Air Resistance

Comparison of Models

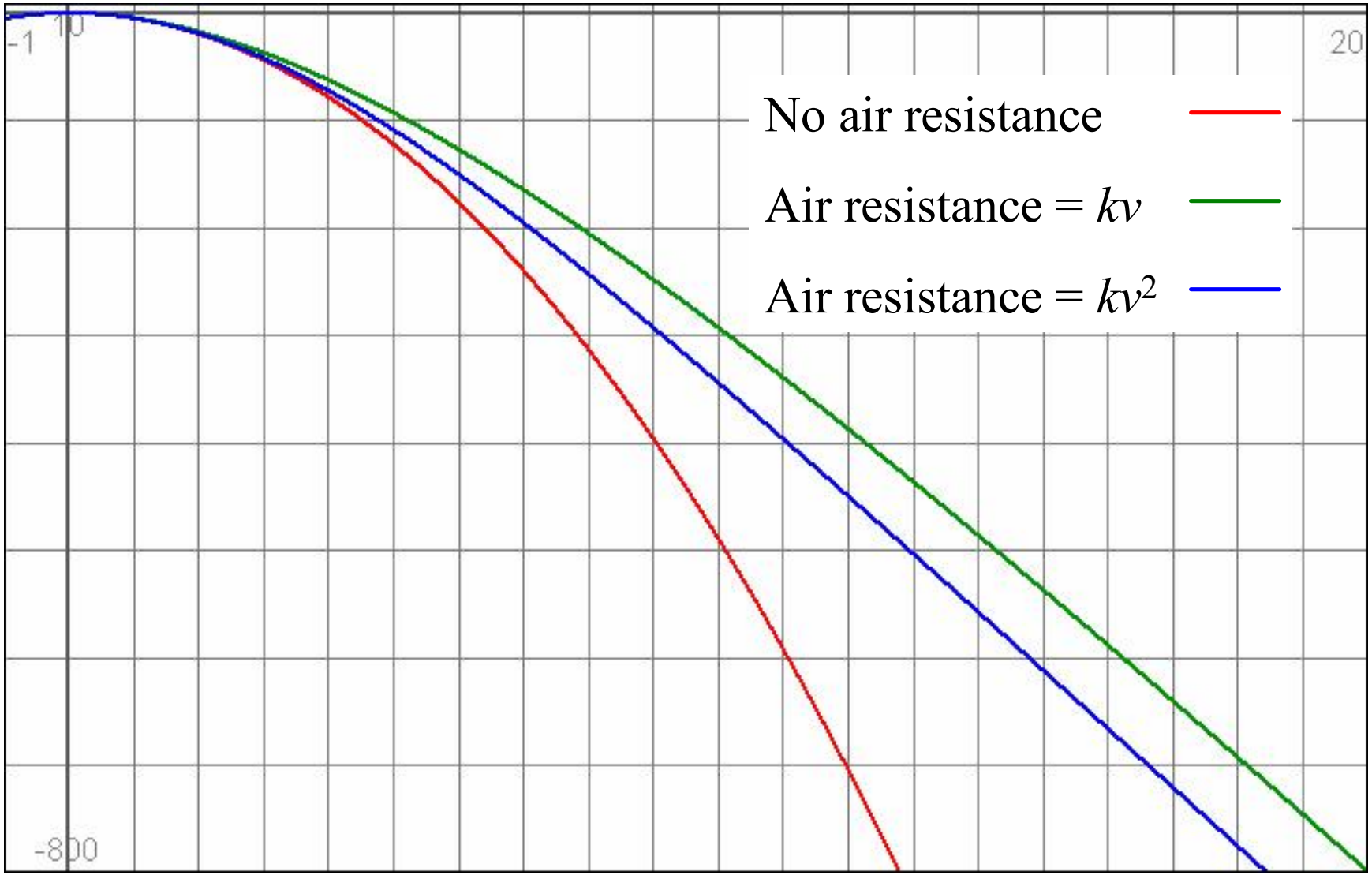
Modeling Motion through Air

- Air resistance is often ignored and acceleration is assumed constant 9.8 m/s^2 downward – the object is said to be in "freefall"
- In reality, air resistance depends on speed, cross-sectional area, density of the air, and the aerodynamic shape (i.e. how "streamlined")
- Usually it is assumed that air resistance is proportional to speed or that it is proportional to the square of the speed.
- Although neither assumption is exactly correct, the latter is usually more accurate

