Isaac Newton (1642–1727)

Newton's First Law (Inertia)

A body at rest or in uniform motion remains at rest or in uniform (straight line) motion unless acted upon by an external force.

Newton's Second Law (Force)

The Acceleration produced by a force is proportional to the force and inversely proportional to the mass being accelerated: $a = F/m$ or

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

Newton's Third Law (Action-Reaction)

To every action force there is an equal and opposite reaction force.

Newton's Law of Universal Gravitation

Two objects attract each other with a force proportional to their masses and inversely proportional to the square of their distance apart:

$$F = \boldsymbol{\gamma}\frac{m_1 m_2}{d^2}.$$

Instantaneous Velocity (from Calculus)

If an object, moving along a straight line, has position at time t given by $at^2 + bt + c$, then its *instantaneous* velocity at time t is $2at + b$.

Motion under constant acceleration (from Calculus)

If an object moves with *constant* acceleration a, then its velocity at time t is given by $v(t) = at + c_1$ and its position at time t is given by $s(t) = \frac{1}{2}at^2 + c_1 t + c_2$, where c_1 and c_2 are constants determined from "initial conditions." (Note that, by the Second Law, acceleration will be constant when force is constant.)