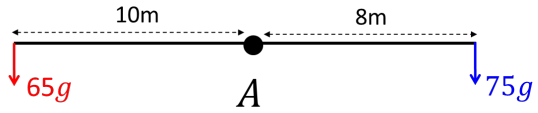
Year 2 Applied Chp 4 – Moments

Moments

Moments = Force x Perpendicular Distance



Anti-Clockwise Moments
M(A)
$= 65g \times 10$
$= \mathbf{6370\ Nm}$

Clockwise Moments
M(A)
$= 75g \times 8$
$= \mathbf{5880\ Nm}$

For moment questions set up two equations.

Vertical Forces

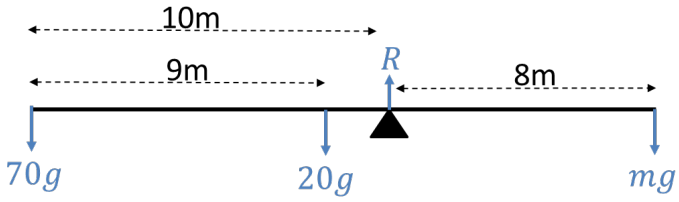
Forces Up = Forces Down

Moments

ACW Moments = CW Moments

(Choice a pivot point that gives you the least amount of work)

Uniform Rods



Moments (R)

$$ACW\ Moments = CW\ Moments$$

$$(20g \times 1) + (70g \times 10) = (mg \times 8)$$

$$720g = 8mg$$

$$m = 90\ \text{kg}$$

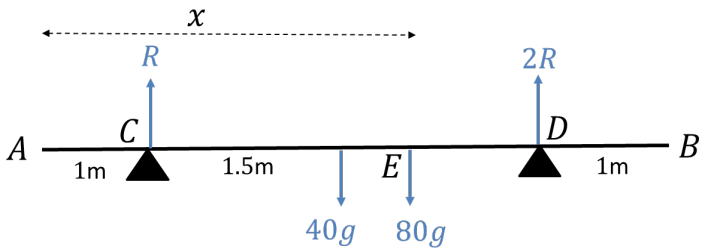
Vertical Direction

$$R = 70g + 20g + mg$$

$$R = 1764N$$

Non-Uniform Rods

(Always take the distance to the end of the rod)



Vertical Direction

$$R + 2R = 40g + 80g$$

$$3R = 120g$$

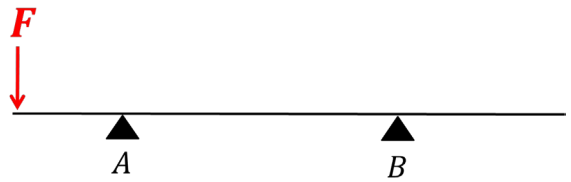
$$R = 40g$$

Moments (A)

$$(40g \times 2.5) + (80g \times x) = (40g \times 1) + (80g \times 4)$$

$$\boldsymbol{x = 3.25\ \text{m}}$$

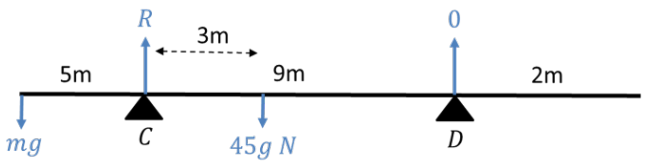
Tilting (Supports)



If a beam is on the point of tilting about A, then there is no reactional force at B and the system is still in equilibrium.

Example:

A uniform beam AB, of mass 45kg and length 16m, rests horizontally on supports C and D where $AC = 5$ m and $CD = 9$ m. When Lewis stands at A, the beam is on the point of tilting about C. Determine Lewis' mass.



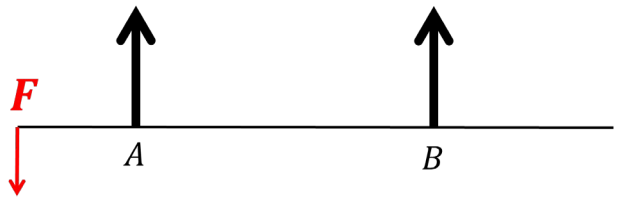
Moments (C)

$$mg \times 5 = 3 \times 45g$$

$$5mg = 135g$$

$$m = 27$$

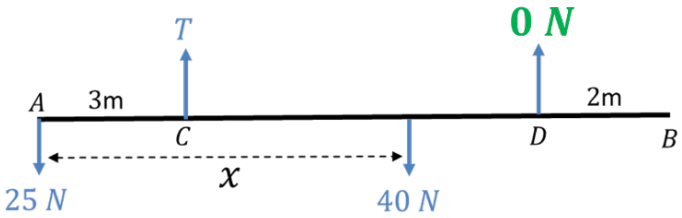
Tilting (Suspended Systems)



If a beam is on the point of tilting about A, then there is no reactional force at B and the system is still in equilibrium.

Example:

A non-uniform rod AB, of length 10 m and weight 40 N, is suspended from a pair of light cables attached to C and D where $AC = 3$ m and $BD = 2$ m. When a weight of 25 N is hung from A the rod is on the point of rotating. Find the distance of the centre of mass of the rod from A.



Moments (C)

$$25 \times 3 = 40(x - 3)$$

$$x = \mathbf{4.875}$$