Modeling Motion through Air

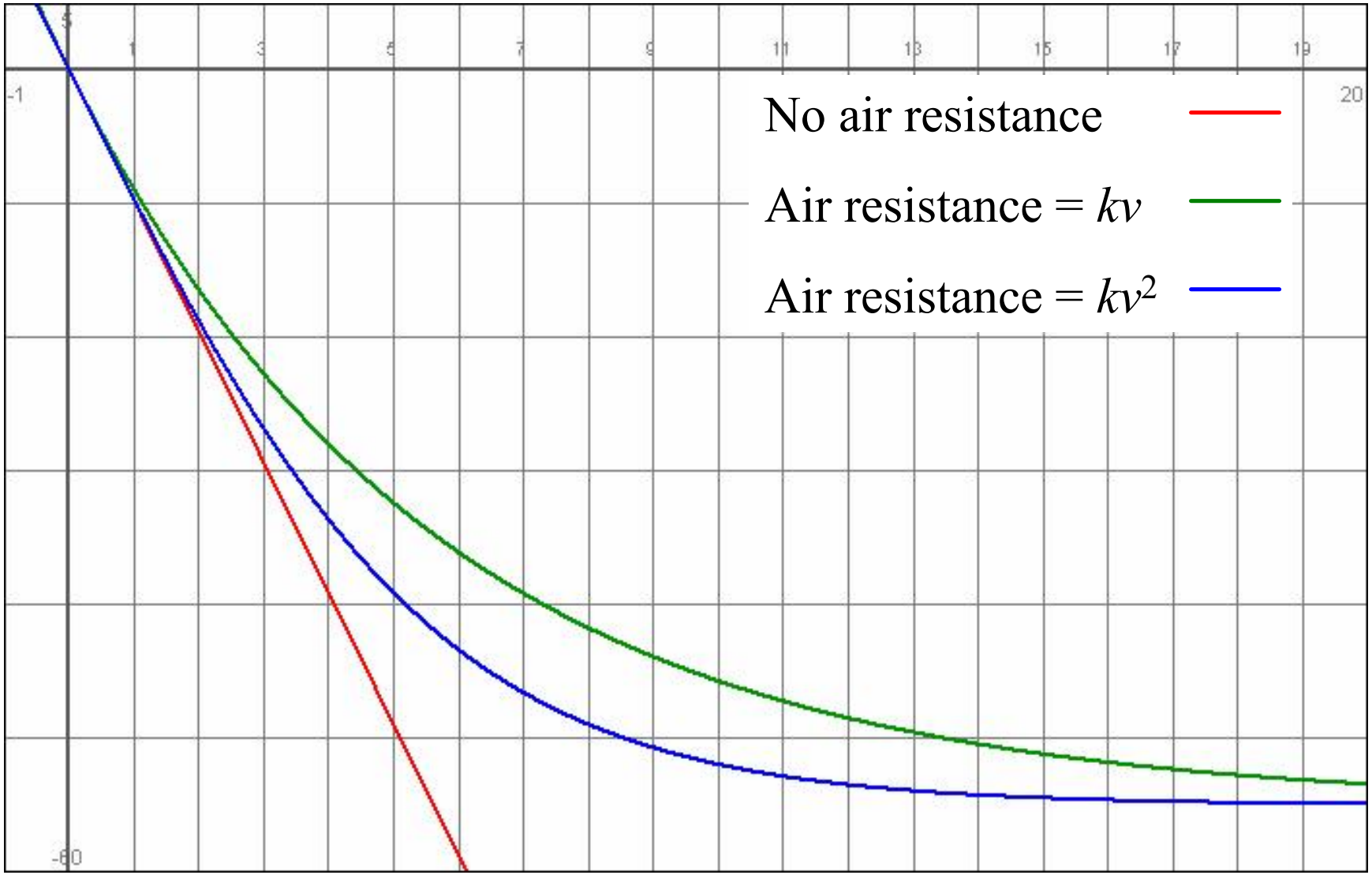
- The graphs that follow illustrate the kinematics of objects moving through the air based on the three different modeling approaches.
- The red lines/curves represent freefall.
- The blue curves represent air resistance proportional to speed squared (and best represent reality)
- The green curves represent air resistance proportional to speed (a common approach used in physics)

