

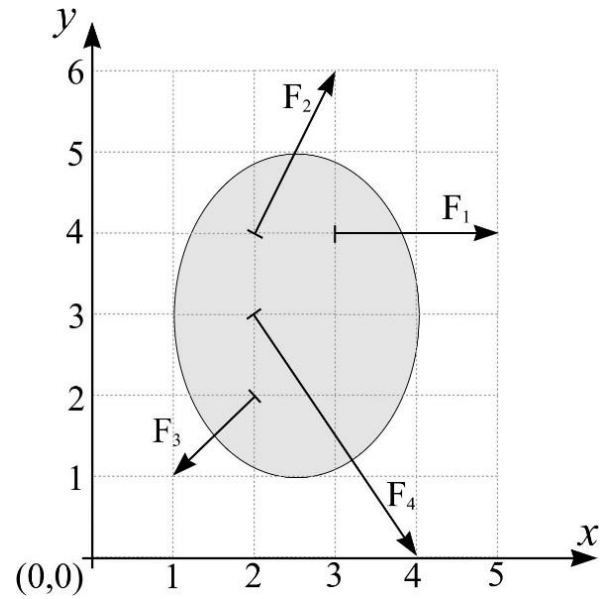
Equilibrium of planar, rigid bodies - 4.

1. Four forces are acting on the ellipse according to the figure.

Replace the system of forces with a force and a moment, both of which act in the center of the ellipse and indicate the solution in the figure!

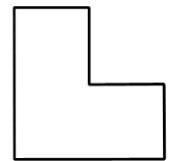
Find the resultant!:

- size of and y component
- where does its line of action cross the axes x and y ?
- find the equation of the line of action! The equation of a line is $y=ax+b$ and the question is "a" and "b"

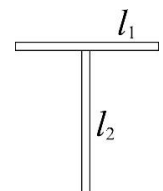


2. A 3 metres long plank is supported by two supports in its ends. In a distance of 1,5 m from one of the endpoints stands a person with a mass of 82 kg. In a distance of 1,1 m from the other endpoint lies a mortar box with a mass of 60 kg. Determine the support reactions of the plank! [M]

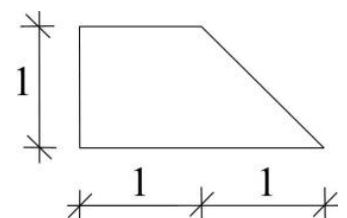
3. Consider a square. The length of its edges is a . We remove the quarter of the square according to the figure. Determine the centroid of this polygon! [M]



4. The figure shows a T-shaped body, which is constructed from two rigid bars. The bars are homogenous with uniform cross sections and their lengths are: $l_1=40$ cm and $l_2=50$ cm. Determine the center of mass of this T-shaped body! [M]



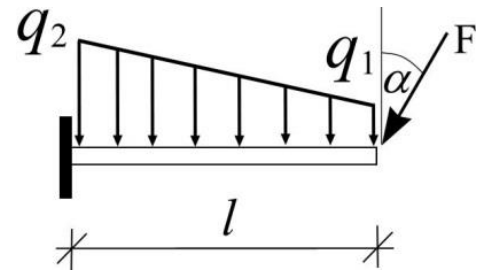
5. Determine the centroid of this polygon!



[M]: These examples originate from the exercise book „Moór Ágnes: Középszintű fizikapéldatár” (Cser kiadó)

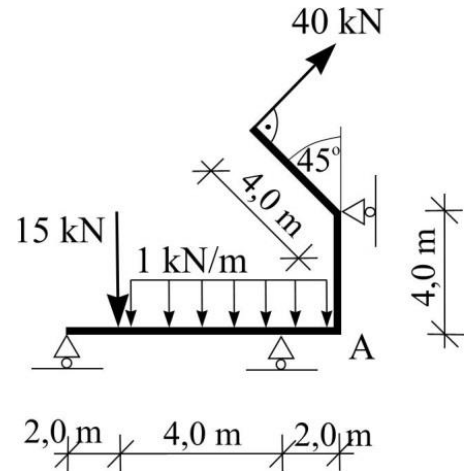
[SD]: This example originates from Dániel Sipeki (a student).

6. A cantilever with the length of l is loaded by a trapezoid distributed load and a skew concentrated load according to the figure. $l=2$ m, $a=30^\circ$, $F=10$ kN, $q_1=2$ kN/m and $q_2=4$ kN/m.



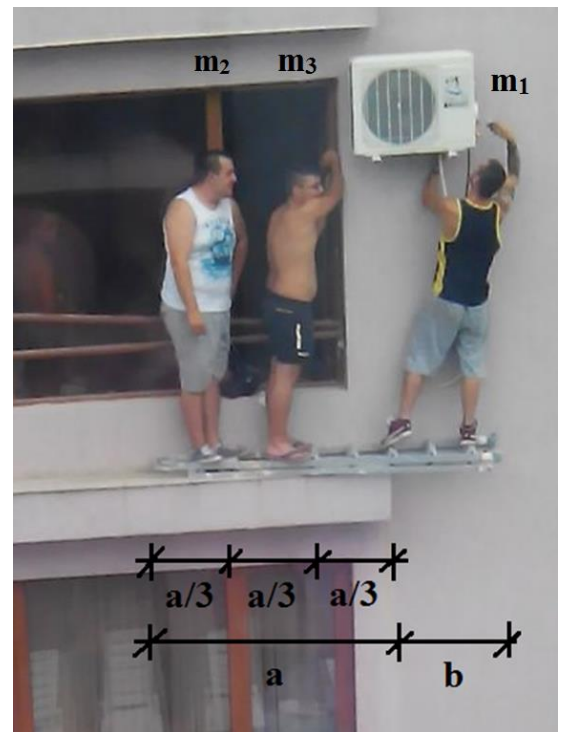
- Give the equation of the equilibrium in matrix form!
- Determine the support reactions of the cantilever (magnitudes and directions)!
- Indicate the results in a final figure (it should contain the beam itself, the loads and the support reactions)!

7. Given a beam with broken segments (see the figure).



- ~~Reduce the system of the loads to point A!~~
- Where does the resultant of the loads cross the horizontal line going through point A?
- Determine the support reactions (magnitudes and directions)!
- Indicate the results in a final figure (it should contain the beam itself, the loads and the support reactions)!

8. The three persons have equal masses ($m_1 = m_2 = m_3$).



Draw a mechanical model of this situation!

What is the maximum value of b/a , for which they do not fall? The person who is repairing the Air Condition is standing on his right leg. [SD]

9.* Is it possible that the centroid of a planar polygon is outside of the polygon? Why?