The moment of a force
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The moment of a force is used to measure how hard something is being turned or twisted about a turning point. It depends upon how big the force is and on how long the lever is.

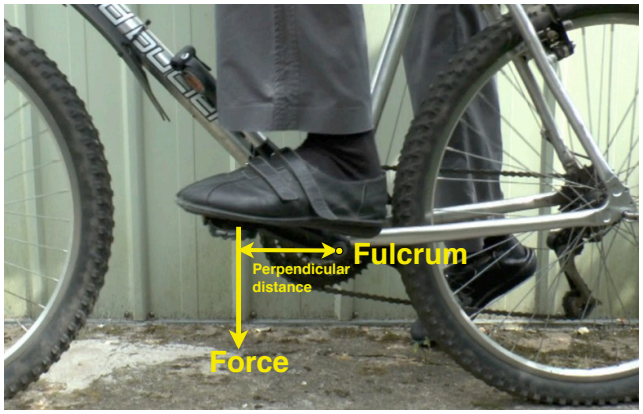
The turning point is often called the pivot or fulcrum.

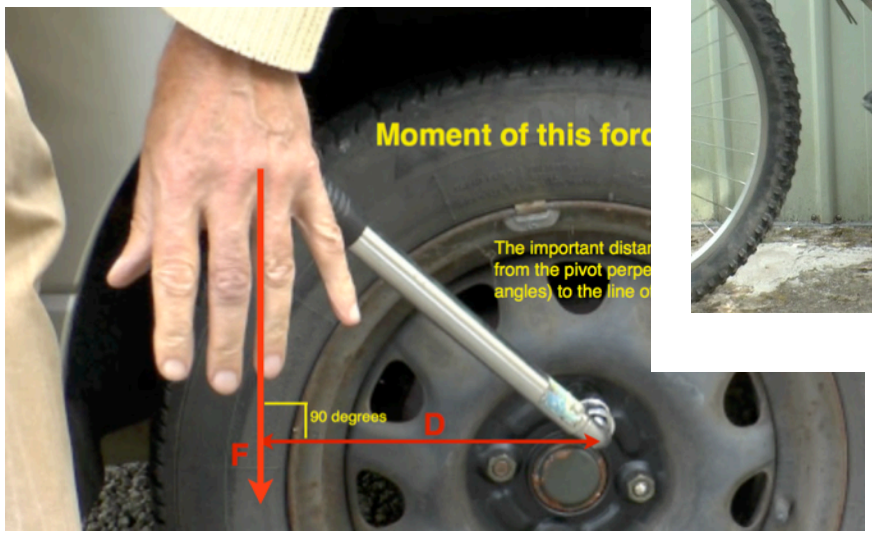
The moment of a force is the perpendicular distance to the line of the force multiplied by the size of the force.

Measured in newton metres (Nm).

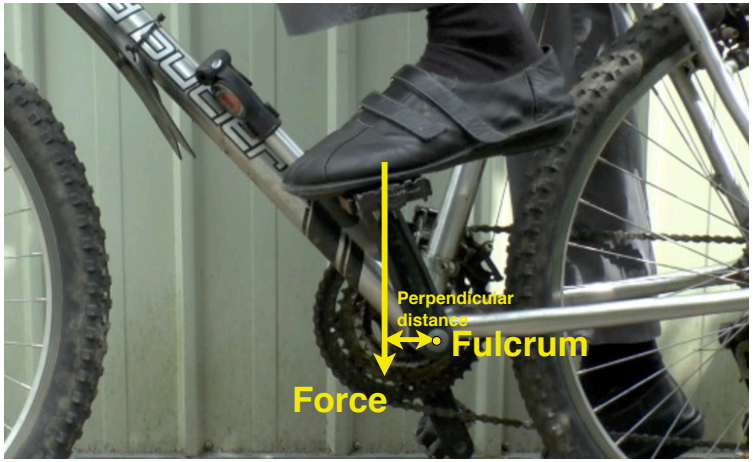
Moment of a force = force x perpendicular distance
Nm **N** **m**

