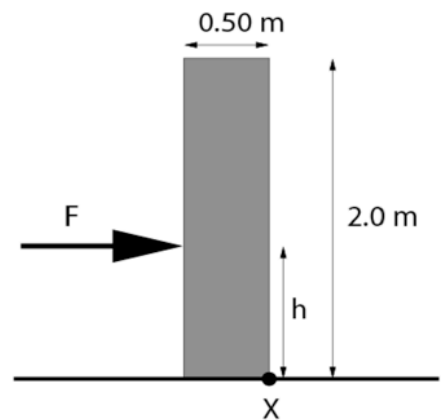


Tipping box (2009 exam)

A box, 2.0m tall and 0.5m by 0.5m wide is resting on a flat horizontal surface. The box is pushed by a horizontal force of magnitude F at a height h above the ground in an attempt to make the box slide.

If the box is pushed too near the top, it will tip over instead of sliding. It will try to rotate about the front corner of the block (labelled X in the diagram).

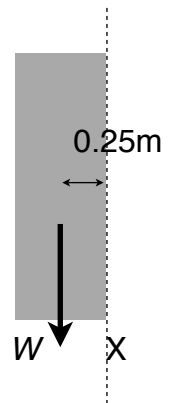
What are the torques acting on the block around point X due to the force F and the weight W ?



Solution: For each force, draw the line of action and calculate the the torque. Let's take clockwise torques to be positive.

- Weight: since the weight acts at the centre of mass, the weight is acting at a perpendicular distance of 0.25m from the corner X. It is trying to make the box rotate anti-clockwise so the torque is *negative*:

$$\tau_W = -0.25W = -0.25mg$$



- Force F : the force is acting at a perpendicular distance h from the corner X. It is trying to make the box rotate clockwise, so the torque is *positive*:

$$\tau_F = +Fh$$

