

# The sample of a book

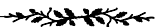
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*Two things are infinite: the universe and the human stupidity.*

Albert Einstein

# 1

## Shall we try physics?

What is physics? We can say that it is an attempt to understand the events that we see around us in the nature.

...

Let's look at force, it's just a mathematical construct, but it can facilitate a lot of calculations that are useful in practical applications. Whether it's space flights or children playing on a swing.

### 1.1 Newton's laws

Issac Newton left us several interesting insights that have been denied for centuries, mainly by church organizations.

**Definition 1.1.1 • Newton first law**

An object at rest remains at rest, or if in motion, remains in motion at a constant velocity unless acted on by a net external force.

Corpus omne perseverare in statu suo quiescendi vel movendi uniformiter in directum, nisi quatenus a viribus impressis cogitur statum illum mutare.

...

**Definition 1.1.2 • Newton's gravity**

Any particle of matter in the universe attracts any other with a force varying directly as the product of the masses and inversely as the square of the distance between them.

The equation for universal gravitation thus takes the form:

$$F = G \frac{m_1 \cdot m_2}{r^2}$$

where  $F$  is the gravitational force acting between two objects,  $m_1$  and  $m_2$  are the masses of the objects,  $r$  is the distance between the centers of their masses, and  $G$  is the gravitational constant.

Over time, it was necessary to replace this theory with a more accurate one. Although Newton's equation is still valid, it is only a certain limit. The reason is that it does

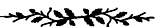


not respect the role of time and its results are sometimes inaccurate.

That's why we use Einstein's special and general relativity today.

$$R_{\mu\nu} - \frac{1}{2}R g_{\mu\nu} + \Lambda g_{\mu\nu} = \frac{8\pi G}{c^4} T_{\mu\nu}$$

...







# 2

## Let's Try Mathematics

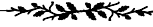
Geometry gives us powerful tools to describe space. One of the most famous results in geometry is the Pythagorean theorem.

### *Definition 2.0.1 • Pythagorean Theorem*

In a right-angled triangle, the square of the hypotenuse is equal to the sum of the squares of the other two sides.

$$c^2 = a^2 + b^2$$

Let's now look at a simple algebraic proof of this statement.

***Proof 2.0.1 • Algebraic proof using square area***

Consider a square of side length  $(a+b)$ , divided as shown below into four right-angled triangles and a small inner square.

The area of the large square is:

$$(a + b)^2$$

The area can also be expressed as the sum of the areas of the four right-angled triangles and the small inner square:

$$4 \cdot \left(\frac{1}{2}ab\right) + c^2$$

Equating both expressions:

$$(a + b)^2 = 4 \cdot \left(\frac{1}{2}ab\right) + c^2$$
$$a^2 + 2ab + b^2 = 2ab + c^2$$

Subtract  $2ab$  from both sides:

$$a^2 + b^2 = c^2$$

Which is exactly the Pythagorean theorem.

This proof shows that the theorem is not just a geometric rule, but also an algebraic identity based on area manipulation.



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