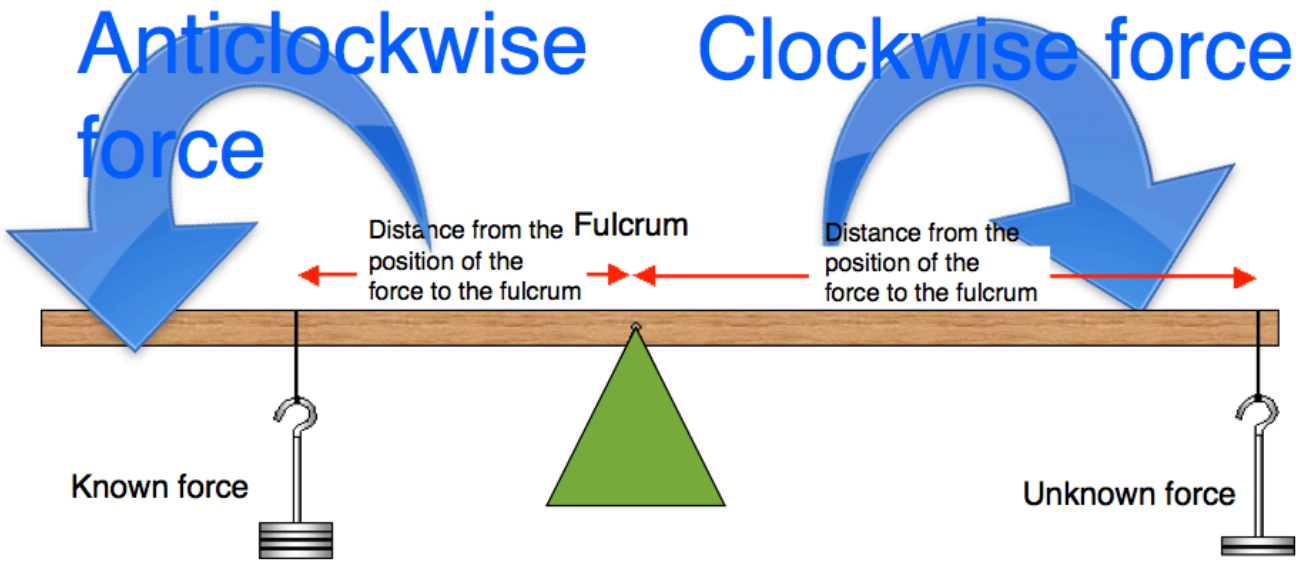
cular distance?





The perpendicular distance is the shortest distance from the pivot the the line of direction of the force.





This uniform beam is balanced in the centre with a weight on each side.

The Law of Moments
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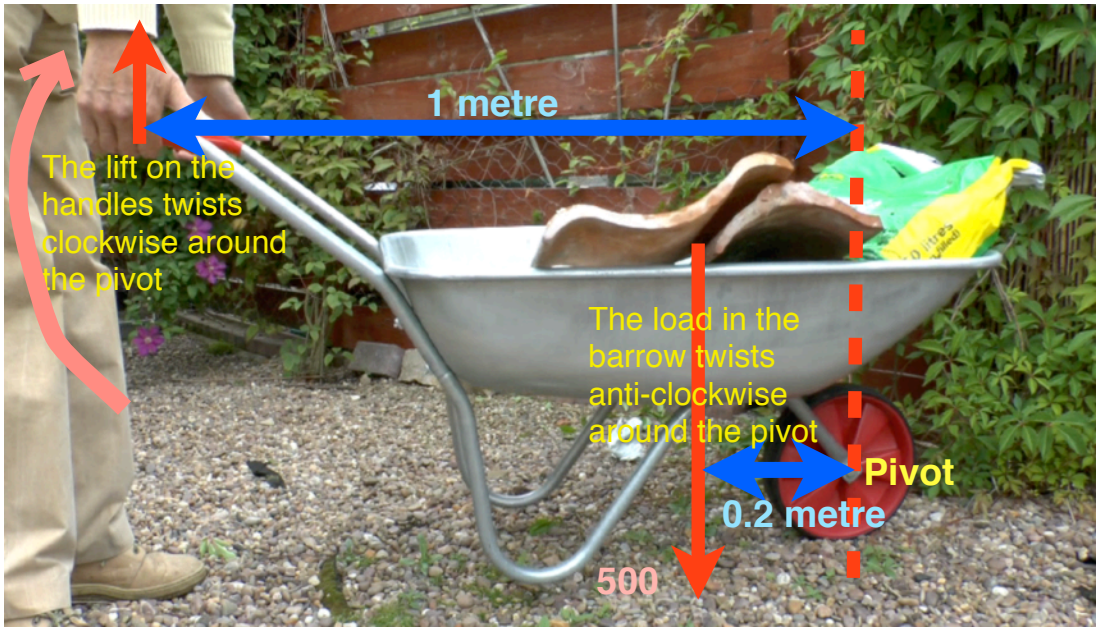
The Law of Moments states that for equilibrium (balance) the clockwise moments are equal to the anti-clockwise moments. We can use this idea to find an unknown force.

