1.

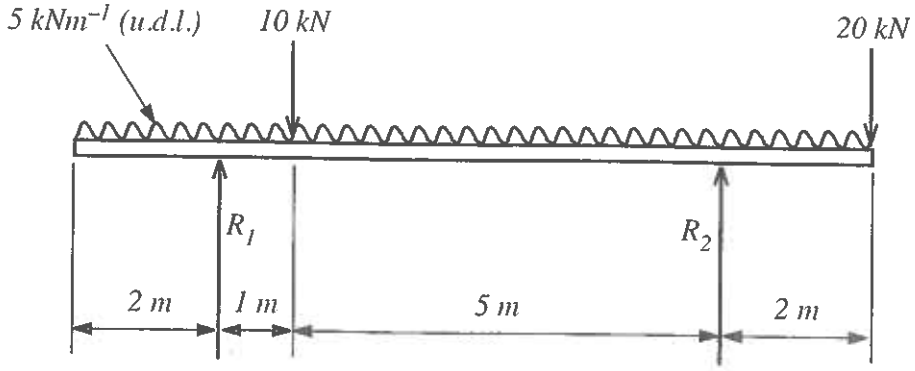


FIG. 1

For the loaded beam shown in FIGURE 1 :

(a) Determine the vertical reactions at the supports.

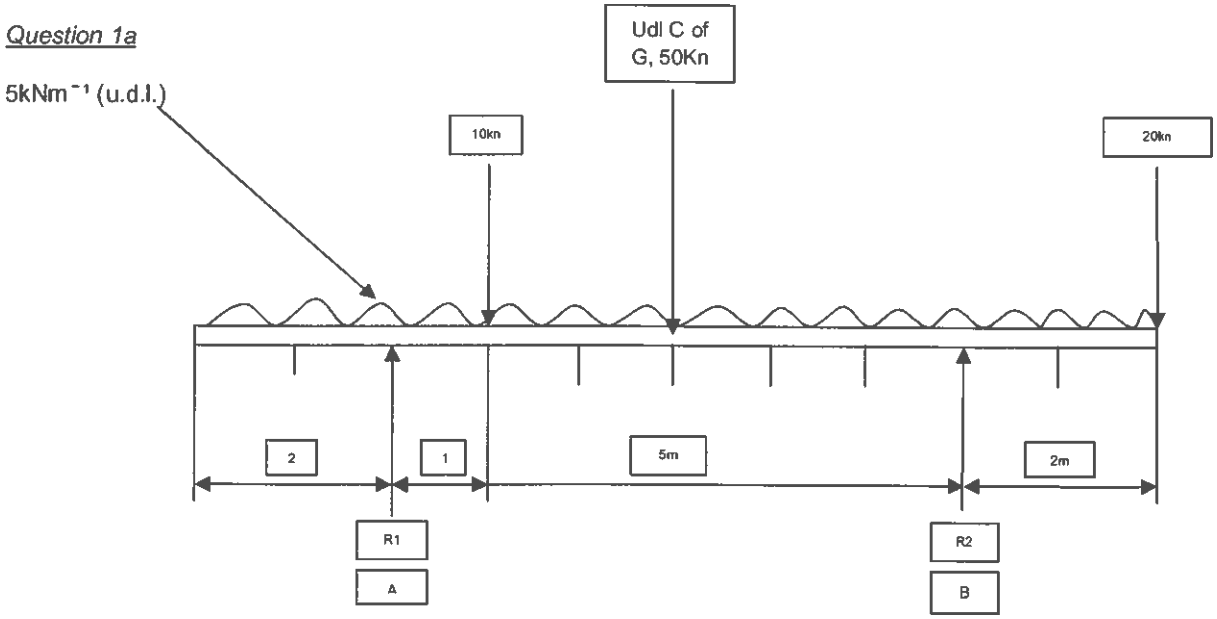
(b) Sketch the shear force diagram for the beam.

(c) Calculate the bending moment at 1m intervals along the beam.

(d) Sketch the bending moment diagram for the beam.

(e) State the position and magnitude of the maximum bending moment in the beam.

