

## Exercise 1

a) For the vectors

$$\vec{x} = \begin{bmatrix} 6 \\ -1 \\ 3 \end{bmatrix} \quad \vec{y} = \begin{bmatrix} 4 \\ c \\ -2 \end{bmatrix}$$

- Calculate the cross product and the dot product of the two vectors.
- Find  $c$  such that the vectors  $\vec{x}$  and  $\vec{y}$  are normal to each other.

b) Give examples for tensors of order zero, one and two.

c) Find the eigenvalues of the tensor

$$\mathbf{\Gamma} = \begin{bmatrix} 10 & 3 & 0 \\ 3 & 2 & 0 \\ 0 & 0 & 0 \end{bmatrix}$$

## Exercise 2

When you draw a free body diagram, you sometimes don't know a priori the direction of the forces. You can therefore choose any orientation.

a) Determine the force  $F_s$  applied by the spring to the seesaw described figure 1. Use signs consistent with the free body diagram.

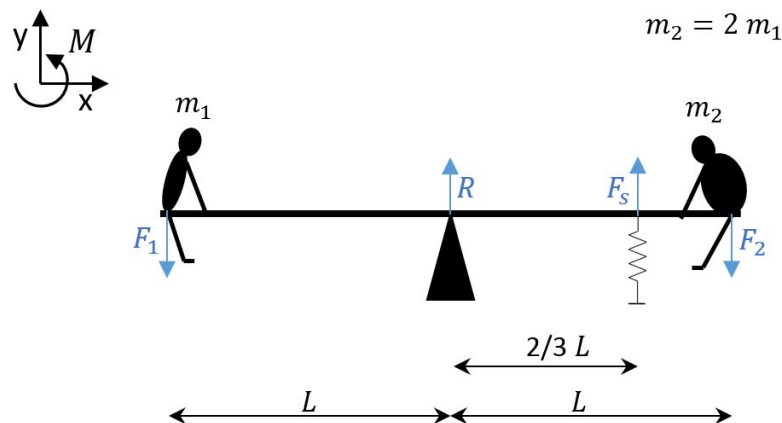


Figure 1: Free body diagram of a seesaw

b) Determine the force  $F_s$  applied by the spring to the seesaw described figure 2. Use signs consistent with the free body diagram.

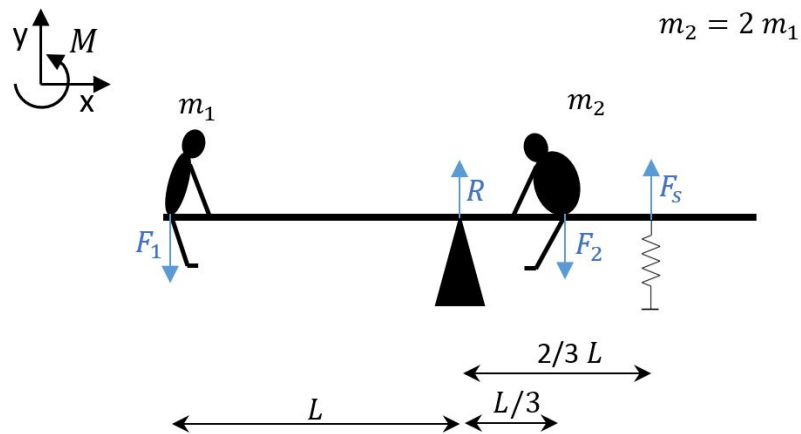


Figure 2: Free body diagram of a seesaw

### Exercise 3

You are holding a book in your hand; your forearm is horizontal and makes a  $90^\circ$  angle with your upper arm. The weight of the book is 4 kg and the weight of your forearm is 2.5 kg (see figure 3).

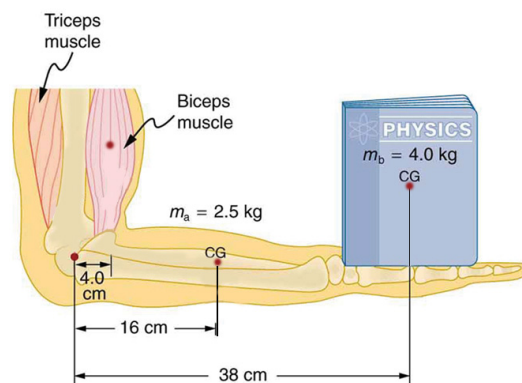


Figure 3: Schematic of the biceps holding up a book.

- Draw the free body diagram.
- Calculate the force that is acting on your biceps muscle and the elbow using the distances given in figure 3.