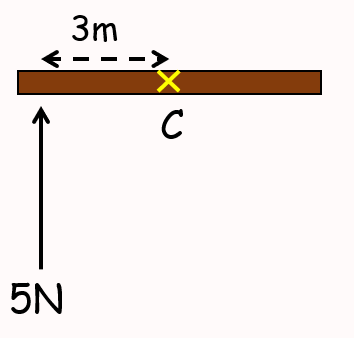
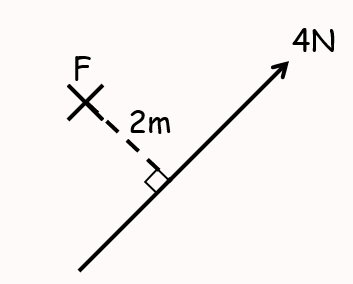
**4A Moments Introduction**

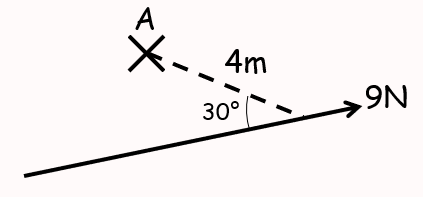
1. Find the Moment about C

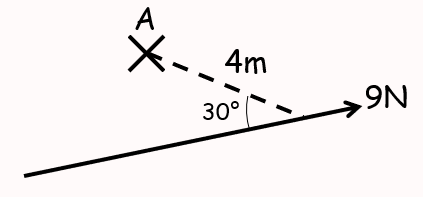


1. Calculate the moment of the force about point F



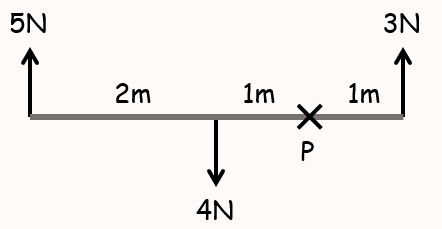
1. Calculate the moment of the force about point A



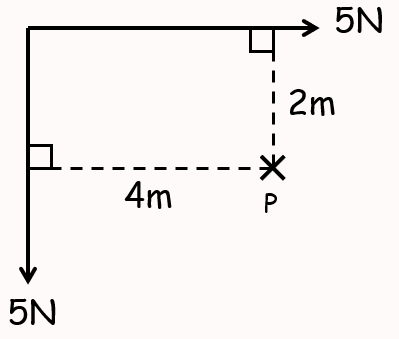


**4B Multiple Moments**

1. Calculate the sum of the moments acting about the point P



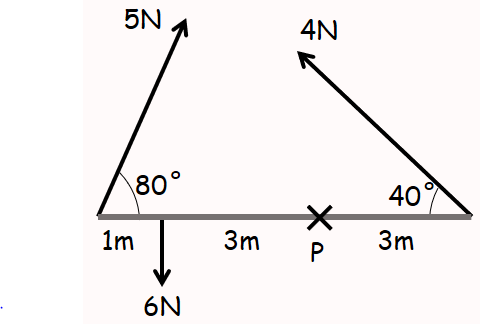
1. Calculate the sum of the moments acting about the point P



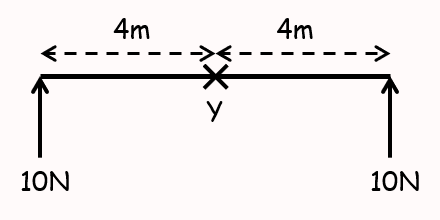
1. The diagram to the right shows 3 forces acting on a light rod.

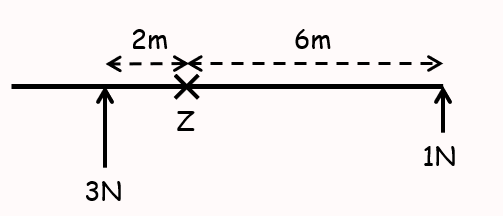
Find the resultant moment about point P

(ie – if the rod were fixed at point P, how would it rotate?)



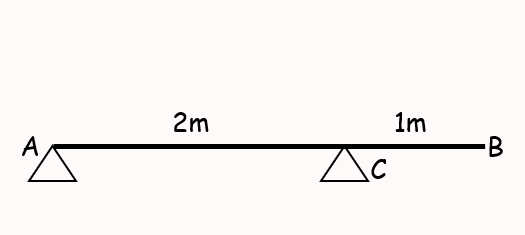
**4C Uniform Rods**





1. The diagram shows a uniform rod of length 3m and weight 20N resting horizontally on supports at A and C, where AC = 2m.

