K J SOMAIYA COLLEGE OF ENGINEERING, MUMBAI-77

(CONSTITUENT COLLEGE OF SOMAIYA VIDYAVIHAR UNIVERSITY)

Module 4.2 : Beams

Presented by:

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Types of support, loads, beams, determination of reactions at supports for various types of loads on beams (excluding internal hinge problems)

Beams

- Structural member that carries a load that is applied transverse to its length
- Used in floors and roofs
- May be called floor joists, stringers, floor beams, or girders

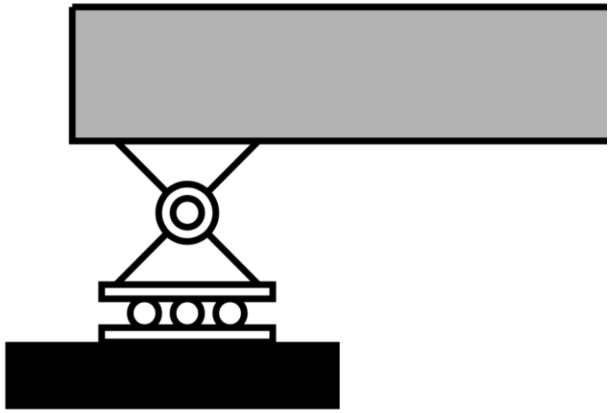
Types of Support

- A **structural support** is a part of a building or structure that provides the necessary stiffness and strength in order to resist the internal forces.
- Types of support

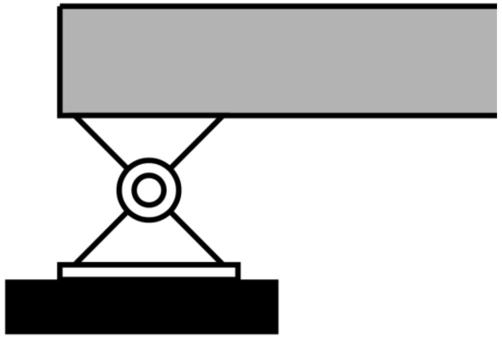
☐ Roller supports. ...

☐ Pinned/Hinged support. ...

☐ Fixed support. ...

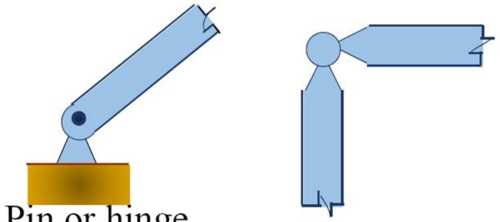
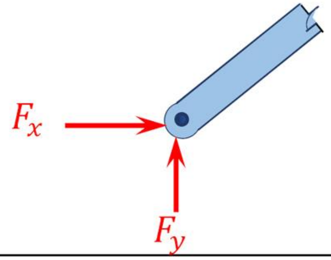
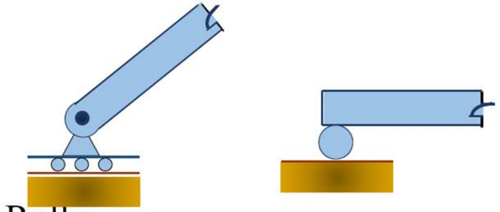
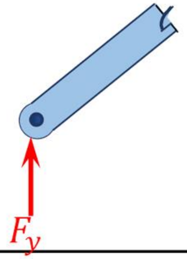
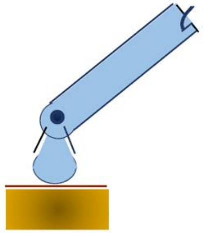
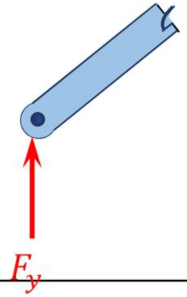
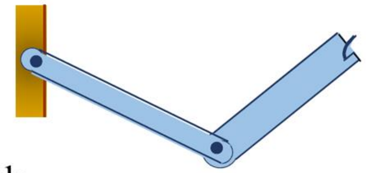
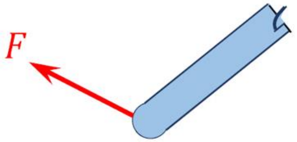
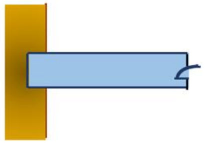
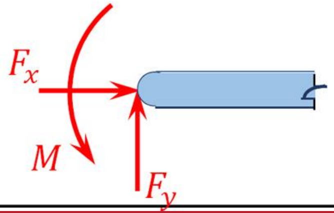