Question 1a



Taking moments about A. Total downward force is 80kN

$(10 \times 1) + (50 \times 3) + (20 \times 8) = R2 \times 6$

$10 + 150 + 160 = R2 \times 6$

$R2 \times 6 = 320$

$R2 = \frac{320}{6} = 53.3kN$

$R1 = 80 - 53.3 = 26.7kN$

Vertical reactions are $R1 = 26.7kN$ *and* $R2 = 53.3kN$

Question 1b

Shear Force at 0 meters = 0Kn

Shear Force at 2 meters $26.67 - (5 \times 2) = 16.67kN$

Shear Force at 3 meters $26.67 - (5 \times 3) - 10 = 1.67kN$

Shear Force at 4 meters $26.67 - (5 \times 4) - 10 = -3.33kN$

Shear Force at 5 meters $26.67 - (5 \times 5) - 10 = -8.33kN$

Shear Force at 6 meters $26.67 - (5 \times 6) - 10 = -13.33kN$

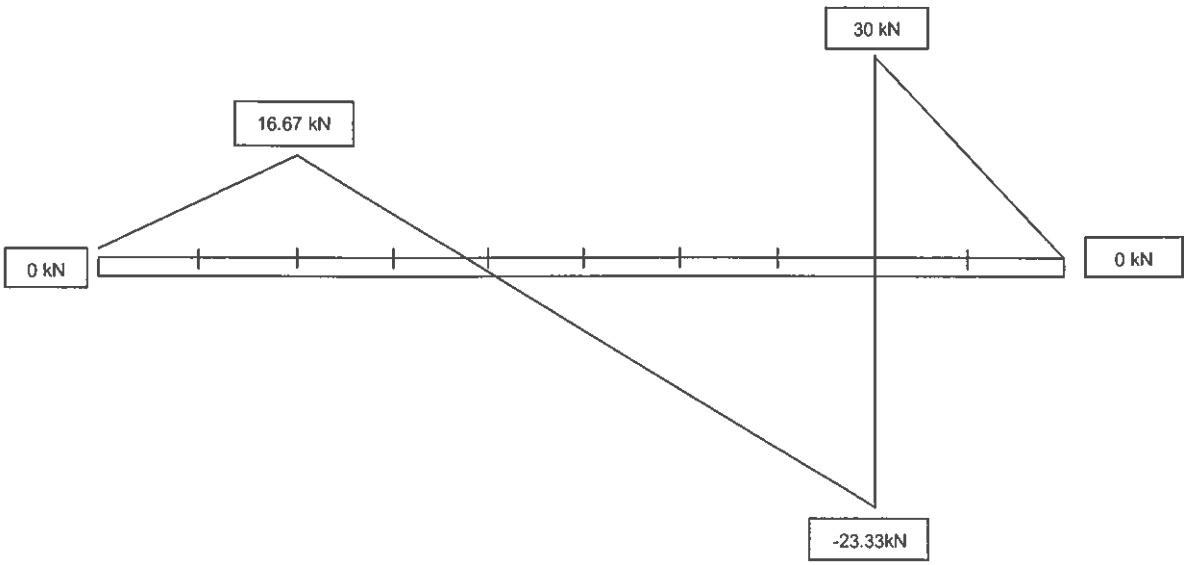
Shear Force at 7 meters $26.67 - (5 \times 7) - 10 = -18.33kN$

Shear Force at 8 meters $26.67 - (5 \times 8) - 10 = -23.33kN$

At this point we need to add R2= 53.33 so $26.67 - (5 \times 8) - 10 + 53.33 = 30kN$

Shear Force at 9 meters $26.67 - (5 \times 9) - 10 + 53.33 = 24.93kN$

Shear Force at 10 meters $26.67 - (5 \times 10) - 10 + 53.33 - 20 = 0kN$



Question 1c

Bending Moment at 0 meters is 0

Bending Moment at M1 is $5 \times 1 \times 0.5 = 2.5kNm$

Bending Moment at M2 is $(5 \times 2 \times 1) = 10kNm$

Bending Moment at M3 is $26.67 - (5 \times 3 \times 1.5) = 4.17kNm$

Bending Moment at M4 is $(26.67 \times 2) - (5 \times 4 \times 2) - 10 = 53.34 - 40 - 10 = 3.34$

Bending Moment at M5 is $(26.67 \times 3) - (5 \times 5 \times 2.5) - (10 \times 2) = 80.01 - 50 - 20 = -2.49kNm$

Bending Moment at M6 is $(26.67 \times 4) - (5 \times 6 \times 3) - (10 \times 3) = 106.68 - 90 - 30 = -13.32kNm$

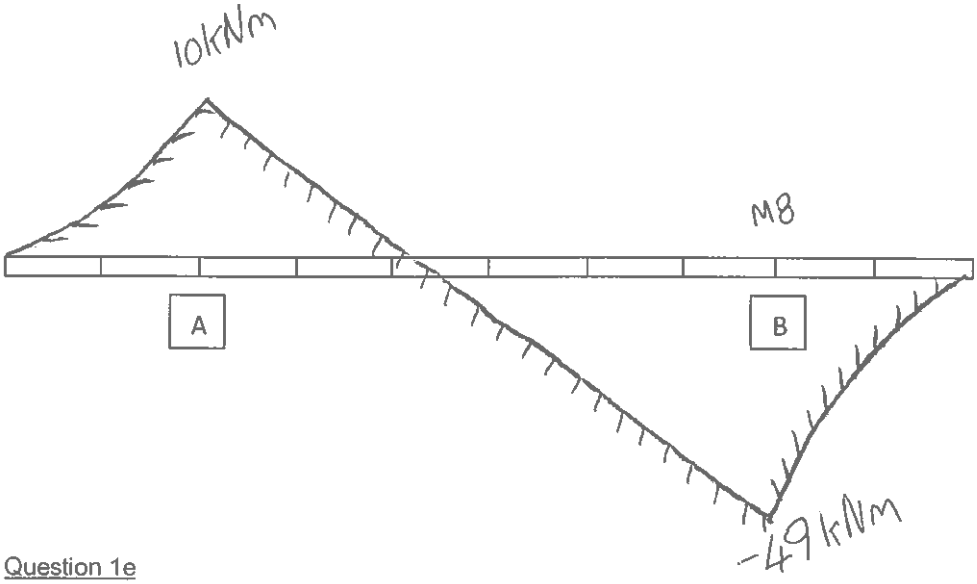
Bending Moment at M7 is $(26.67 \times 5) - (5 \times 7 \times 3.5) - (10 \times 4) = 133.35 - 122.5 - 40 = -29.15kNm$

Bending Moment at M8 is $(26.67 \times 6) - (5 \times 8 \times 4) - (10 \times 5) = 160.02 - 160 - 50 = -49.98kNm$

Bending Moment at M9 is $(26.67 \times 7) - (5 \times 9 \times 4.5) - (10 \times 6) + 53.33 = -22.48kNm$

Bending Moment at M10 is $(26.67 \times 8) - (5 \times 10 \times 5) - (10 \times 7) + (53.33 \times 2) = 0.02kNm$

Question 1d



Question 1e

The maximum bending moment was at M8 and was -49.98kNm.