Position vs. Time for a Skydiver



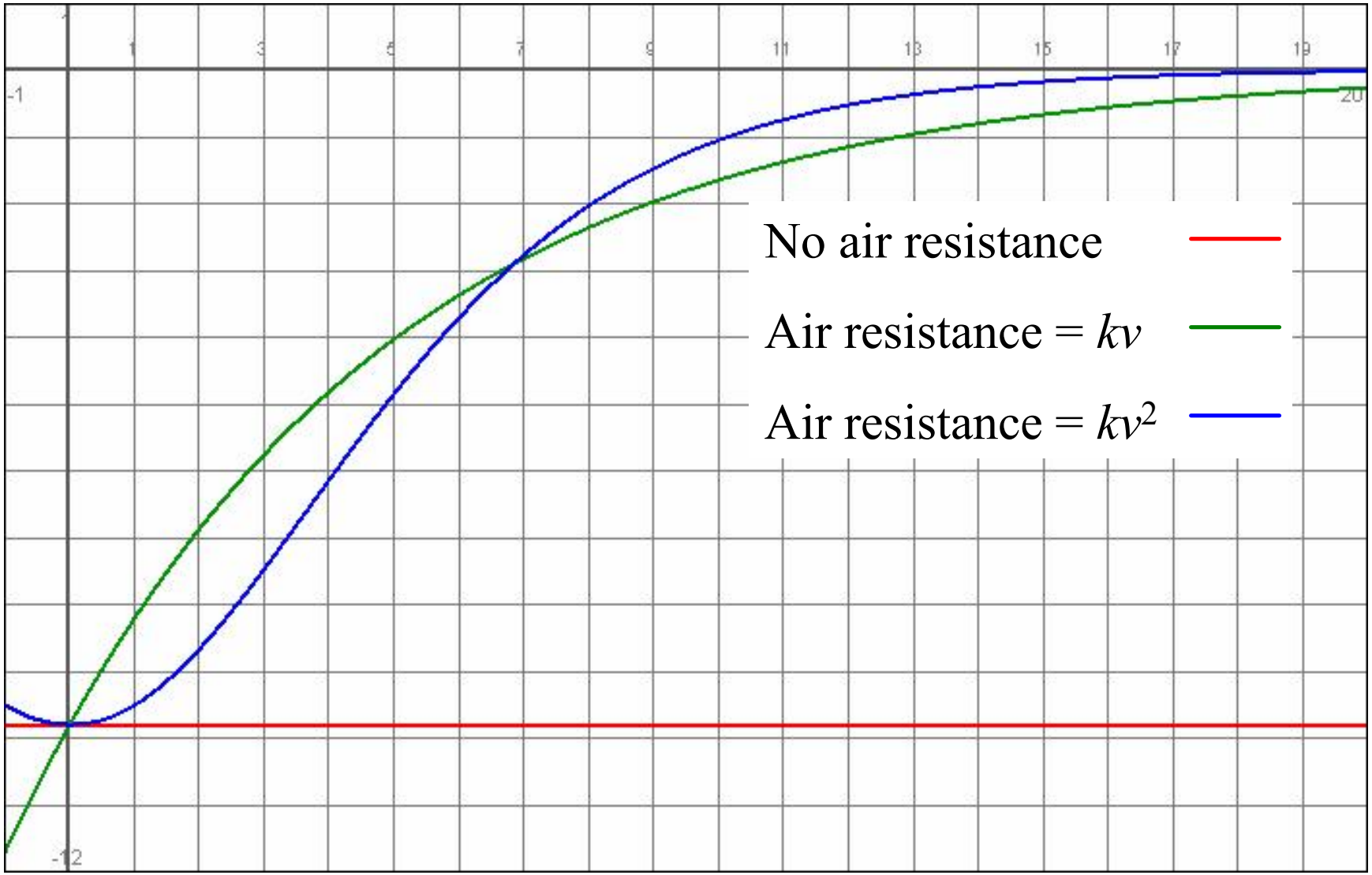
initial velocity = zero; terminal speed = 55 m/s