Roller support



Pinned/Hinged support

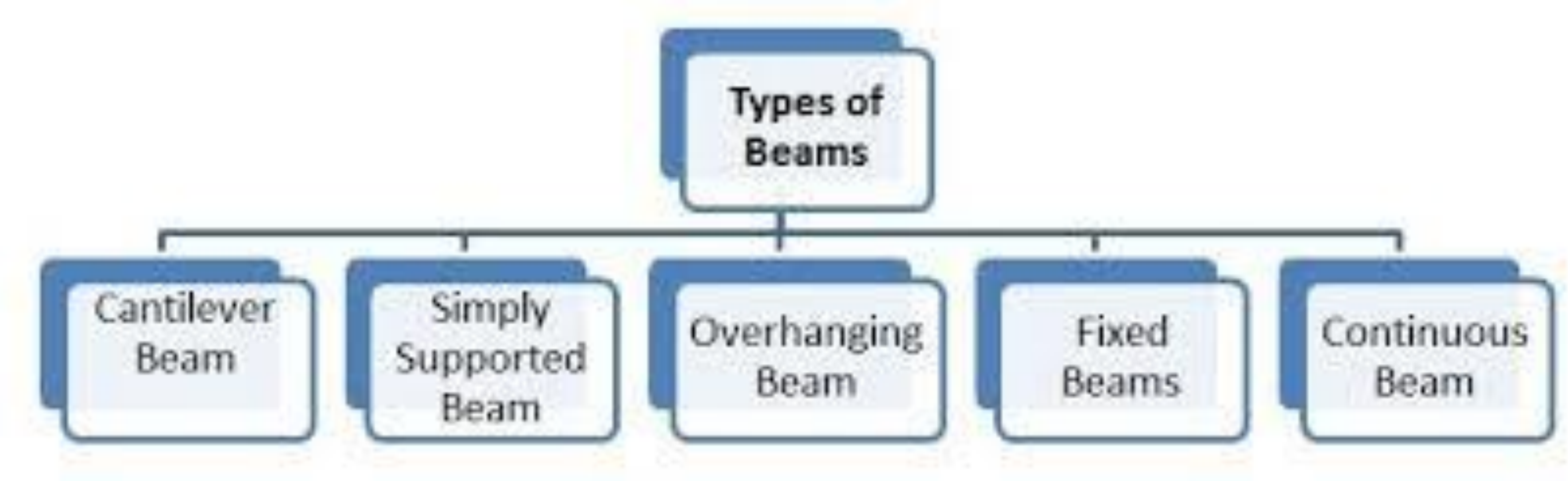
Fixed support

Idealization of Support	Reaction	Characteristics
 Pin or hinge		Prevents movement in the vertical and horizontal direction but allows rotation.
 Roller		Prevents movement in the vertical direction but allows rotation and translation in the horizontal direction.
 Rocker		The characteristics of a rocker support are similar to that of a roller.
 Link		Prevents movement in the direction perpendicular to the axis of the link.
 Fixed		Does not allow translation in any direction and rotation.

Types of Beams

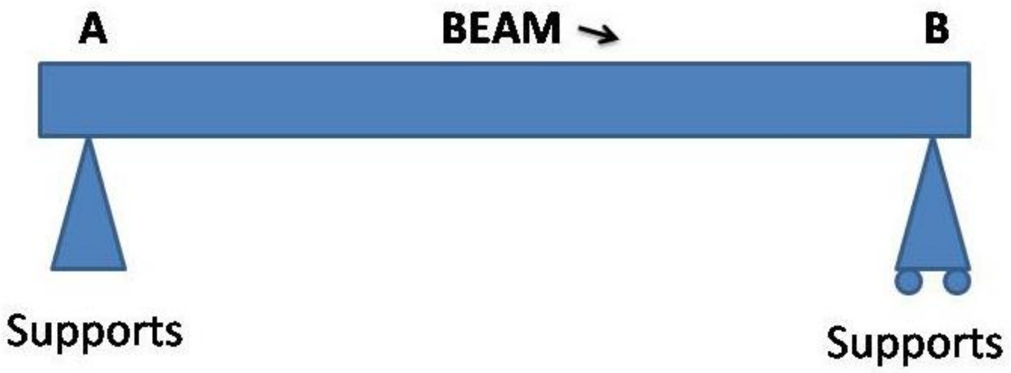
According to end supports condition, types of beam are

1. Simply supported beam
2. Cantilever beam
3. Continuous beam
4. Fixed end beam
5. Overhanging beam
6. Double overhanging beam



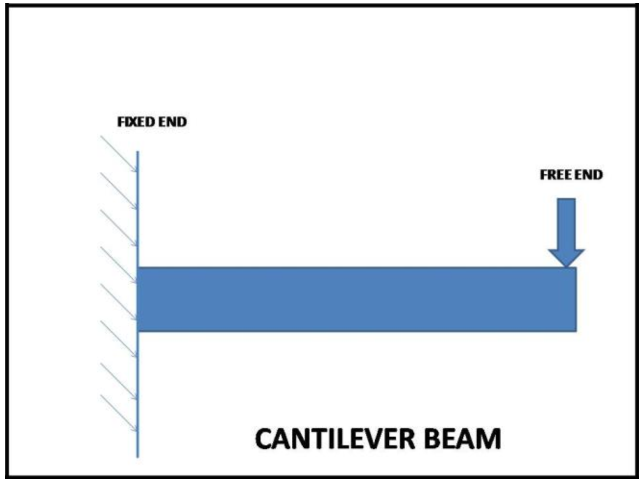
SIMPLY SUPPORTED BEAM

This type of beam is supported at both ends consisting of pin support at one of the end and a roller support at the other end.



CANTILEVER BEAM

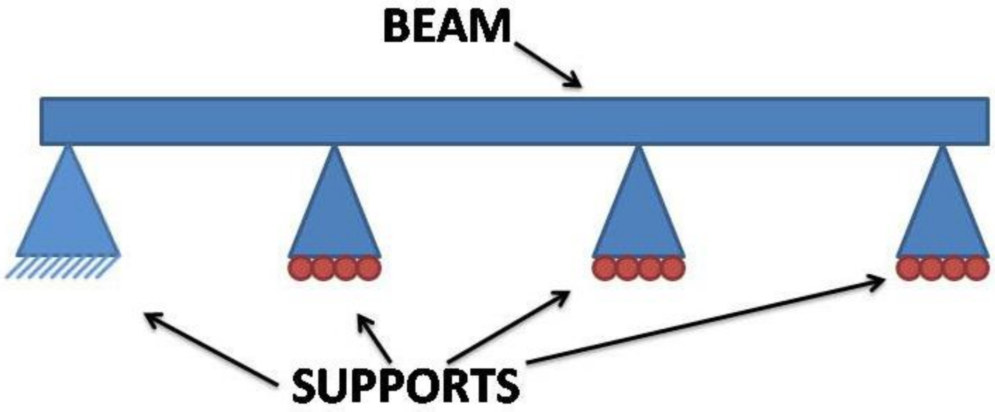
A Cantilever Beam is a type of beam constrained at one end with the other end extending freely outwards. In other words, this beam is supported at one end and the other end is free i.e. it has no support.



