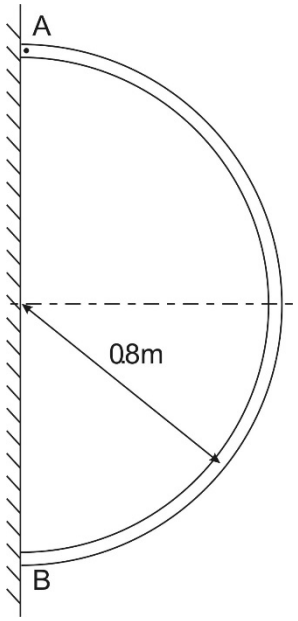
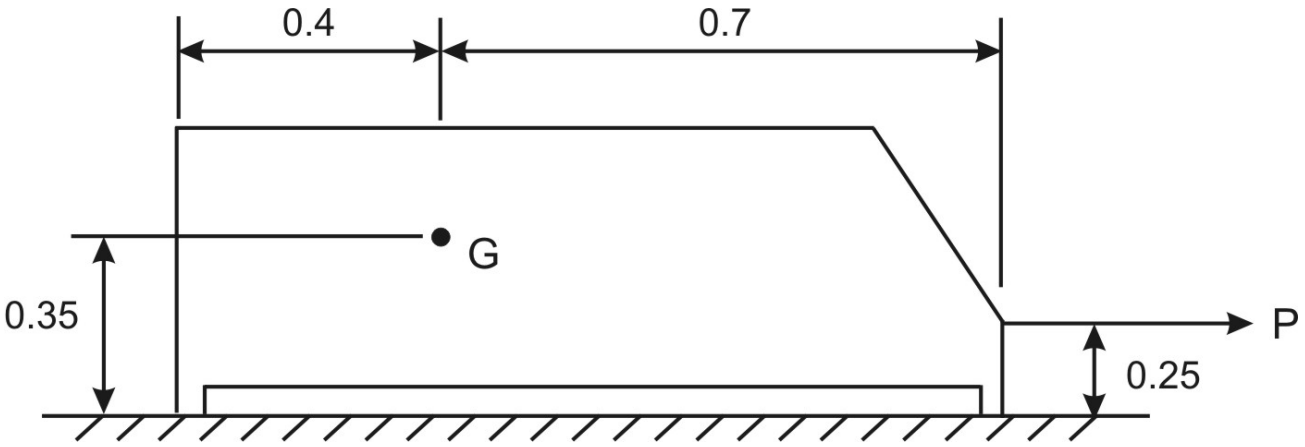
Dynamics 2 – Tutorial 4

Pure Translation of Bodies and Location of G

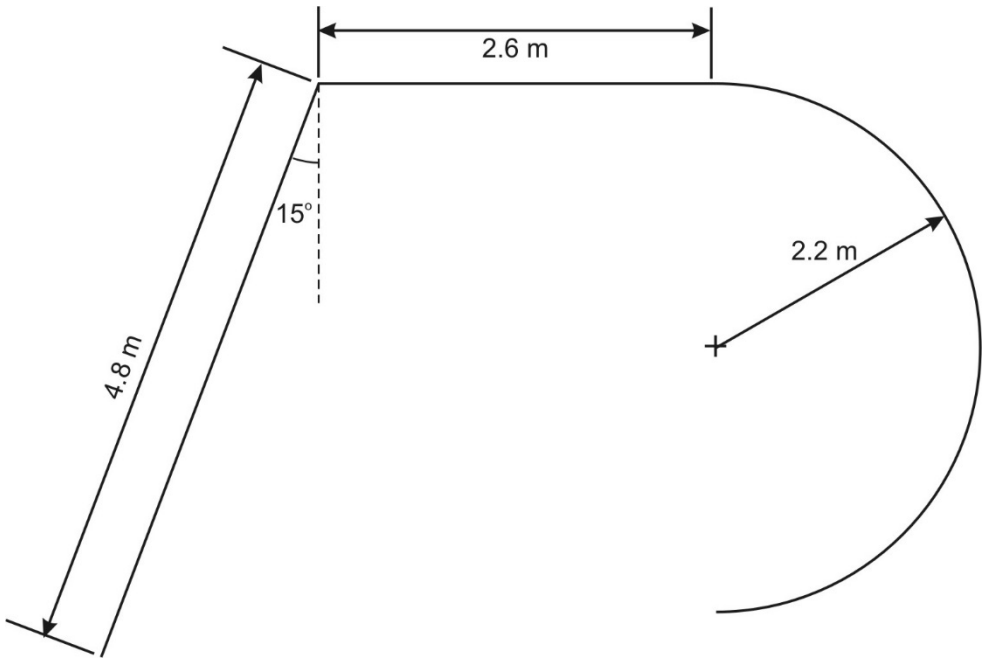
1. A steel bar (mass 45kg) is bent into a semicircle of radius 0.8 m as shown. The top A is hinged to a vertical wall, while the bottom B rests on the wall (no friction force). If the wall with the bar attached is accelerating upwards at 15m/s^2, what is the normal force exerted by the bar on the wall at B? Show its direction clearly in a diagram. [355N]



2. The figure shows a 24 kg metal block being pulled along a horizontal surface by a wire force P of 95N. The block has machined pads at the front and rear. The front pads are coated with "Slippo" anti-friction cream and have negligible friction. The rear pads have a coefficient of friction of 0.35. Draw a clear FBD. Evaluate all the forces on the FBD and find the acceleration of the block. [forces 92.9, 142.6, 49.9, acceleration = 1.88 m/s^2]



3. A steel bar of total mass 480 kg is fabricated into the shape shown. It needs to be lifted by crane so that the top edge remains horizontal. Where would you attach the crane wire? If the initial upwards acceleration of the crane wire is 12 m/s^2 what is the wire tension?



4. An accelerating vehicle may be treated (approximately) as a body in pure translation, i.e. the effect of the additional motion of the wheels and internal drive machinery is neglected compared with the translation motion of the total mass. The van shown has a mass of 2500 kg and is front-wheel drive**.** The rear wheels are freely revolving and may be considered as frictionless support points to a first approximation.
   (a) If the van was accelerating at 2.8 m/s^2 on a horizontal road, draw a FBD and calculate all values of external forces.
   (b) If the traction force at a drive wheel has a limit of 55% of the normal road force at the wheel due to the onset of wheel-spin, what is the maximum van acceleration possible when going up a 5 degree incline?