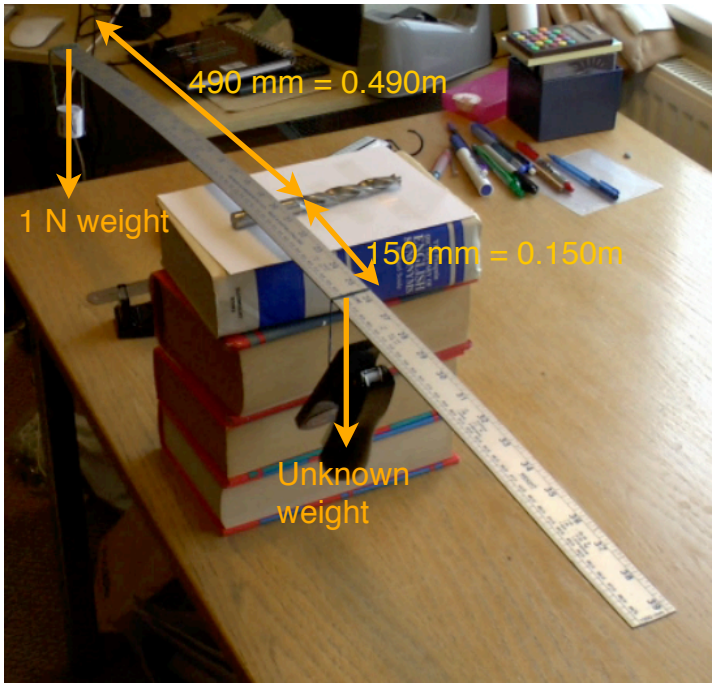


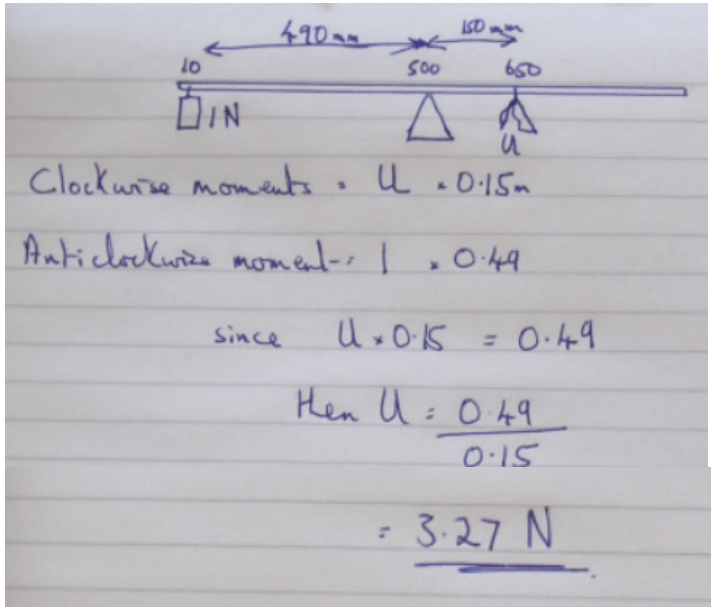
The load in the barrow is 500N and we can calculate the force (F) to just lift (balance) it.