Types of Beams

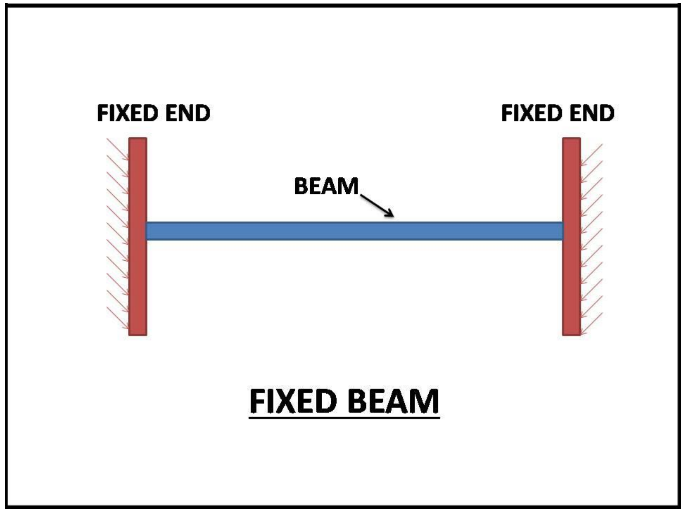
CONTINUOUS BEAM

A continuous beam is a type of beam extending over more than two supports distributed throughout its length.



FIXED END BEAM

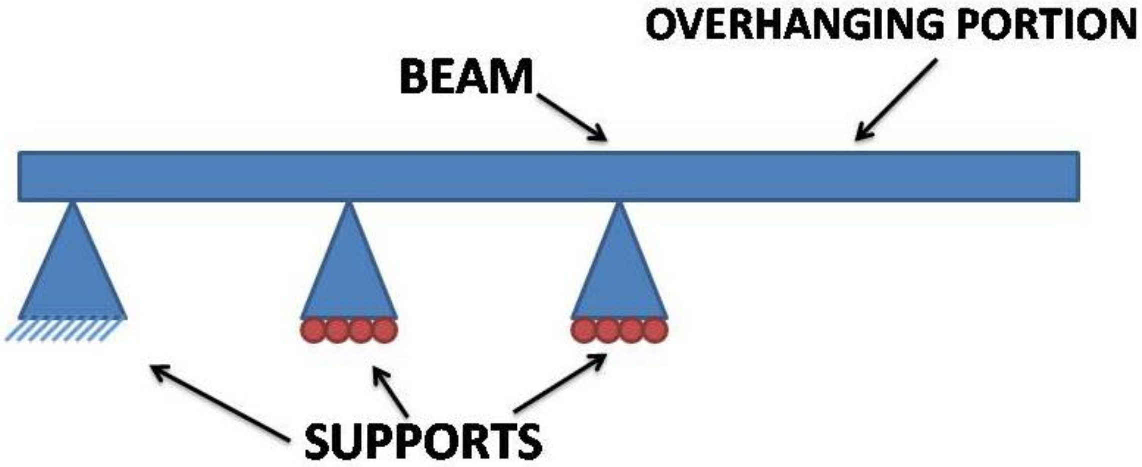
As the name indicates in this beam both the ends are fixed which restrains it from rotating or moving horizontally or vertically at that end.



Types of Beams

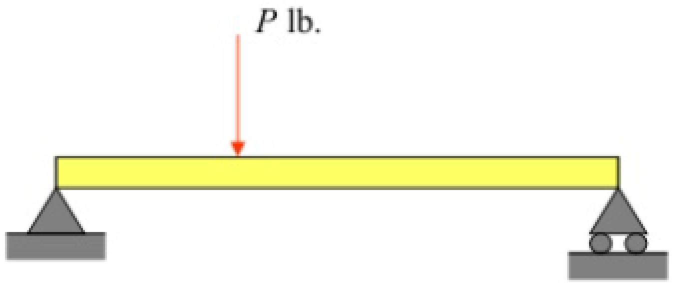
OVERHANGING BEAM

The overhanging beam is a type of beam having its end portion extending beyond its supports. This beam has the properties of both cantilever beam and simply supported beam. The overhanging portion can be at one end or at both the ends of the beam which is called a **double overhanging beam**.



