Newton's Law

Laith

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1 Laws:

First Law:

If an object is not experiencing the effect of any force, then it will either remain stationary **or** keep moving with constant velocity.

Second Law:

If force $\vec{\mathbf{F}}$ is acting on an object with mass m, then the acceleration $\vec{\mathbf{a}}$ is given by:

$$\vec{\mathbf{F}} = m\vec{\mathbf{a}}$$

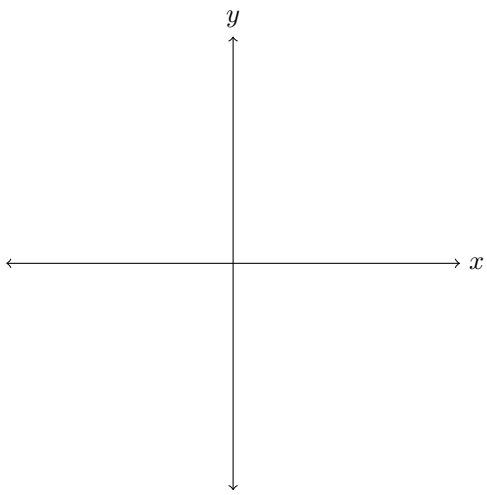
Since the book is not moving, the net forces (sum of the forces) should equal 0 N. Since the forces are vectors, the forces must act in opposite directions in order for them to cancel out. Like you can see in the above figure, the force F_{table} of the table acts upwards, which is opposite of the force m_g of gravity which is acting downwards.

Mathematically, this would look like:

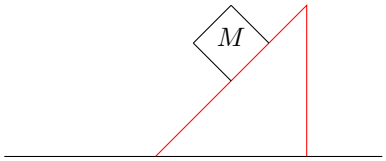
$$\sum F_{net} = F_{\text{table}} + Mg = 0\,\text{N}$$

Generally speaking, **a net force of 0 N means all components of force are 0**.

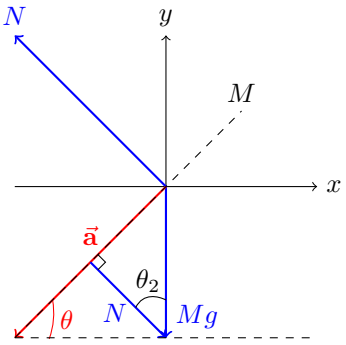
We can use free-body diagrams to model forces:



2 Example Problem



We can draw a free-body diagram to model the forces acting on the box with mass M:



Using the formula $\vec{\mathbf{F}} = M\vec{\mathbf{a}}$, we can determine the formulas for the x and y components of the net force.

For the x component, we need to look at the angle θ_2 formed between the normal force vector N and gravity vector Mg. We can see that the vectors form a triangle, which allows us to use the

trigonmetric functions to setup an equation in which we can solve for x.

$$\cos(\theta) = \frac{Mg}{x}$$

If the box starts from rest, how long does it take for it to come distance $l = 1$ m down the incline?