Clockwise moment = F x 1
Anti-clockwise moment = 500 x 0.20

if they are balanced:
F x 1 = 500 x 0.20

so F = 100N





Using the Law of Moments to measure weight
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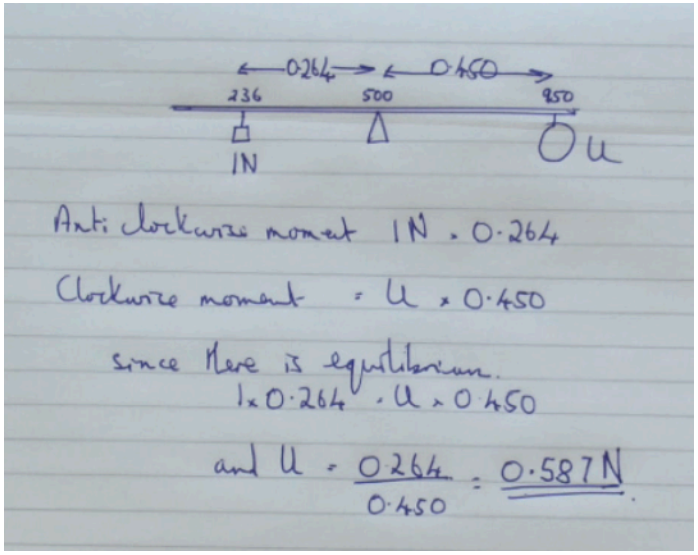
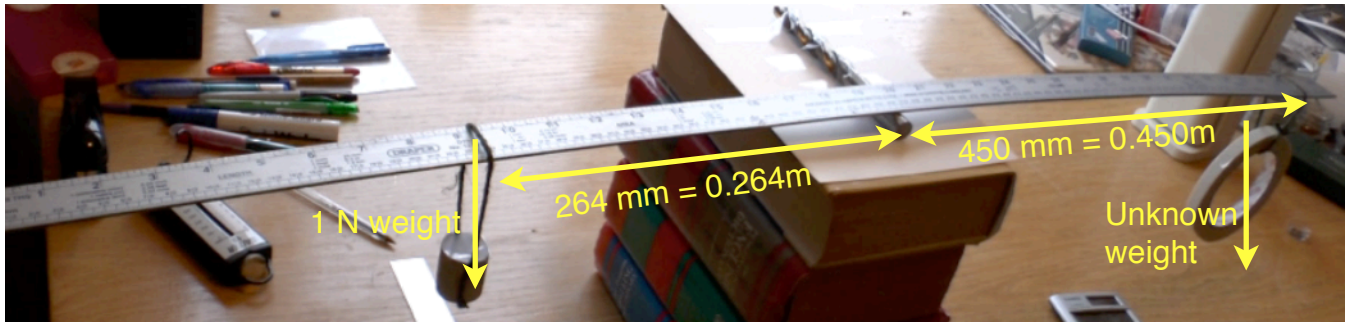
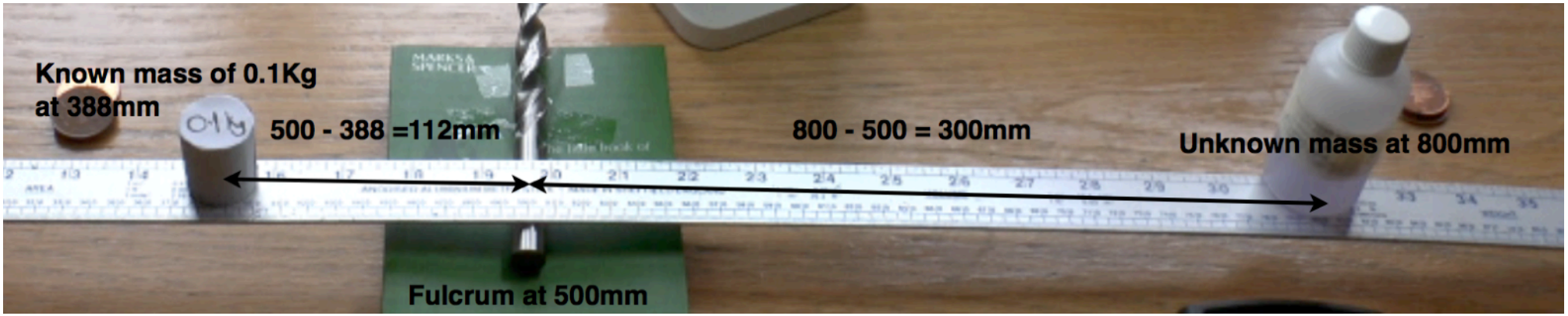




Although the Law of Moments strictly applies to forces and weight (which is a force measured in Newtons) since Weight =Mass x gravitational field strength
and since gravity is (obviously) the same on both sides of the balance, the Law can reasonably be applied to masses - in other words this is a mass balance.