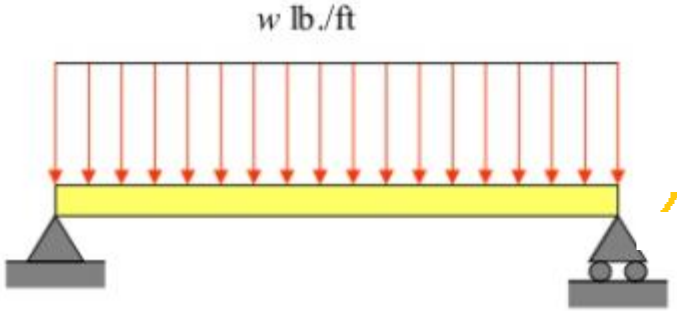
Types of Loads

1. Point load/Concentrated load

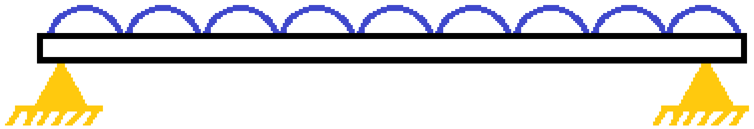


Concentrated/point load

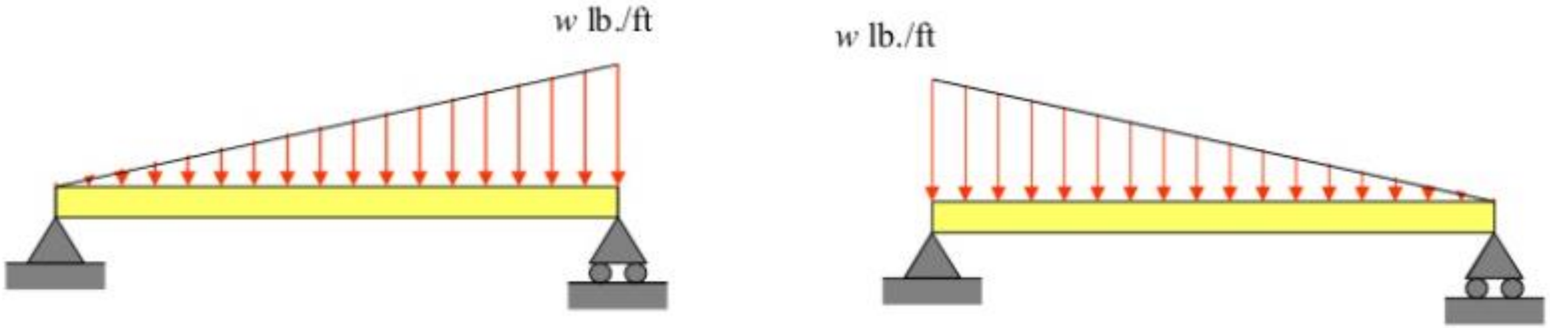
2. Uniformly Distributed Load (UDL)/ Rectangular Load



