Moments, parallel force systems

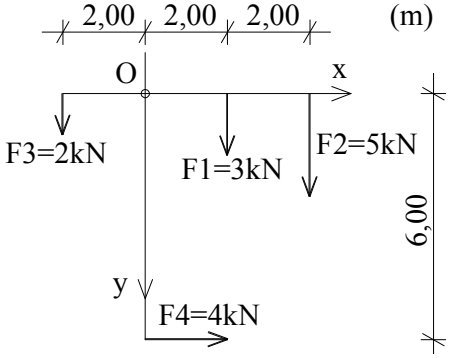
Motto: 2kN 2kN → + ← = 0 but 2kN ← □ → 2kN the box is not in equilibrium!

Why? → the sum of the forces is 0 => it does not accelerate
→ but they <u>rotate</u> the box

How strongly do they rotate the object?

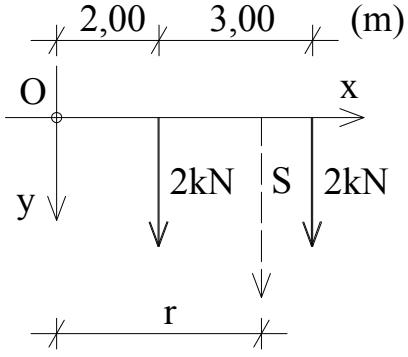
Definition: The moment M of a force F about a point P is $M = F \cdot r$
where r is the distance between P and the line in which F acts. (=line of action)

1) Determine the moment of the forces about point O!

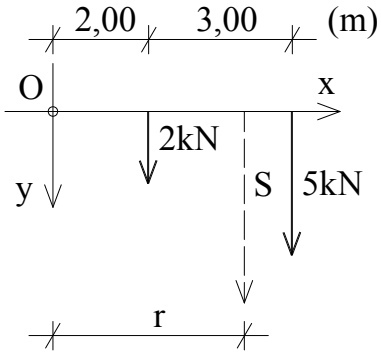


2) Replace the two forces by on force (S) such that it has the same effect! How big is S? Where does it act?

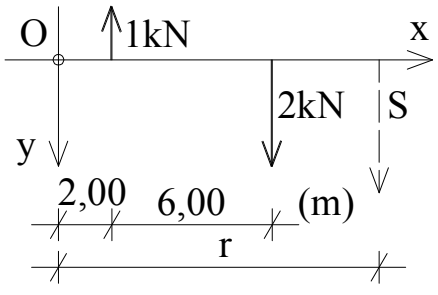
A)



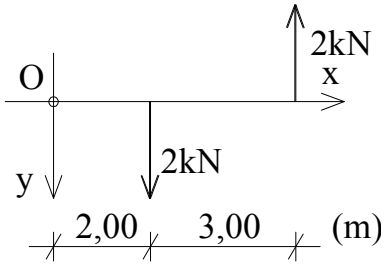
B)



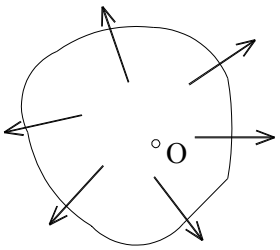
C)



D)



The moment is very useful too to check if an object is in equilibrium or not:

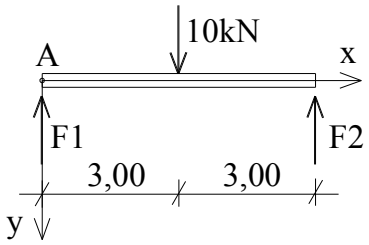


The object is in equilibrium if and only if:

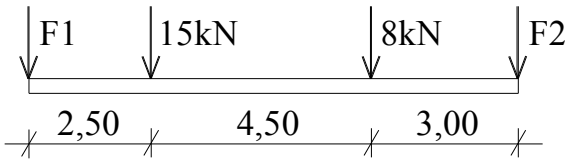
$\sum F_x = 0$, and
$\sum F_y = 0$, and
$\sum M_O = 0$ where O is an arbitrary point
(you can choose any point!)

3) Determine F_1, F_2 such that the rod is in equilibrium!

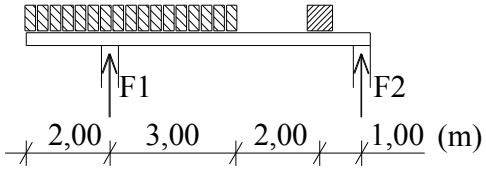
A)

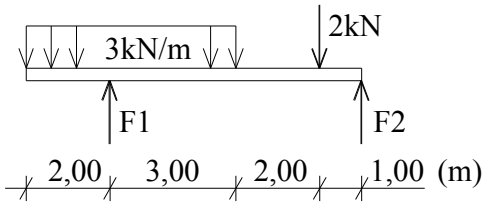


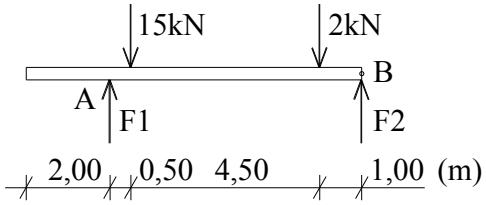
B)



4) Weight of big box = 2 kN. Weight of small boxes = 3 kN/m (distributed load)
Step 1: distributed load can be replaced by its sum in the middle
Step 2: calculation of the equilibrium ($F_1$and F_2).







5) A man, 60 kg, is standing above a lake at the end of a beam. The beam has 2 supports on the coast 1.2 m from each other. The total length of the beam is 5.2 m.
What loads are carried by the supports?