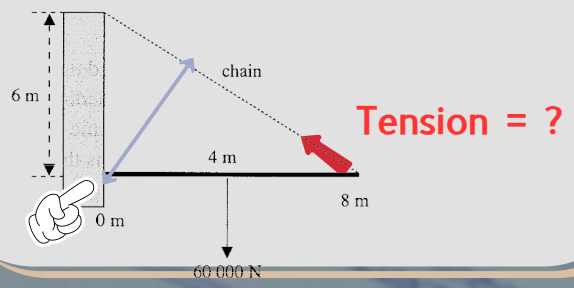
Moments

The moment of a force acting on an object is defined as the product of force and the perpendicular distance from a given point of reference.

THE SCIENCE ACADEMY

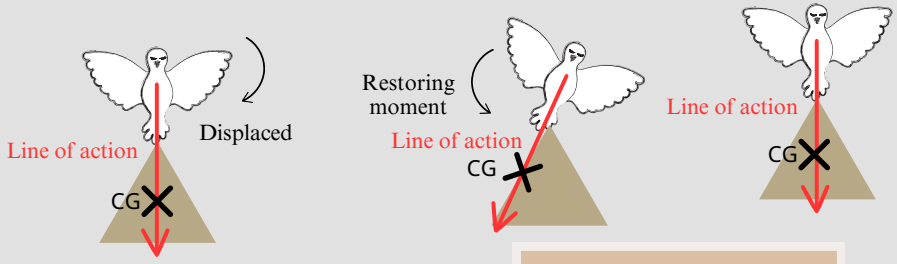
Solving oblique forces in Equilibrium



"In equilibrium, the sum of Clockwise moments is equal to the sum of Anti-Clockwise moments about the same pivot".

- Define a favourable pivot point.
- Clockwise moment cause by weight of beam (4m x 60,000N)
- Anti-Clockwise moment by tension (Tension x Perpendicular Distance)
- To find Perpendicular Distance, first find the angle between beam and chain. ($\tan^{-1}$ 6/8 = 36.8°)
- Use TOA - CAH - SOH to find Perpendicular Distance (8sin36.8° = 4.81m)
- Equate Anti-Clockwise moment = Clockwise moment to find Tension

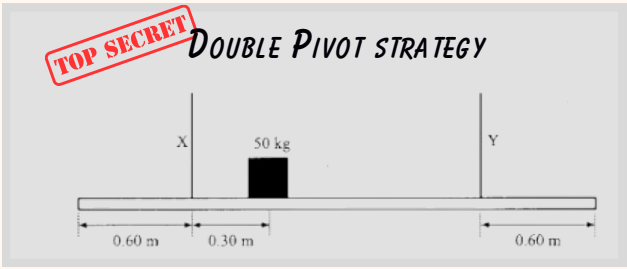
Restoring moment - Stable Equilibrium



The Center of Gravity of the bird lies below the pivot point. This is a stable equilibrium.

When the bird is displaced clockwise, there is a perpendicular distance from the Center of Gravity of the bird to the pivot point. There is a net anti-clockwise moment to restore the bird back to its original position.

TOP SECRET Double Pivot strategy



Distance XY is 2.4m

"In equilibrium, the sum of net moments is zero".

- Define a favourable pivot point (X) to find Tension at (Y).
- Clockwise moment cause by weight of box (0.3m x 500N)
- Anti-Clockwise moment by Tension Y (2.1m x Tension Y)
- Equate Anti-Clockwise moment = Clockwise moment to find Tension Y.

"In equilibrium, the sum of net force is zero".

- Total sum of Upward forces = Total sum of Downward forces
- To find Tension X, equate:
- Tension X + Tension Y = Weight of Box (500N)

Neutral Equilibrium

CG at pivot

Unstable Equilibrium

CG above pivot

Key to higher stability