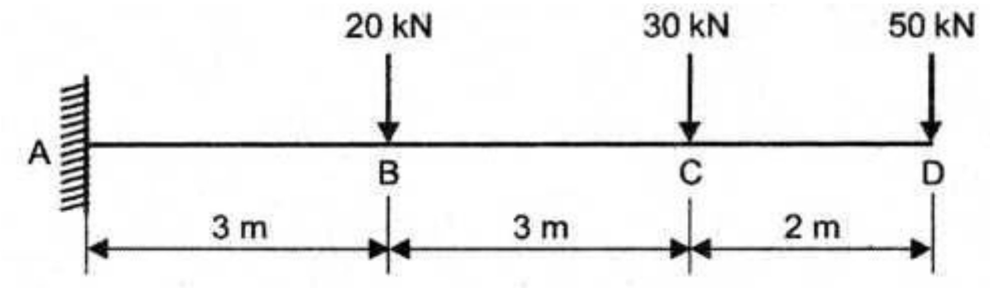
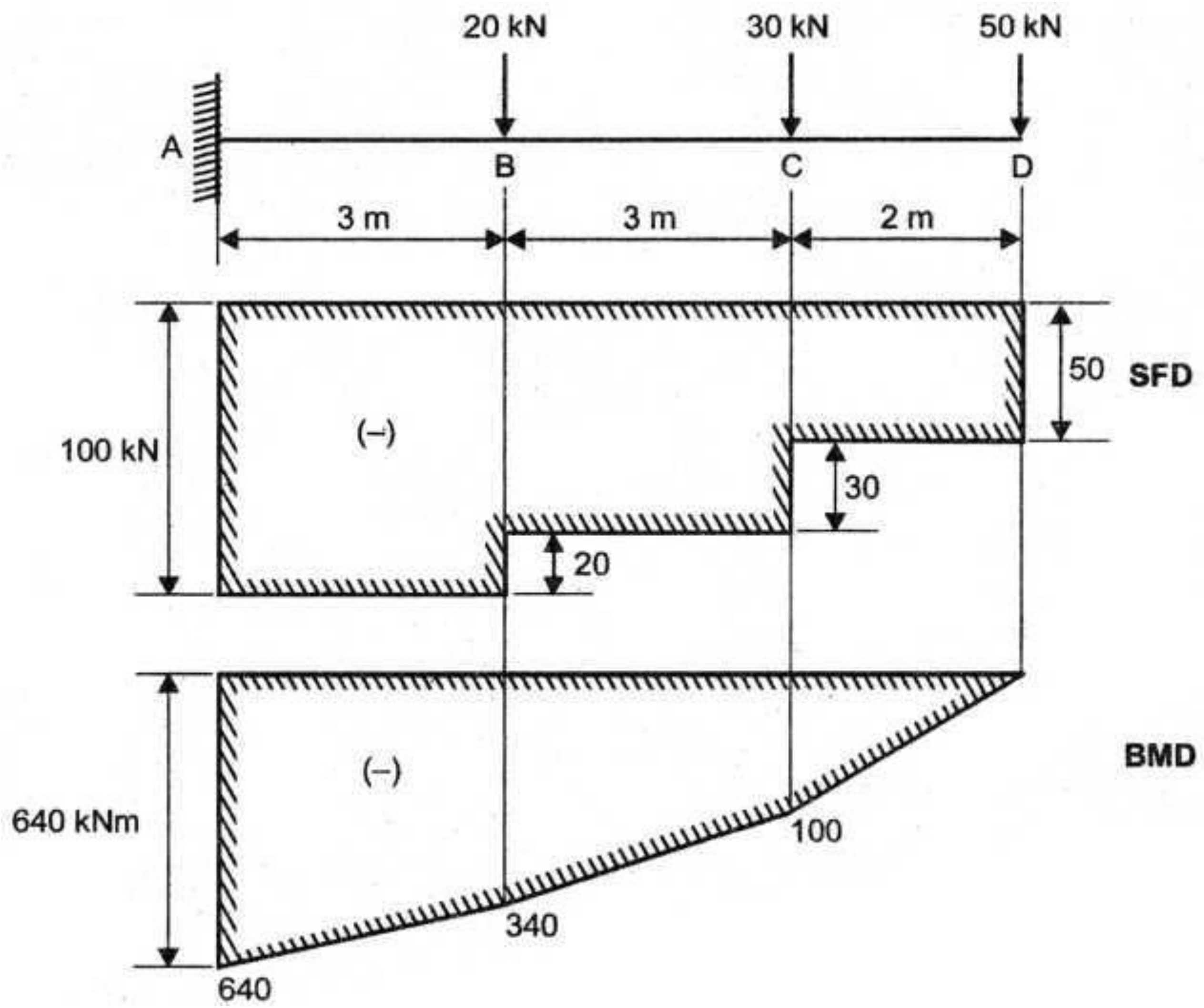
Cantilevers