UDL: Uniformly distributed load

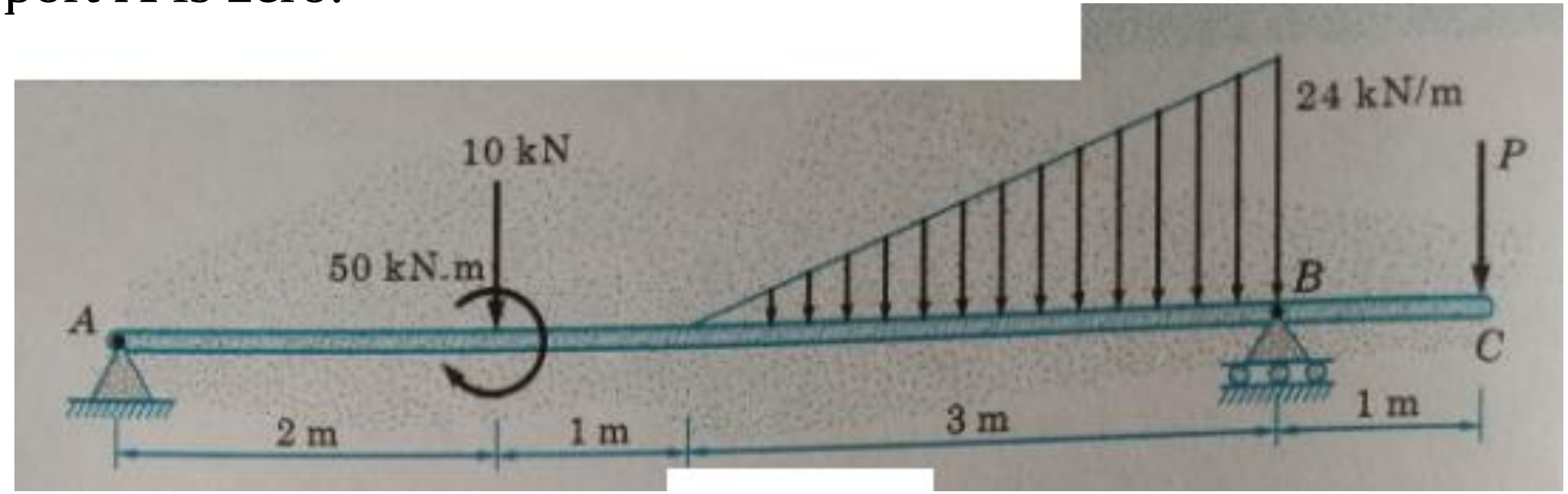


3. Uniformly Varying Load (UVL)/ Triangular Load



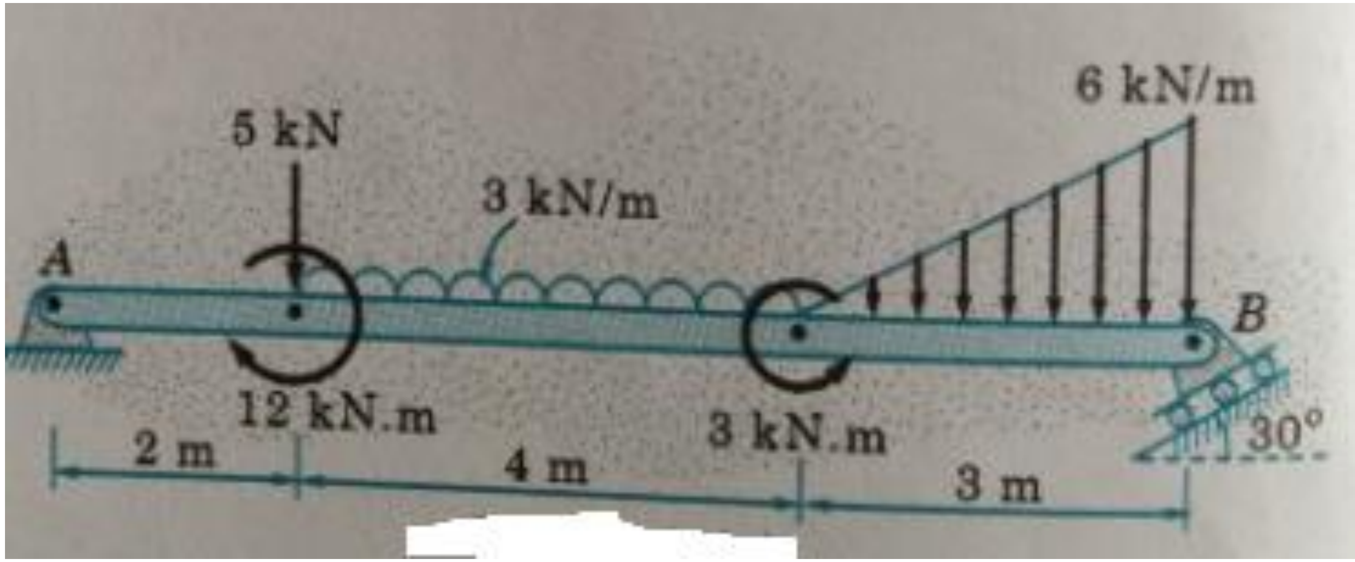
Problem No. 1

Find analytically the support reaction at B and load P for the beam shown in figure if reaction at support A is zero.



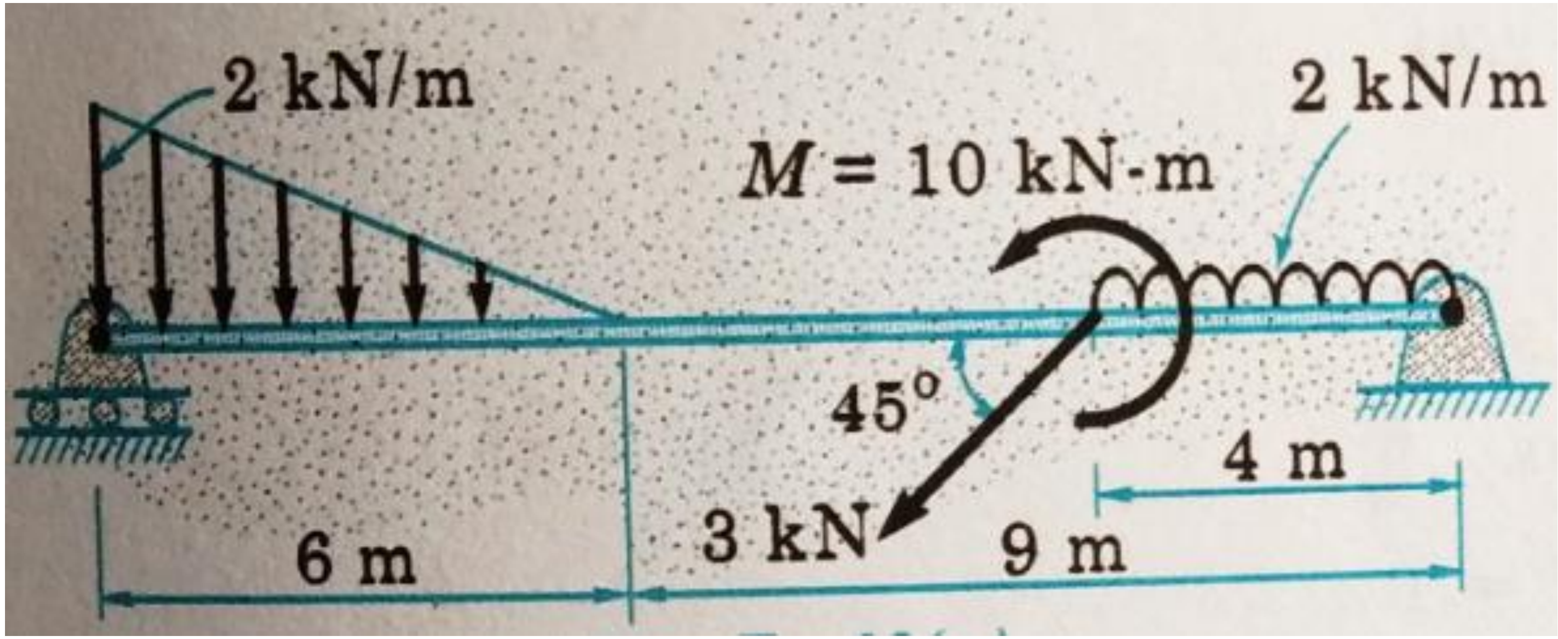
Problem No. 2

Determine the reactions at all supports of the beam AB as shown in figure.