Velocity vs. Time for a Skydiver



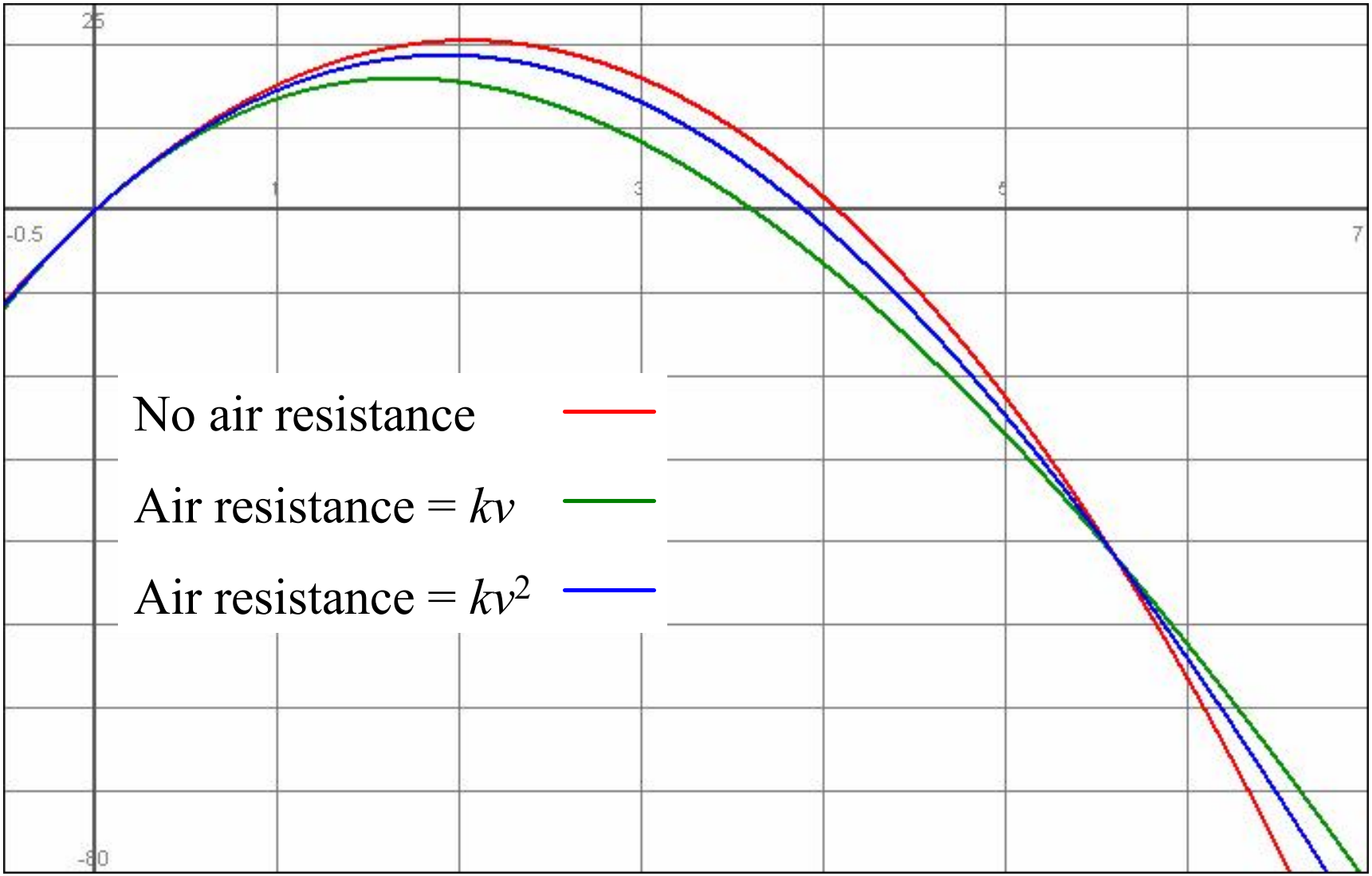
initial velocity = zero; terminal speed = 55 m/s