Let us draw the shear force diagram and bending moment diagram of



Solution:

Given beam is cantilever beam. Hence shear force and Bending moment diagrams can be drawn directly without finding support reaction. Determine the shear force and Bending moment values at load points moving from the free end D to the fixed end A.



Shear Force:

$(SF)_D = -50$ KN

$(SF)_C = -50 - 30 = -80$ KN

$(SF)_B = -50 - 30 - 20 = -100$ KN

$(SF)_A = -100$ KN

Bending moment:

$(BM)_D = 0$

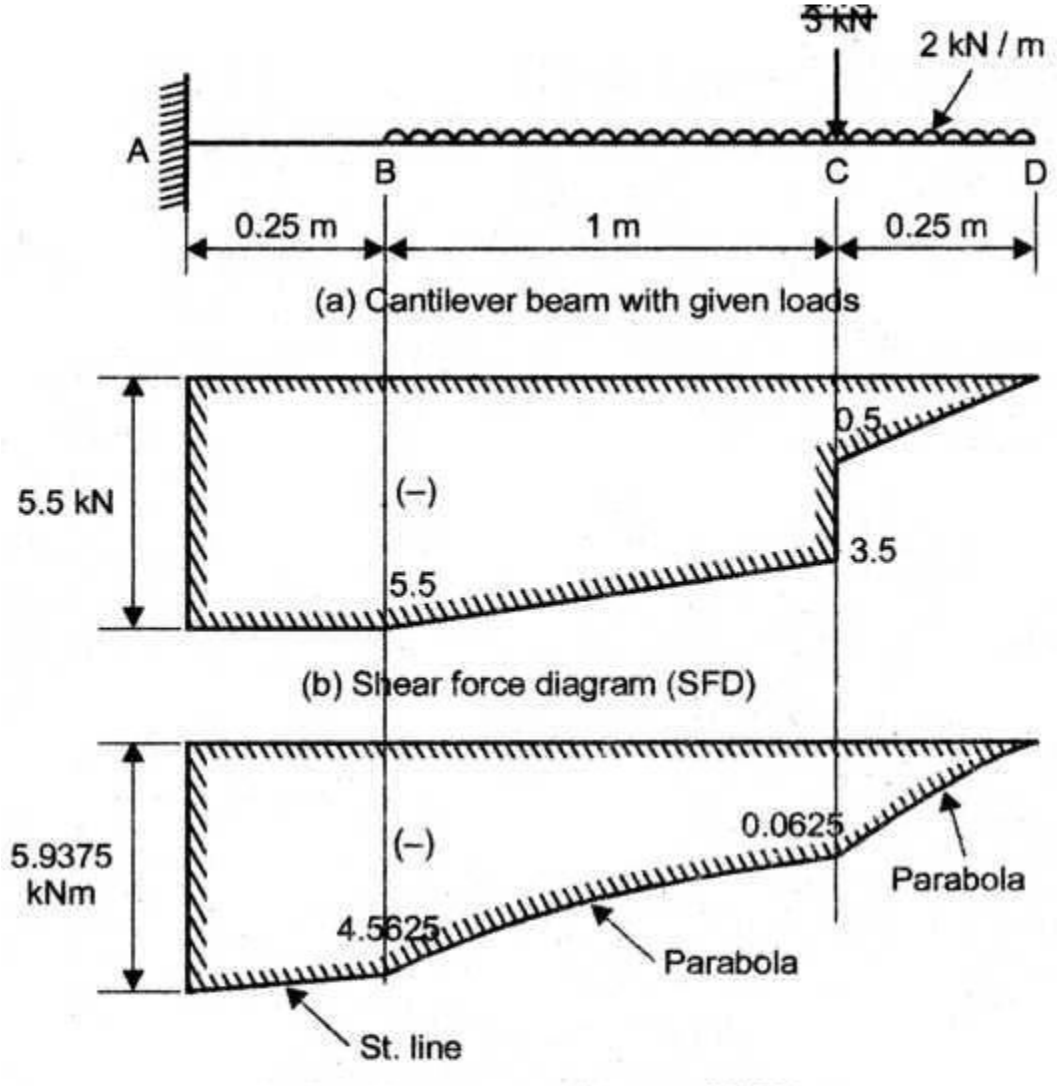
$(BM)_C = -(50 \times 2) = -100$ k Nm

$(BM)_B = -(50 \times 5) - (30 \times 3) = -340$ k Nm