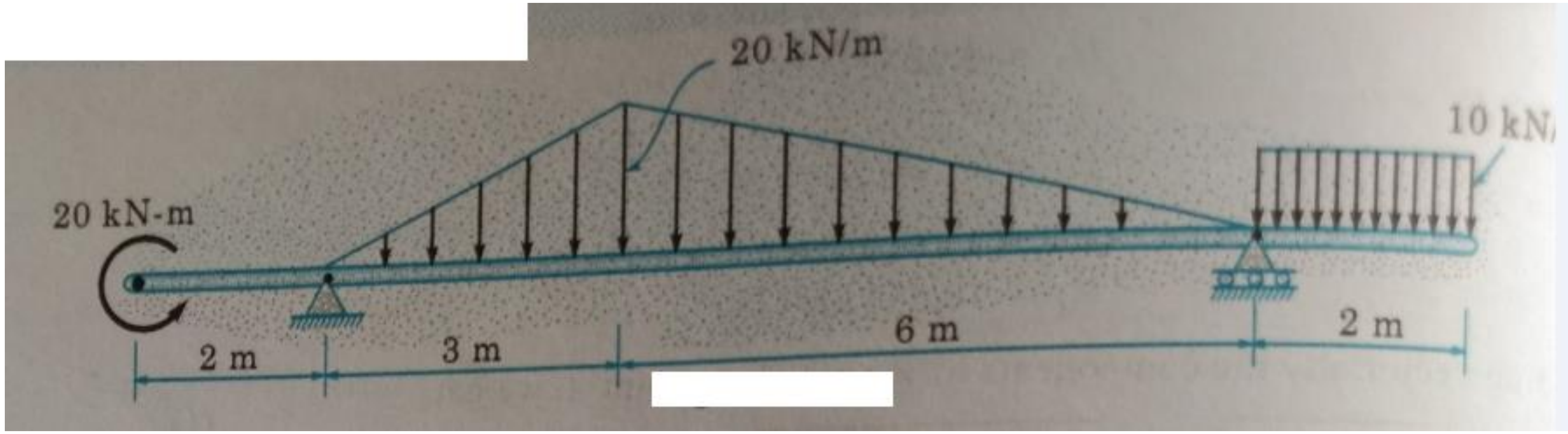
Problem No. 3

Determine the reactions at all supports of the beam AB as shown in figure.



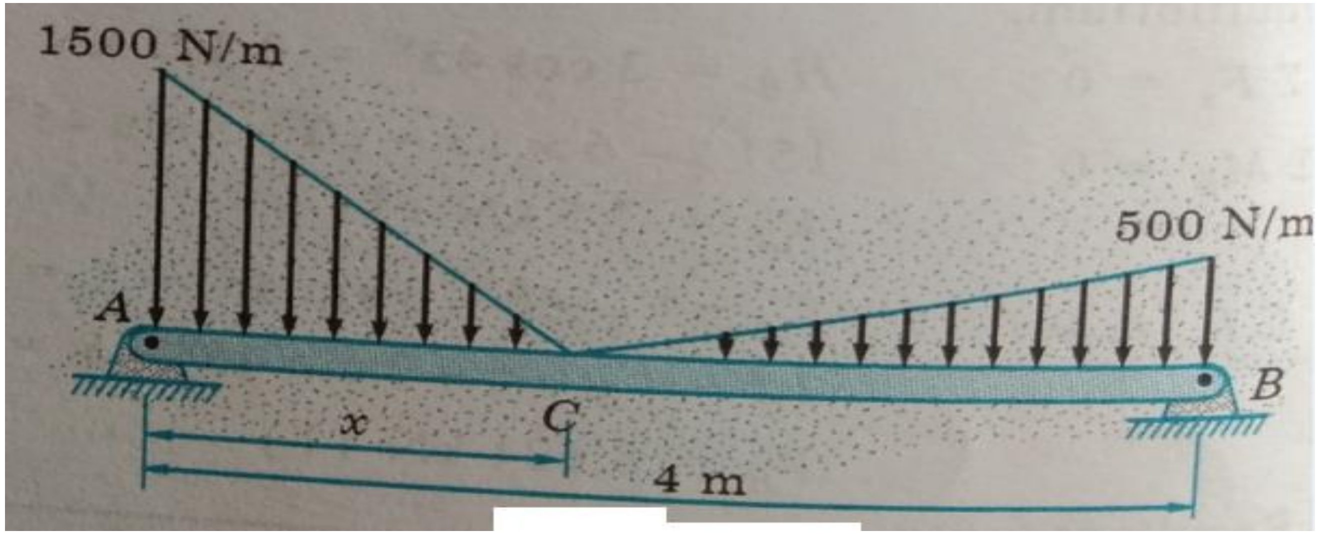
Problem No. 4

Determine the reactions at all supports of the beam as shown in figure.



