The law of inertia for material bodies through the history

a brief recapitulation:

Aristotle – limited motion of bodies

Newton – unlimited motion of bodies

Einstein – „limited" motion of bodies in spacetime

The history of extrapolation. Extrapolation from observations of natural processes at a given level of natural processes.

Newton's first law: A matter body at rest remains at rest or a matter body in motion, remains in motion at constant linear velocity unless an external force acts on it.

The law of Inertia. The result of the first law of motion is an escape velocity: Every body accelerated to the escape velocity will move away until infinity.

According to physical textbooks, the Newton first law of motion is an brilliant extrapolation of our experience.

Every body remains in a state of rest or straight forward motion when it is not forced by external forces to change this state. In the real world, where there are always some forces (resistive, frictional, ... , gravitational), the body will stop after some time or will stop at infinity in the case of an escape velocity. In other words, the so-called ideal case is not possible in the world. It is possible to reduce the forces resisting motion, but not to cancel them. However, even in the so-called ideal state, the definition (without external forces) is meaningless. **There is an contradiction in the case of the ideal state.** The misunderstanding is at the very beginning – the level of observable natural processes.
It follows from the very nature of a material body - for wherever there is a body or bodies, there are always external forces (gravity - deformation of spacetime). There is no possible state of having material bodies without external forces. The external (gravitational) forces are the results of the deformation of spacetime and they are related to every material body.

As we know today, bodies are only in the universe along with time and space. There are also forces interacting with each other body as the result of space and time – see gravitational force. For there is no space or time without matter and vice versa. There is no matter, no body without space and time.

And so the meaning of the Newton 1st law of motion in the light of space-time bound to matter (bodies) does not make sense also for so-called the ideal state. There will always be a gravitational force acting on a body, e.g. in intergalactic space, and such force always influences the body. The material body itself is an indivisible part of space and time. The material body as we perceive and measure it is an excitation of the omnipresent quantum field.
Thus the ideal state without all acceleration no forces would act on the body, is impossible. ***The nature of the contradiction is in the very beginning. That it is a body.*** *If it's not a body, that's different. But we don't know and can't describe the motions of non-bodies. Where there are bodies, there is always force action and the impossibility of movement without limits. It follows necessarily from the nature of bodies. Even if there is one single body, it will necessarily gravitationally affect itself in motion.*

There always be forces among bodies. Yes, in a case of an escape velocity, there is no chance to stop accellerated body, but such body will be still influenced by gravitational field of the first body and, no doubt, self-gravitational field.

There is another point of view. The body is the source of a gravity force. Such force curves the spacetime.
Bodies, by the very nature of bodies, cannot move freely through spacetime without forces.

There is an equation – the body means gravitational forces and gravitational forces mean the body or bodies. Without bodies there are no gravitational forces and vice verse. Without gravitational forces there are no bodies, either.

Let's imagine a thought experiment - *there are only two bodies in the universe, that have been accelerated to escape velocity from each other - so they will move away to infinity, as we calculated from the equations of classical mechanics.*
But the reality in light of Einstein's equations of general relativity is different – see the following

Two bodies accelerated from each other to the level of the escape velocity do not mowe away until infinity, but these two bodies will deform spacetime. The conclusion – these two bodies with escape velocity do not mowe away, but they will follow the main curve of spacetime. In an ideal state the main curve will be the main circle of an sphere. **The result – two accelerated bodies will meet after a long time. The time is given by (growing) mass of two bodies and their escape velocity from each other.**

This is not a negation of Newton's law, but a specification of it by knowledge that Newton did not have in his time. In other words - every model, every theory, is valid for a certain range of natural processes, and it is impossible to establish a universal formula. Especially if we don´t know every process in Nature, plus every process is unique – there are only common characteristic – *like appearance of hexagons in snowflakes.*

The age-old human tempation of applying abstract models or ideas from a given level of natural processes to the whole of nature or the universe and then being surprised that nature or the universe does not work according to them.
However, models are good, proven models. Yes, they are good and repeatedly tested, but at a given level, at a given scale of natural processes. Moreover, a model is a model - i.e. a simplified, abstracted description - so it has limited validity even at the original level from which the model was created.

Go back to bodies:

The bodies have to be together in spacetime (spacetimematter). There is no chance for matter bodies to escape from each other to infinity. There is an exception if there is external force (power) above all bodies. Sometimes called dark energy.

Conclusion:

The greater the mass of the bodies and the greater their escape velocity, the greater the deformation of spacetime and the smaller the radius of the main circle and the shorter the time for the bodies to meet. And vice versa - the smaller the mass of the bodies and the smaller their escape velocity, the smaller the deformation of spacetime and the longer the time it takes for the bodies to meet.

In a rough analogy, it is like sailors on two ships in an earthly ocean, drifting apart into "infinity" until they meet on the other side of the globe.