$(BM)_A = -(50 \times 8) - (30 \times 6) - (20 \times 3) = -640$ k Nm

Shear Force and Bending moment diagram are drawn as shown in figure by plotting the shear force and Bending moment values at respective points and joining them in proper sequence.

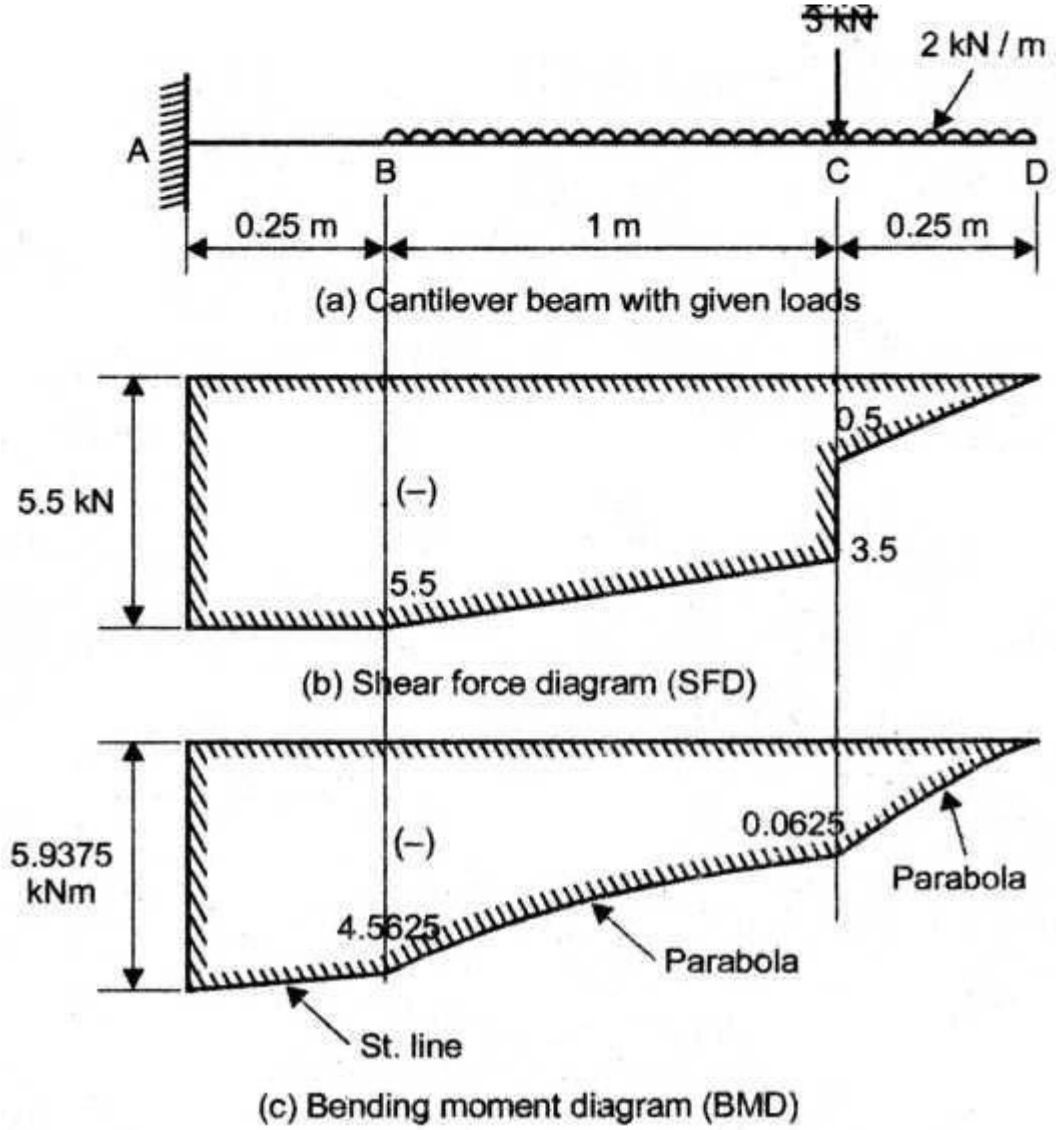
Here we draw a shear force diagram and bending moment diagram of acantilever 1.5m long has loaded with a uniformly distributed load of 2 KN/m run over a length of 1.25m from the free end. It also carries a point load of 3 KN at a distance of 0.25 m from the free end.