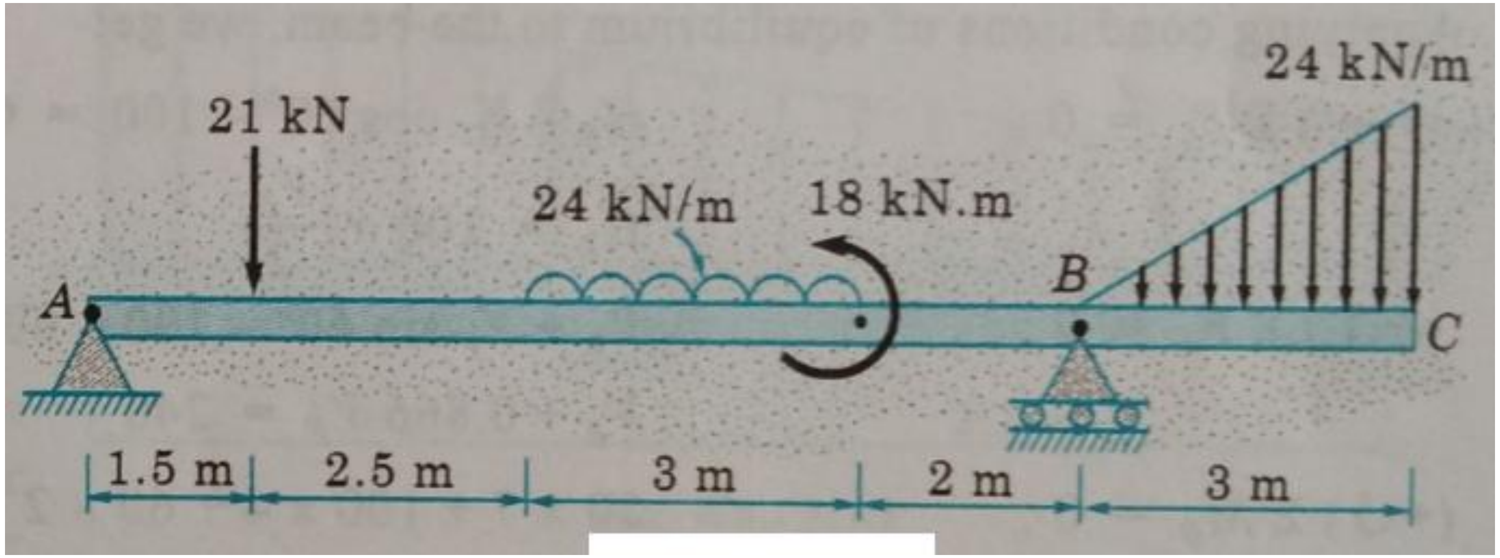
Problem No. 5

Determine the reactions at all supports of the beam AB as shown in figure.



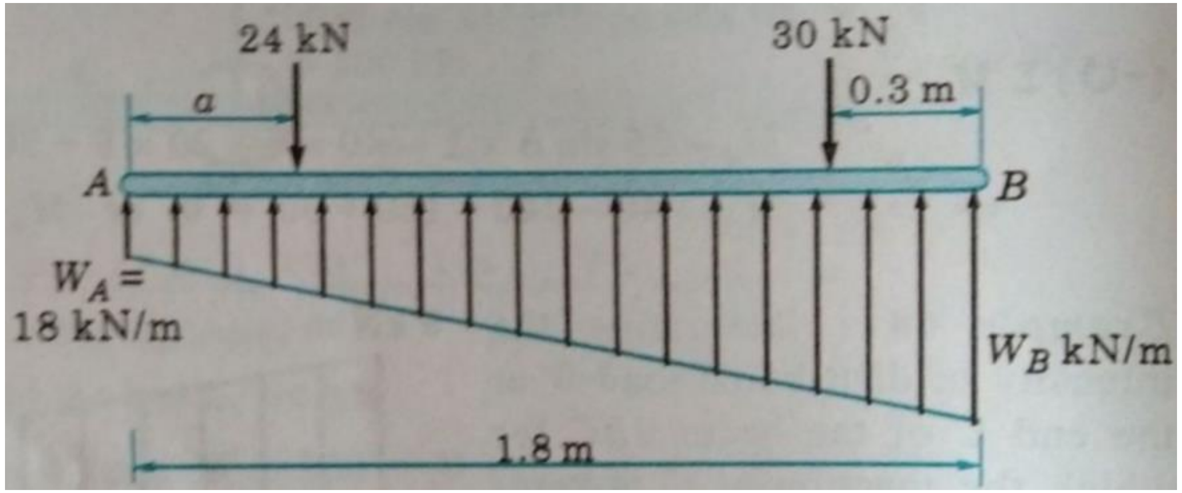
Problem No. 6

Determine the reactions at all supports of the beam AB as shown in figure.



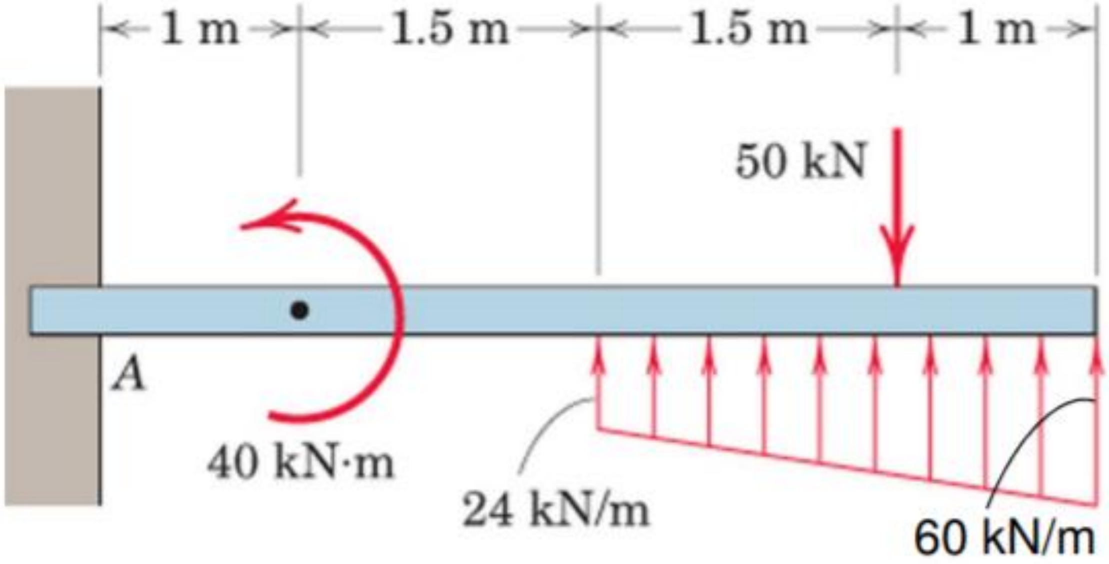
Problem No. 7

The beam AB supports two concentrated loads and rests on the soil which exerts a linearly distributed reaction as shown in figure. Determine the distance a and the corresponding value of W_B.