So 0.1 x 0.112 = U x 0.800
so the unknown mass = 0.1x 0.112/0.800
= 0.037 Kg

A mass balance
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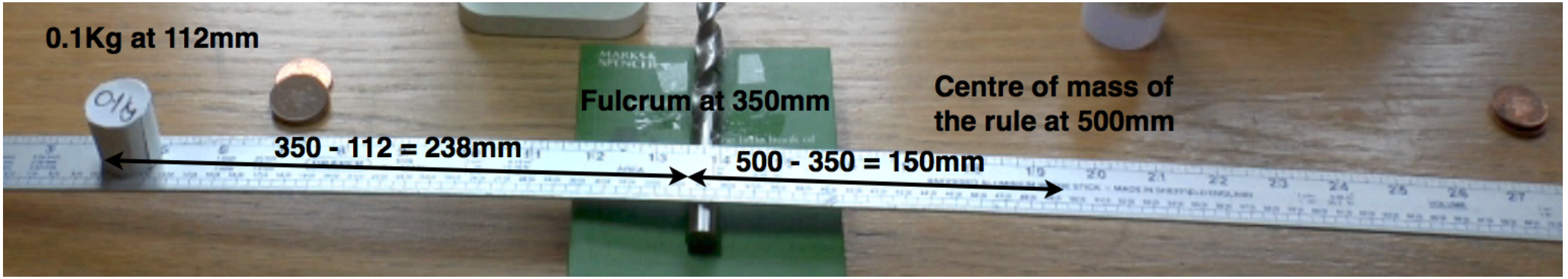
The metre rule is balanced off centre with a 0.1 Kg mass balancing the rulers own weight, with the centre of mass at the 500mm mark



0.1 x 0.238 = 0.150 x R
therefore R = 0.10 x 0.238/0.150
= 0.158 Kg

Applications of the Law of Moments
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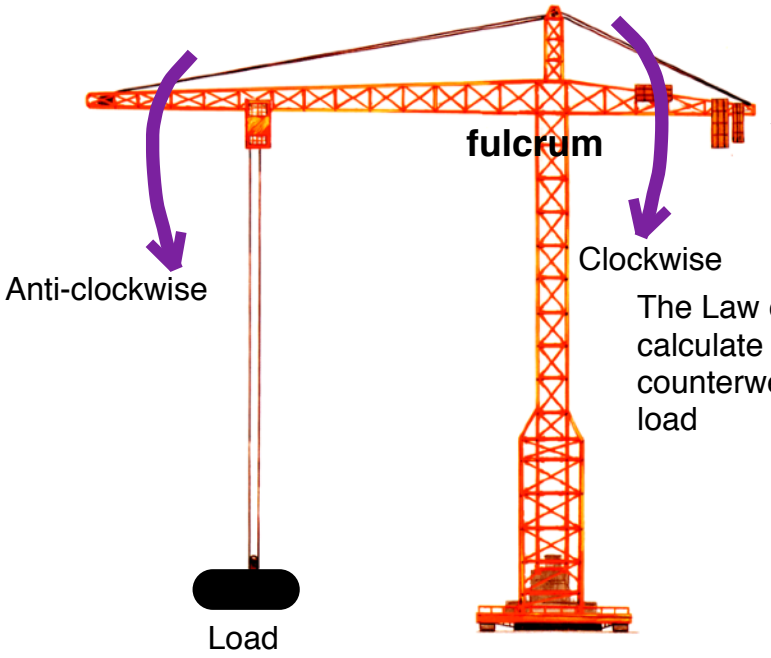
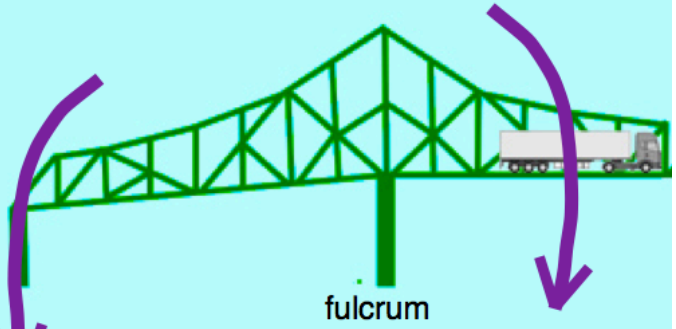
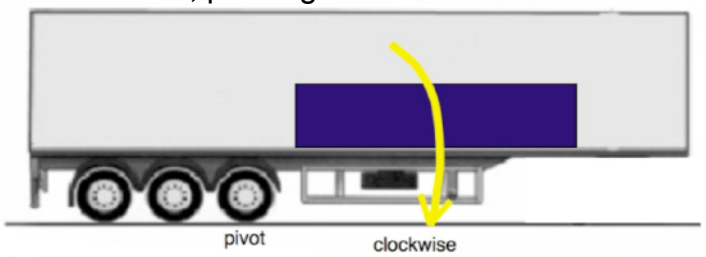


The Law of Moments can be used to calculate the size and position of the counterweight needed to balance the load



The weight of the lorry on this half of the bridge causes it to turn around the support. The Law of Moments can be used to calculate the force required to secure the bridge

If the cab was taken away from the trailer it would fall down, pivoting around the rear wheels.



The cab provides the force to turn the load back up. The law of moments helps to calculate load distribution and maximum loads.