Acceleration vs. Time for a Skydiver



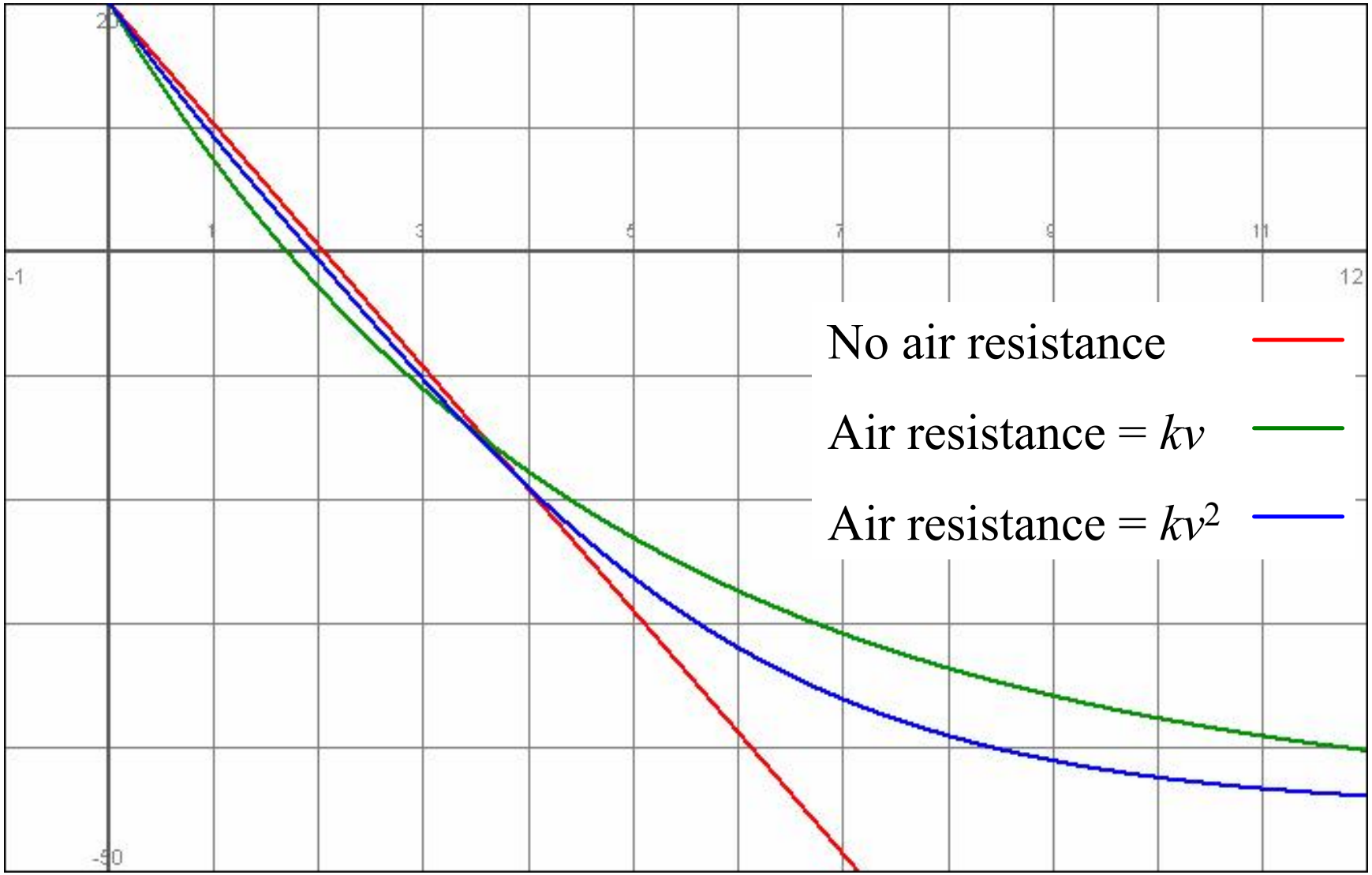
initial velocity = zero; terminal speed = 55 m/s

Position vs. Time for a Baseball



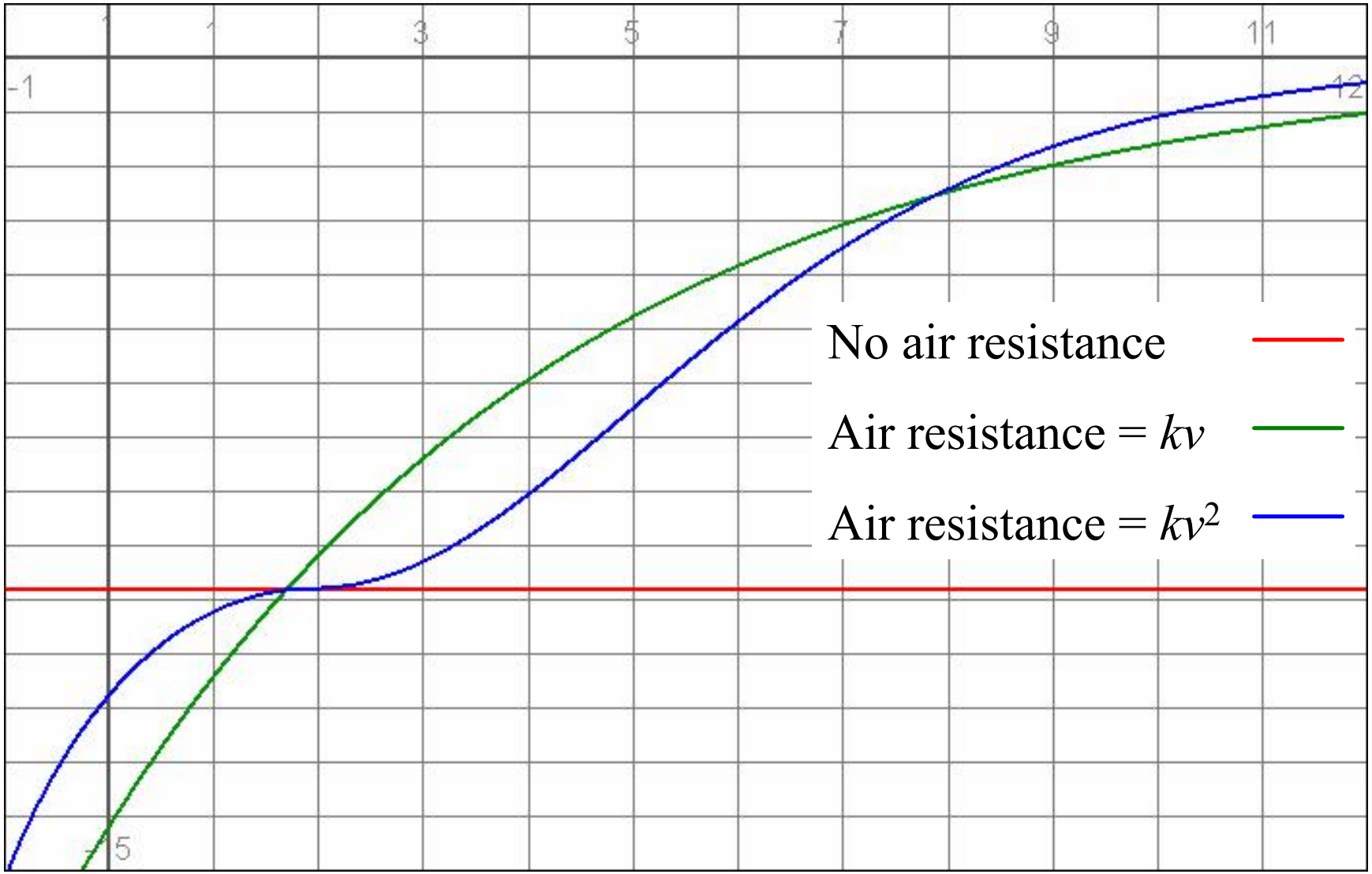
initial velocity = 20 m/s, upward; terminal speed = 45 m/s