(c) Bending moment diagram (BMD)

Solution:

The cantilever beam with given loads are shown in figure(a). Shear force and Bending moment values are determined at various points and plotted in Figure (b) and (c) respectively.



Shear Force:

$(SF)_d = 0$

$(SF_C)_R = -(2 \times 0.25) = -0.5$ KN

$(SF)_C = -(2 \times 0.25) - 3 = -3.5$ KN

$(SF)_B = -(2 \times 1.25) - 3 = -5.5$ KN

$(SF)_A = -5.5$ KN

Bending Moment:

$(BM)_d = 0$

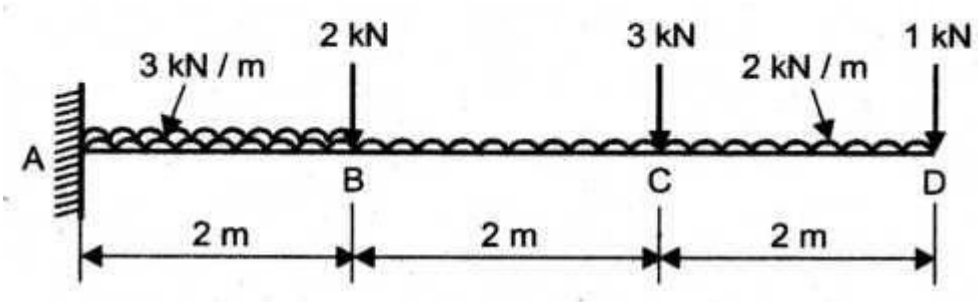
$$(BM)_C = -\left[2 \times 0.25 \times \frac{0.25}{2}\right] = -0.0625 \text{ k Nm}$$

$$(BM)_b = -\left[2 \times 1.25 \times \frac{1.25}{2}\right] - (3 \times 1) = -4.5625 \text{ k Nm}$$

