AEN 4131 – FARM STRUCTURES

ASSIGNMENT 3

Due date: Thursday: 26/05/2022

Question

The beam shown in Fig. Q, has a pin support at A and a (roller) smooth support at B.

i) Determine the reaction forces at the supports A and B.

ii) Draw the shear force diagram (SFD) and bending moment diagram (BMD) for the beam.

iii) Give the value of the maximum shear force and state its location.

iv) Give the value of the maximum bending moment and state its location.

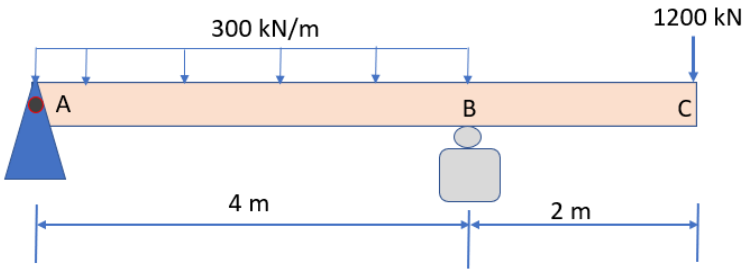


Fig. Q

NOTE: Since the loading changes at one point (point B), there are two sections to be analysed. Check the example below for a better understanding.

EXAMPLE

On a particular day, one beam supported 20kN/m of the weight of the first floor of a storage building which included the maize stored on the floor. On that day, the farmer who owns the structure was using the beam to hoist a 450kN load into a right truck. The hoist was placed in the middle of the beam span as shown in Fig.QE.

i. Determine the reactions at A and C
ii. Draw the shear force and bending moment diagrams for the beam
iii. State the maximum absolute values of the shear force and bending moment and indicate the location with respect to point A.

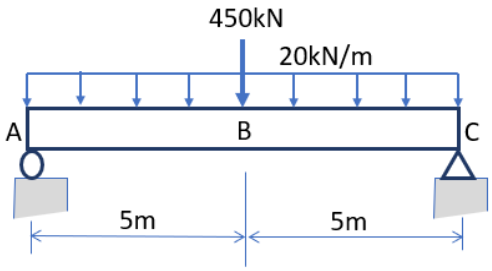


Fig. QE

Solution

i. Determine the reactions at A and C

*RA+RC-450-20*10 = 0*

RA +RC = 650 kN ……..(1)

Summation of moments about A = 0. Clockwise positive

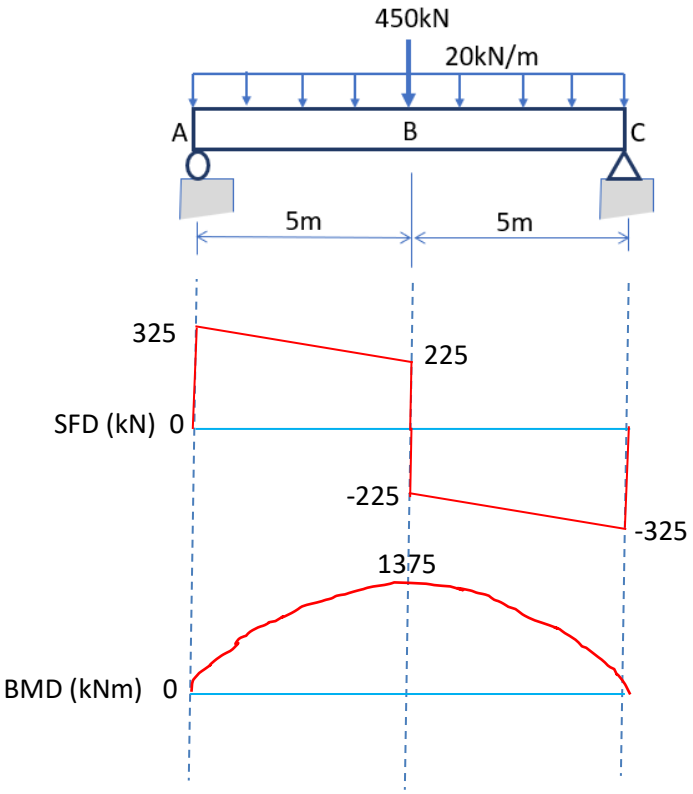
*450*5+200*5-10RC = 0*

RC = 325kN

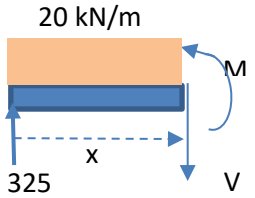
RA = 650 – 325 = 325 kN

ii. Draw the shear force and bending moment diagrams for the beam

Since the loading of the beam is changed at one point (point B), two sections of the beam are analysed.



Section AB



325 -20x - V = 0

V = 325 -20x

For x =0, V = 325 kN

For x = 5, V = 325 – 100 = 225 kN

Moments about x, clockwise positive

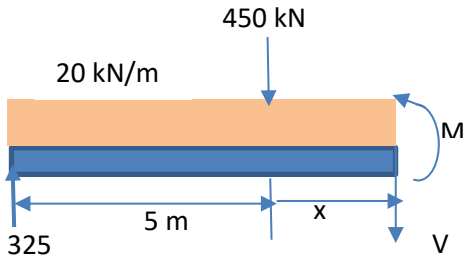
$325x -10x^2 - M = 0$

$M = 325x - 10x^2$

For x = 0, M = 0

For x = 5, M = 325*5 – 10*25 = 1375 kNm

Section BC



325 – 20(5+x) -450 - V = 0

V = 325 – 100-450 – 20x

V = -225-20x

For x = 0, V = -225 kN

For x = 5, V = -325 kN

Moments about x, clockwise positive

$325 (5+x) –(20*5)*(2.5 +x) -10x^2 -450x -M =0$

$M = 1625+325x -250 – 100x -10x^2 -450x$

$= 1375-225x -10x^2$

For x = 0, M = 1375 kNm

For x = 5, M = 0

iii. State the maximum absolute values of the shear force and bending moment and indicate the location with respect to point A.

Maximum shear force = 325 kN at A and C

Maximum bending moment = 1375 kNm at B