Velocity vs. Time for a Baseball



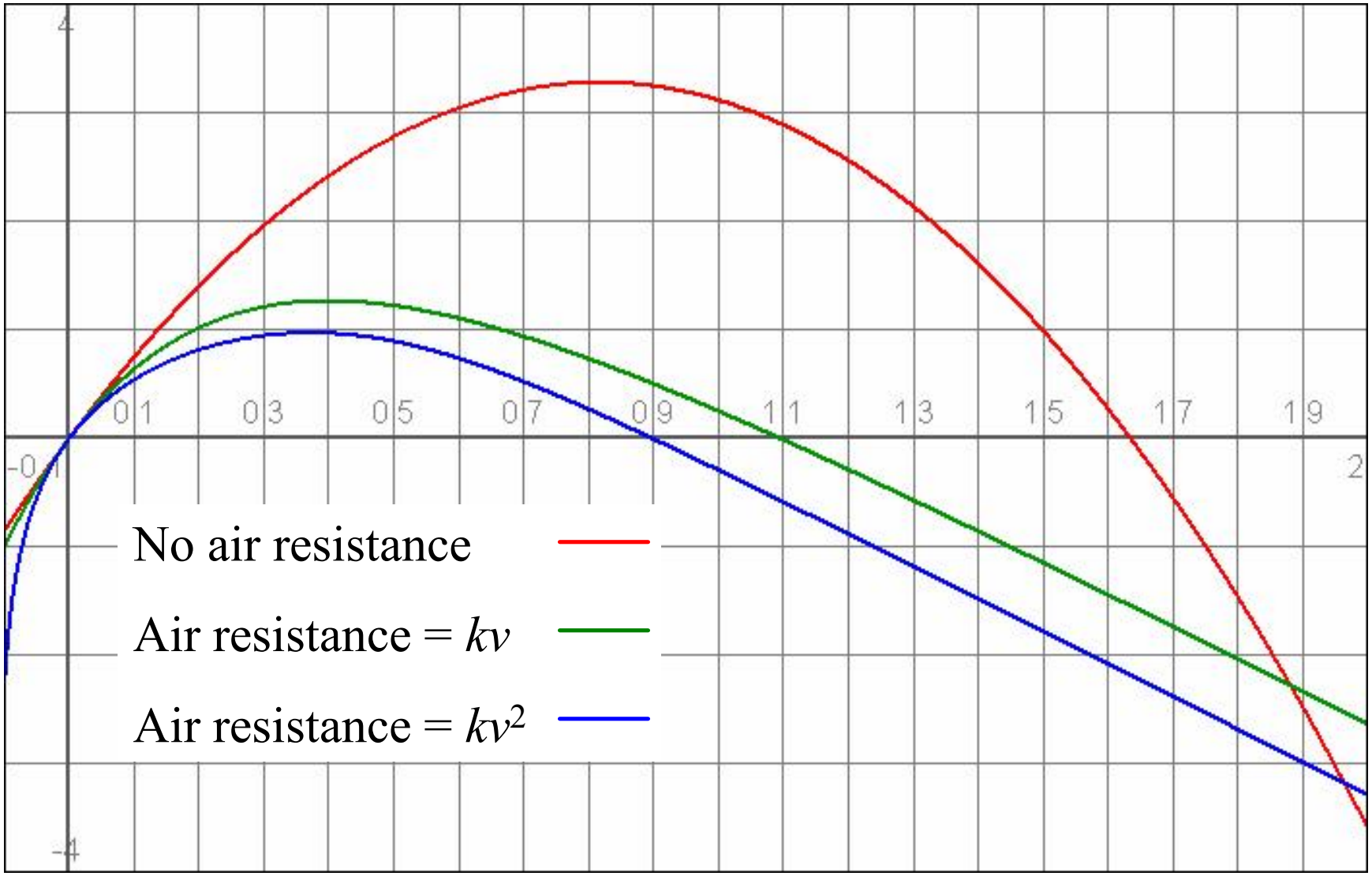
initial velocity = 20 m/s, upward; terminal speed = 45 m/s

