

Math basics: systems of equations

Please solve at least 3 exercises for max point.

1. a) Solve the following system of equations if $a=4$!

$$-10x + 3y = 25$$

$$5x - ay = -2$$

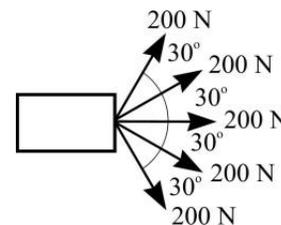
- b) For which value(s) of a does this system of equation have exactly 1 solution?

2. Break up vector $\mathbf{a}=[5,4]$ into the sum of 2 vectors, one of which is parallel to $\mathbf{v}_1=[1,3]$ and the other one is parallel to $\mathbf{v}_2=[3,-1]$! (You have to solve a system of equations.)

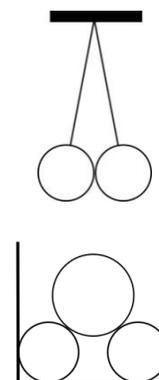
Equilibrium of point-like objects

Before starting calculations, always draw free-body diagram(s)!

3. Five dogs pull a sleigh according to the given figure. Each dog bears 200 N. How large is the total pulling force? [M]
4. In a room with 3 meters clear height we want to fix a lamp (weighing 1 kg) to the slab in a symmetrical way by using a 6 meters long rope. We want the lamp to be in 2 meters distance from the floor. Determine the forces acting in the fixing point

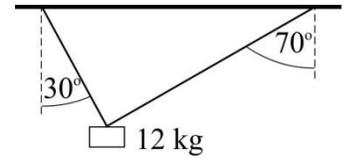


5. The figure shows two balls. Their radius is 3 cm. Both of them weighs 10 N and they are fixed to the ceiling by two pieces of 12 cm long ropes. Determine the force which acts between the two balls and the forces acting in the ropes! [M]
6. The figure shows a 50 cm wide box, in which there are three metal cylinders: the two on the bottom have 10 cm radius and 200 N weight, the one on the top has 15 cm radius and 600 N weight. Determine the forces acting on the wall of the box! [M]

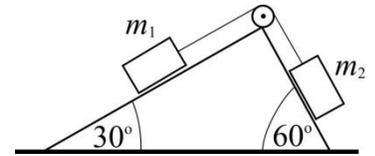


Hint: draw the free-body diagrams of the cylinders before calculations!

7. The figure shows a body with 12 kg, which is hanged to the ceiling by two ropes. Determine the forces inside the ropes! [M]



8. Two bodies (with masses m_1 and m_2) are fastened to each other across a frictionless pulley on a double slope (see the figure). What is the proportion between the masses m_1 and m_2 in the case of equilibrium?



- 9.* Three forces create a concurrent force system. The magnitudes of the forces are the following: $|\mathbf{F}_1| = 3 \text{ N}$, $|\mathbf{F}_2| = 4 \text{ N}$, $|\mathbf{F}_3| = 5 \text{ N}$. Determine the angles between the forces in the case of equilibrium! [M]