Calculate the magnitude of the normal reaction at both of the supports

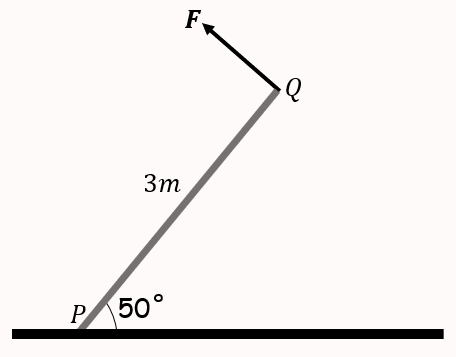


1. A uniform beam, AB, of mass 40kg and length 5m, rests horizontally on supports at C and D where AC = DB = 1m.

When a man of mass 80kg stands on the beam at E, the magnitude of the reaction at D is double the reaction at C.

By modelling the beam as a rod and the man as a particle, find the distance AE

1. A uniform rod is hinged at the point , and is held in equilibrium at an angle of 50˚ to the horizontal by a force of magnitude F acting perpendicular to the rod at . Given that the rod has a length of 3m and a mass of 8kg, find the value of .



**4D Non-Uniform Rods**

1. Sam and Tamsin are sitting on a non-uniform plank AB of mass 25kg and length 4m.

The plank is pivoted at M, the midpoint of AB, and the centre of mass is at C where AC = 1.8m.

Tamsin has mass 25kg and sits at A. Sam has mass 35kg. How far should Sam sit from A to balance the plank?

1. A rod AB is 3m long and has weight 20N. It is in a horizontal position resting on supports at points C and D, where AC = 1m and AD = 2.5m.

The magnitude of the reaction at C is three times the magnitude of the reaction at D.

Find the distance of the centre of mass of the rod from A.

**4E Tipping Point**

1. A uniform rod of length 4m and mass 12kg is resting in a horizontal position on supports at C and D, with AC = DB = 0.5m

When a particle of mass mkg is placed on the rod at point B, the rod is on the point of turning about D.

Find the value of m.

1. A non-uniform rod , of length 10m and weight 40N, is suspended from a pair of light cables attached to and where and .

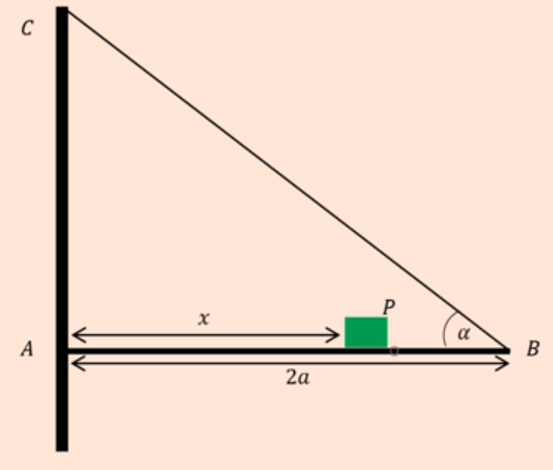
When a weight of 25N is hung from point the rod is on the point of rotation.

Find the distance of the centre of mass of the rod from point .

**7D Hinges**

1. A Plank AB of mass M and length 2a, rests with its end A against a rough vertical wall. The plank is held in a horizontal position by a rope. One end of the rope is attached to the plank and the other end is attached to the wall at the point C, which is vertically above A.

A small block of mass 3M is placed on the plank at the point P, where AP = x. The plank is in equilibrium in a vertical plane which is perpendicular to the wall. The angle between the rope and the plank is , where tan, as shown.



The plank is modelled as a uniform rod, the block is modelled at a particle and the rope is modelled as a light inextensible string.

1. Using the model, show that the tension in the rope is

The magnitude of the horizontal component of the force exerted on the plane AB by the wall is 2Mg.

1. Find x in terms of a

The forces exerted on the plank by the wall acts in a direction which makes an angle with the horizontal.

1. Find the value of tan

The rope will break if the tension in it exceeds 5Mg.

1. Explain how this will restrict the possible values of P

**5B (old Spec) Hinges**

1. A uniform rod AB, of mass 6kg and length 4m, is smoothly hinged at A. A light inextensible string is attached to the rod at a point C where AC = 3m, and the point D, which is vertically above point A. If the string is keeping the rod in equilibrium in a horizontal position and the angle between the string and the rod is 40°, calculate:
2. The tension in the string
3. The magnitude and direction of the reaction at the hinge.

**7D Ladders**

1. A uniform rod AB of mass 40kg and length 10m rests with the end A on rough horizontal ground. The rod rests against a smooth peg C where AC = 8m. The rod is in limiting equilibrium at an angle of 15° to the horizontal. Find:
2. The magnitude of the reaction at C
3. The coefficient of friction between the rod and the ground

1. A ladder, AB, of mass m and length 3a, has one end A resting on rough horizontal ground. The other end, B, rests against a smooth vertical wall. A load of mass 2m is fixed on the ladder at point C, where AC = a. The ladder is modelled as a uniform rod and the load is modelled as a particle. The ladder rests in limiting equilibrium at an angle of 60° with the ground.

Find the coefficient of friction between the ladder and the ground.