Acceleration vs. Time for a Baseball



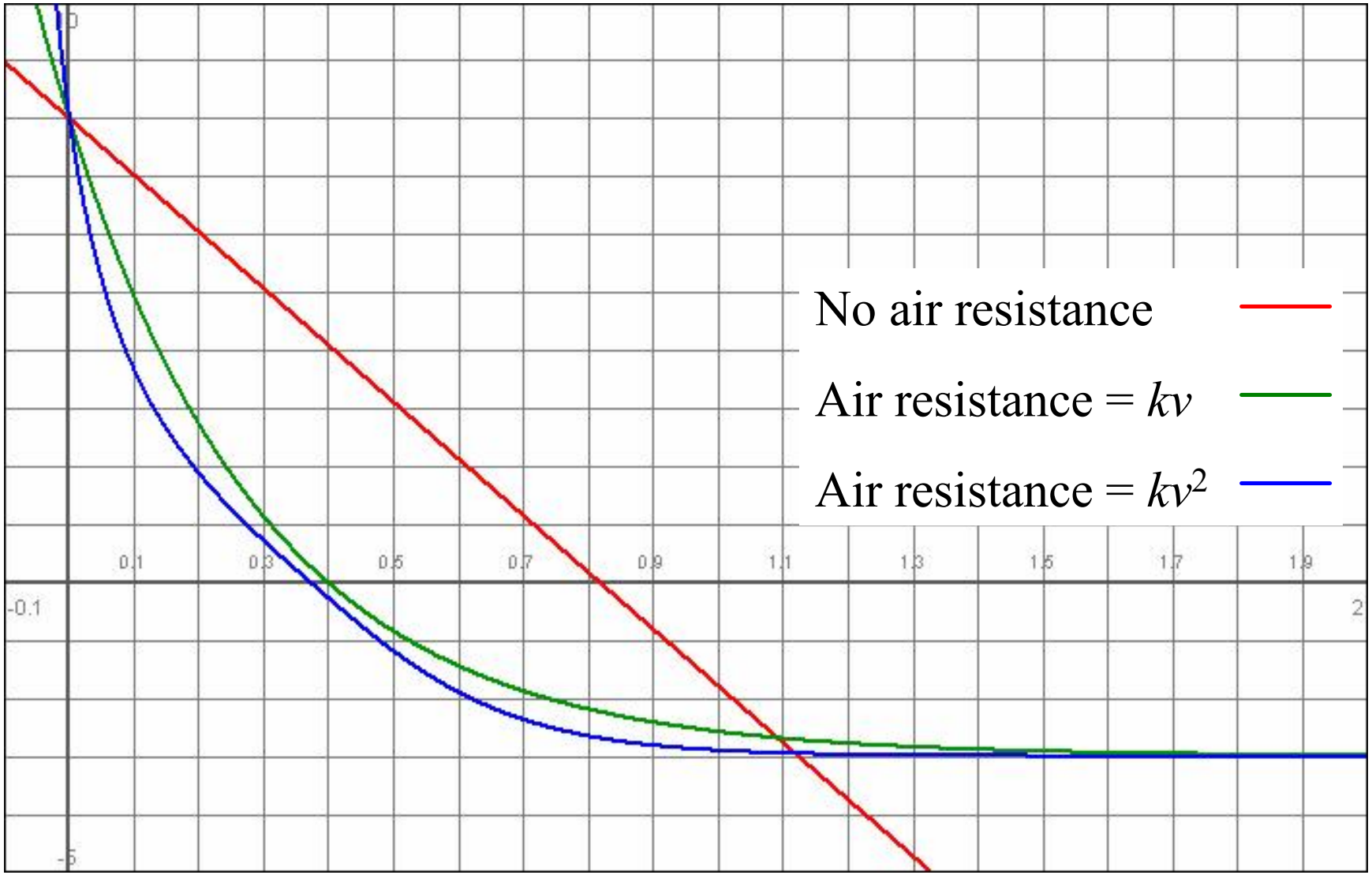
initial velocity = 20 m/s, upward; terminal speed = 45 m/s