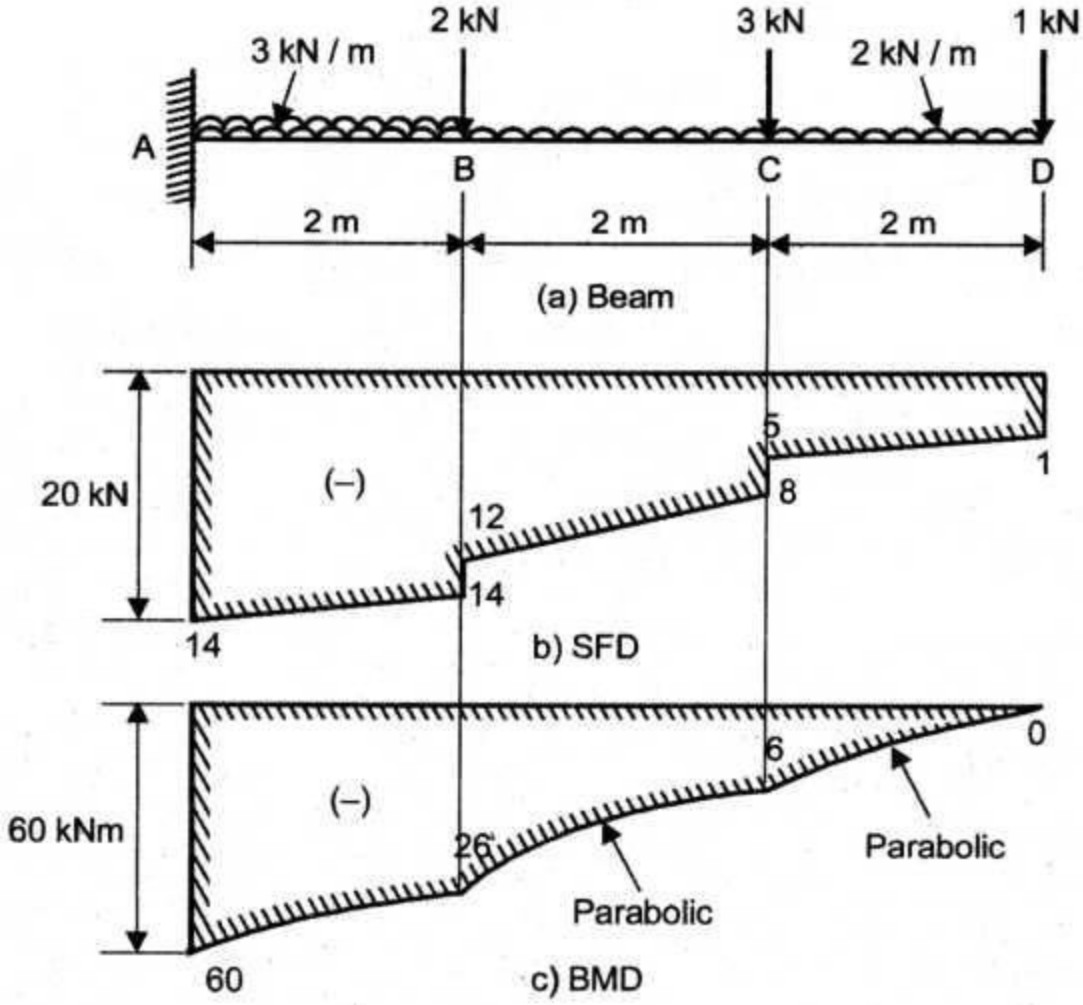
$$(BM)_a = -\left\{2 \times 1.25 \times \left[\frac{1.25}{2} + 0.25\right]\right\} - (3 \times 1.25)$$

$= -5.9375$ k Nm

We derive shear force and bending moment diagram for the following figure.



Solution:



Shear Force:

$(SF)_d = -1$ KN

$(SF_c)_r = -1 - (2 \times 2) = -5$ KN

$(SF)_C = -1 - 3 - (2 \times 2) = -8$ KN

$(SF_b)_r = -1 - 3 - (2 \times 4) = -12$ KN

$(SF)_B = -1 - 3 - 2 - (2 \times 4) = -14$ KN

$(SF)_a = -1 - 3 - 2 - (2 \times 4) - (3 \times 2) = -20$ KN

Bending Moment:

$BM)_d = 0$

$(BM)_C = -(1 \times 2) - (2 \times 2 \times \frac{2}{2}) = -6$ k Nm

$(BM)_B = -(1 \times 4) - (3 \times 2) - (2 \times 4 \times \frac{4}{2}$

$(BM)_A = -(1 \times 6) - (3 \times 4) - (2 \times 2)$ $\left\{2 \text{ x } 4 \text{ x}\left[\frac{4}{2} + 2\right]\right\} - \left\{3 \text{ x } 2 \text{ x} \frac{2}{2}\right\}$

$= -60$ k Nm

The Shear Force diagram and Bending moment diagram are shown in Figure (b) and Figure (c) respectively.