4.3) Equilibrium

Worked example

Person A and Person B are on opposite ends of a uniform seesaw of mass 30kg.
A weighs 60kg and is 5m from the pivot.
B is 4m from the pivot.
The seesaw remains horizontal. Determine:

a) The reaction force at the pivot of the seesaw
b) The mass of B

Your turn

Person A and Person B are on opposite ends of a uniform seesaw of mass 20kg.
A weighs 70kg and is 10m from the pivot.
B is 8m from the pivot.
The seesaw remains horizontal. Determine:

a) The reaction force at the pivot of the seesaw
b) The mass of B

a) $1764\ N$
b) $90\ kg$

Worked example

A uniform beam AB, of mass 20 kg and length 10m, rests horizontally on supports at C and D, where $AC = DB = 2$ m.
When a man of mass 60kg stands on the beam at E the magnitude of the reaction at D is three times the magnitude of the reaction at C.
By modelling the beam as a rod and the man as a particle, find the distance AE.

Your turn

A uniform beam AB, of mass 40 kg and length 5m, rests horizontally on supports at C and D, where $AC = DB = 1$ m.
When a man of mass 80kg stands on the beam at E the magnitude of the reaction at D is twice the magnitude of the reaction at C.
By modelling the beam as a rod and the man as a particle, find the distance AE.

$3.25\ m$

Worked example

A uniform rod AB has length $5\ m$ and mass $20\ kg$. The rod is in equilibrium in a horizontal position, resting on two smooth supports at C and D, where $AC = 0.4$ metres and $DB = x$ metres.
Given that the magnitude of the reaction on the rod at D is three times the magnitude of the reaction on the rod at C, find the value of x

Your turn

A uniform rod AB has length $2\ m$ and mass $50\ kg$. The rod is in equilibrium in a horizontal position, resting on two smooth supports at C and D, where $AC = 0.2$ metres and $DB = x$ metres.
Given that the magnitude of the reaction on the rod at D is twice the magnitude of the reaction on the rod at C, find the value of x

$x = 0.6$

Worked example

A uniform ladder, AB, is leaning against a smooth vertical wall on rough horizontal ground at an angle of $50°$ to the horizontal. The ladder has length $6\ m$ and is held in equilibrium by a frictional force of magnitude $40\ N$ acting horizontally at B which is the end of the ladder on the ground.
Find the mass of the ladder.

Your turn

A uniform ladder, AB, is leaning against a smooth vertical wall on rough horizontal ground at an angle of $60°$ to the horizontal. The ladder has length $5\ m$ and is held in equilibrium by a frictional force of magnitude $80\ N$ acting horizontally at B which is the end of the ladder on the ground.
Find the mass of the ladder.

$28.3\ kg$ (3 sf)