# On moments

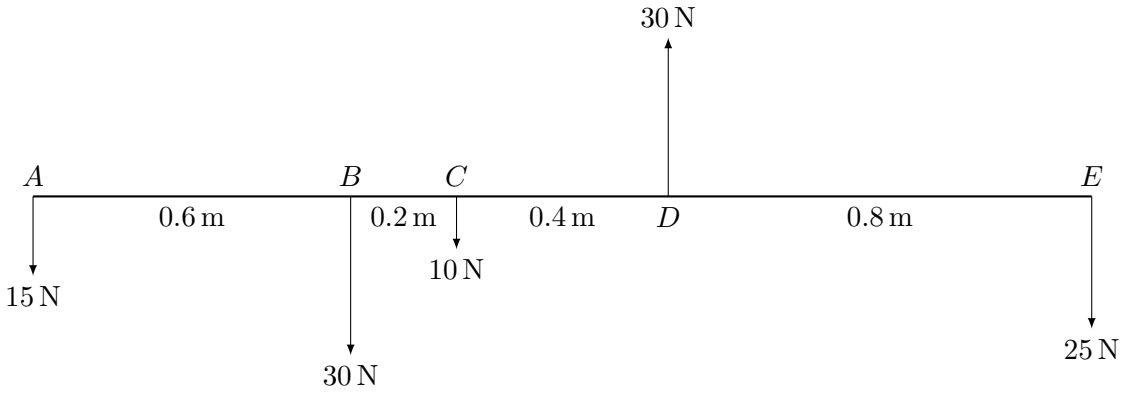
A.C. Norman
anorman@bishopheber.cheshire.sch.uk

## Warm-up problems

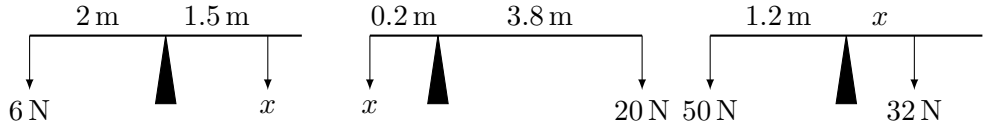
1. What is a 'moment' in physics, and how might you work one out? Draw a diagram to illustrate your answer.
2. What does *equilibrium* mean, and what are the conditions for an object to be in equilibrium?
3. What is the *centre of mass* of an object, and how does the hanging method for finding it used in class work?

## Regular problems

4. In the following diagram, the beam has negligible mass (so the weight force on it can be ignored).
   (a) Find the total moment of all the forces about the points $A$, $B$, $C$, $D$ and $E$.
   (b) At which of these points could you place a pivot to balance the beam and what would the force on the pivot be?

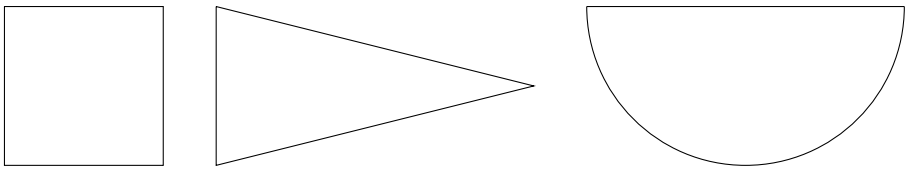



5. In all the situations below, the beams (again of negligible mass) are in equilibrium. Find $x$ in each case and give its unit.




6. In the last question, why do you take moments about that particular point (*Hint: think about the vertical equilibrium of forces.*)

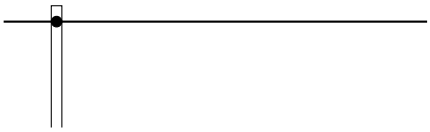
7. Draw the shapes below and show where you think the centre of mass is, with a short comment why you think this.



8. Explain why it is difficult to balance a metre ruler so that it is vertical on top of your finger, and how a traffic cone's design makes it difficult to knock over.

## Extension problems

9. Suppose a long uniform metal pole is pivoted across a gateway a short way from its end. Can you design a method to find the mass of the pole, even if it can't be removed from the pivot to weigh it?



10. How is the center of mass like an average (mean)? Can you use this to find the centre of mass of the following masses?