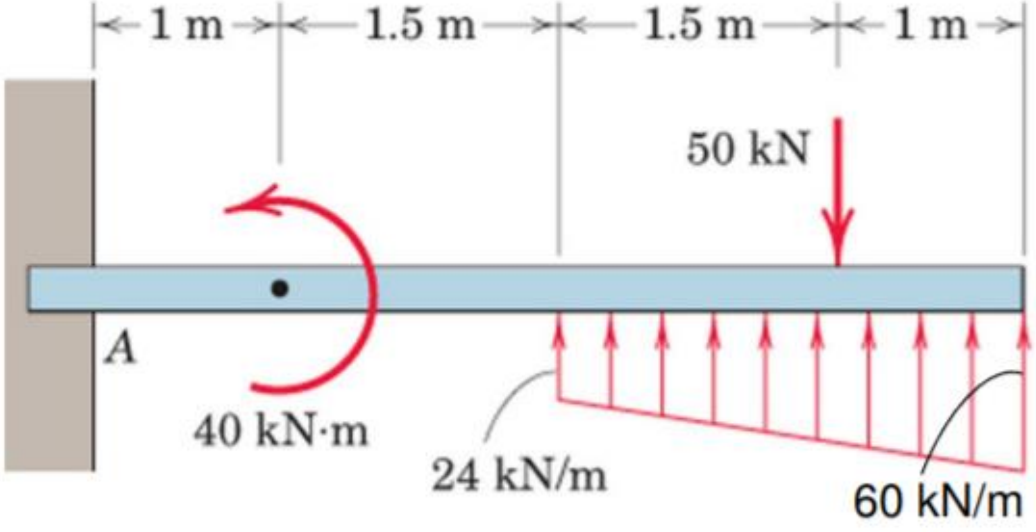


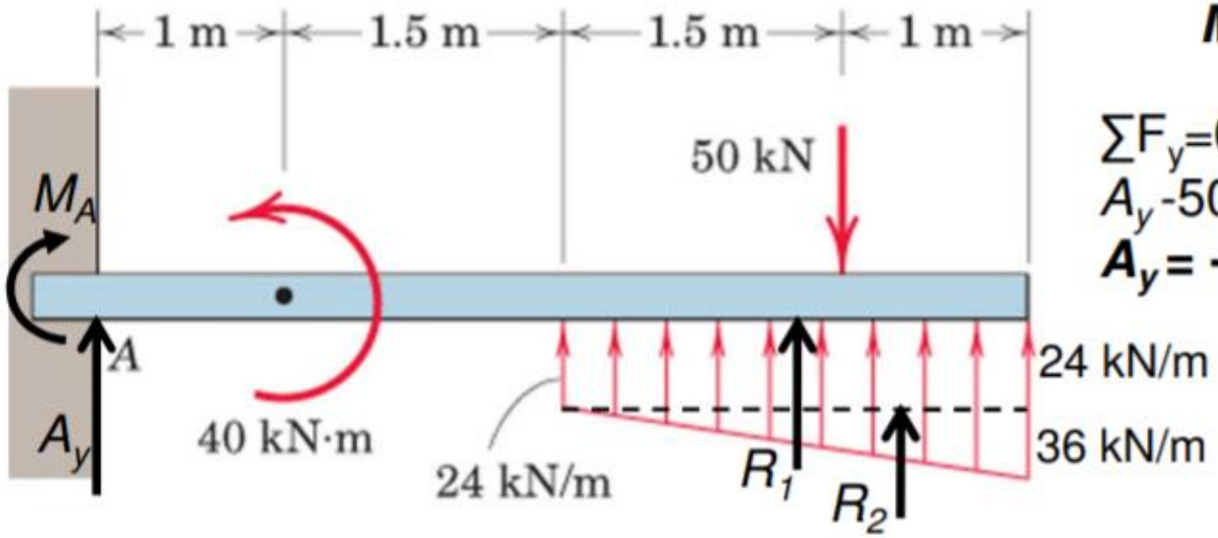
Problem No. 8

A cantilever beam is loaded and supported as shown in the figure. Determine the support reactions



Determine the external reactions for the beam





Dividing the trapezoidal load into two parts with resultants R_1 and R_2

$R_1 = 24\text{x}2.5 = 60$ kN @ 3.75m → A
$R_2 = 0.5\text{x}2.5\text{x}36 = 45$ kN@4.17m → A
(distances from A)

$\sum M_A = 0$ →
$M_A - 40 + 50\text{x}4.0 - 60\text{x}3.75 - 45\text{x}4.17 = 0$
$M_A = 253$ kNm

$\sum F_y = 0$ →
$A_y - 50 + 60 + 45 = 0$
$A_y = -55$ kN → Downwards