Moments

Introduction and examples

The moment of a force is the measure of its capacity to turn the body on which it is acting.

Moment = Force × Perpendicular Distance

Example 1

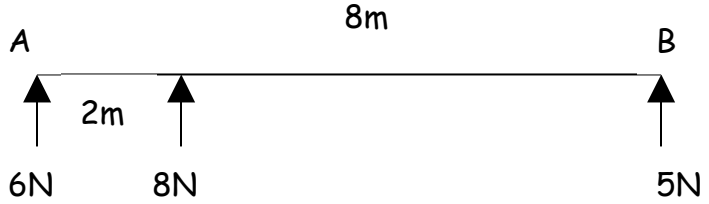
A door of width 1.2m is being pushed by a force of 25N. Find the moment about the hinge.

Moment = Force × Perpendicular Distance

= 25 × 1.2 = 30Nm

Example 2

Forces of magnitude 6N, 8N and 5N are applied to a light rod AB, of length 8m, as outlined in the diagram below.

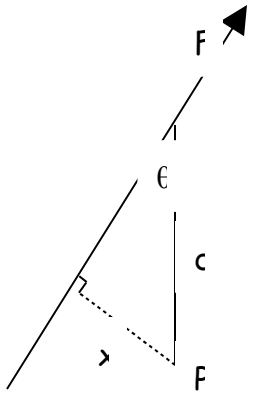


Calculate the sum of the moments about the midpoint of the rod.

Moment of 6N force is given by: 6 × 4 = 24Nm clockwise
Moment of 8N force is given by: 8 × 2 = 16Nm clockwise
Moment of 5N force is given by: 5 × 4 = 20Nm anti-clockwise

Therefore the sum of the moments is 20Nm clockwise.

It is more likely however that the forces are not being applied at right angles to the object.



The diagram above shows a force F, acting on an object P at a given angle θ and given distance d. The force brings about a turning effect at P. The dotted line is the perpendicular distance. $x = d \times \sin\theta$.

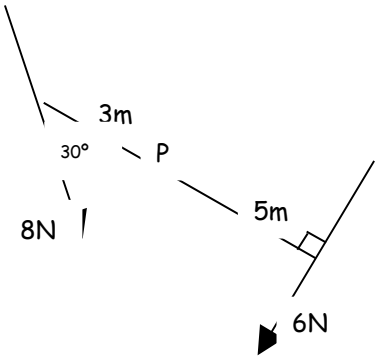
Therefore the moment about P is given by:

Moment = Force × Perpendicular Distance from line of action of force to pivot point

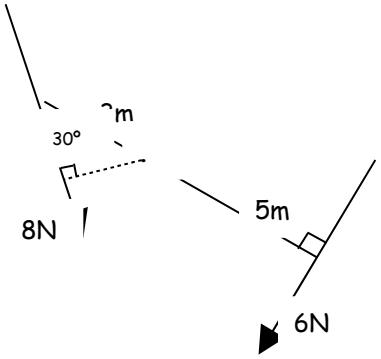
$$\text{Moment} = Fd\sin\theta$$

Example 3

Two forces are applied to a light rod as outlined in the diagram below. Find the sum of the moment about P.



The 6N force gives a 30Nm clockwise moment.



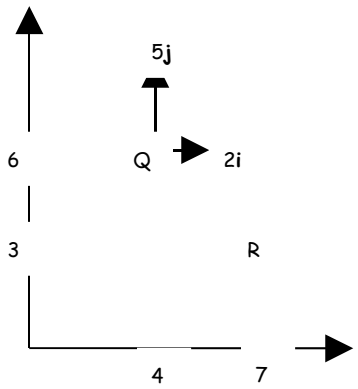
The dotted line has been added to show the perpendicular distance. The 8N force gives an anticlockwise moment of magnitude:

$$8 \times 3 \times \sin 30 = 12\text{Nm}.$$

Therefore the system is experiencing a clockwise moment of magnitude 18Nm.

Example 4

A point Q(4,6) is acted upon by a force $(2\mathbf{i} + 5\mathbf{j})$N. Calculate the sum of the moment about the origin.



The 2**i** force gives a clockwise moment of: 2 × 6 = 12Nm
The 5**j** force gives a anticlockwise moment of: 5 × 4 = 20Nm
Therefore the sum of the moments is 8Nm anticlockwise.

Find the sum of the moments about the point R(7,3).
The 2**i** force gives a clockwise moment of: 2 × 3 = 6Nm
The 5**j** force gives a clockwise moment of: 5 × 3 = 15Nm
Therefore the sum of the moments is 21Nm clockwise.