Position vs. Time for a Balloon



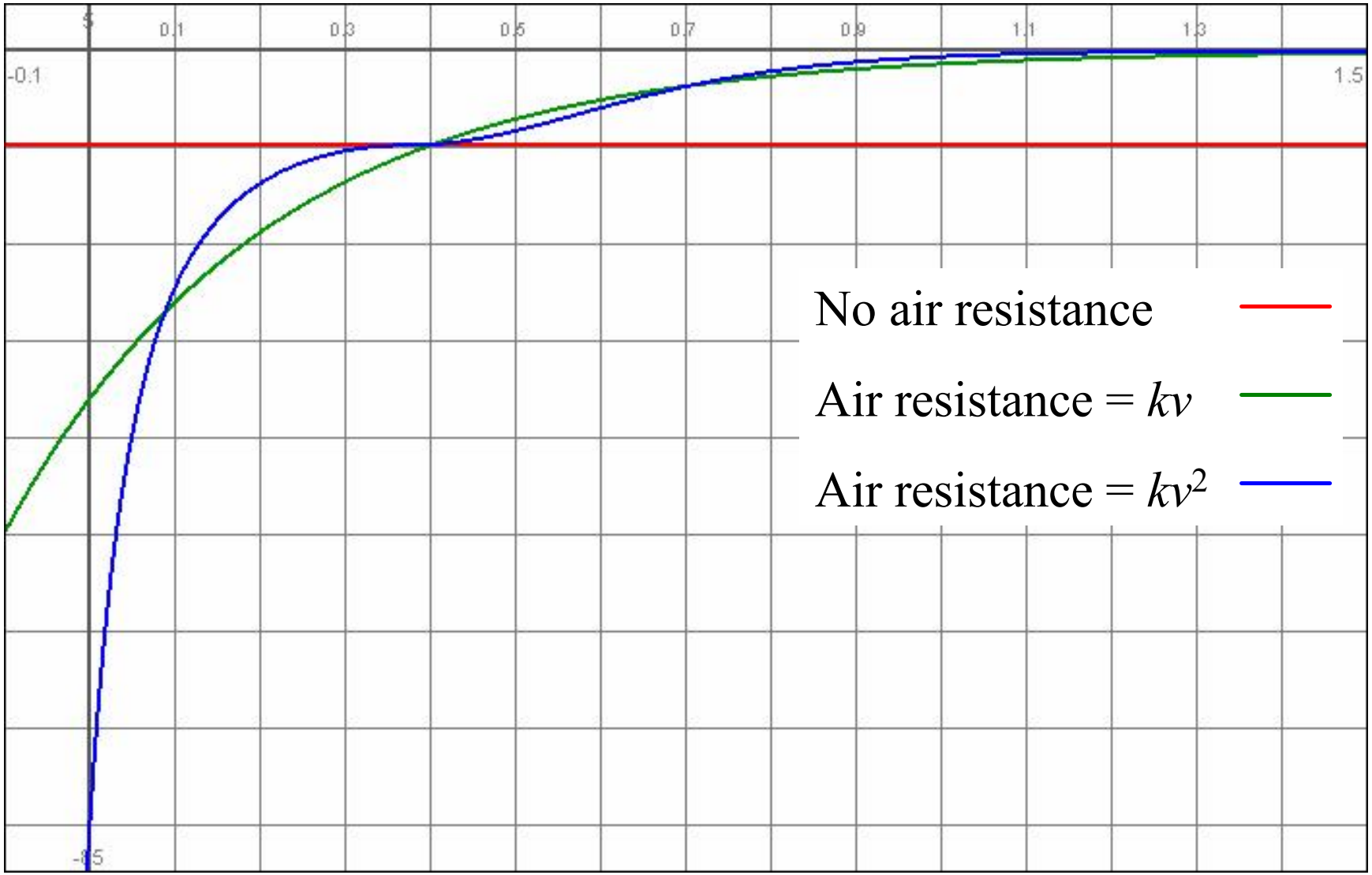
initial velocity = 8 m/s, upward; terminal speed = 3 m/s

Velocity vs. Time for a Balloon



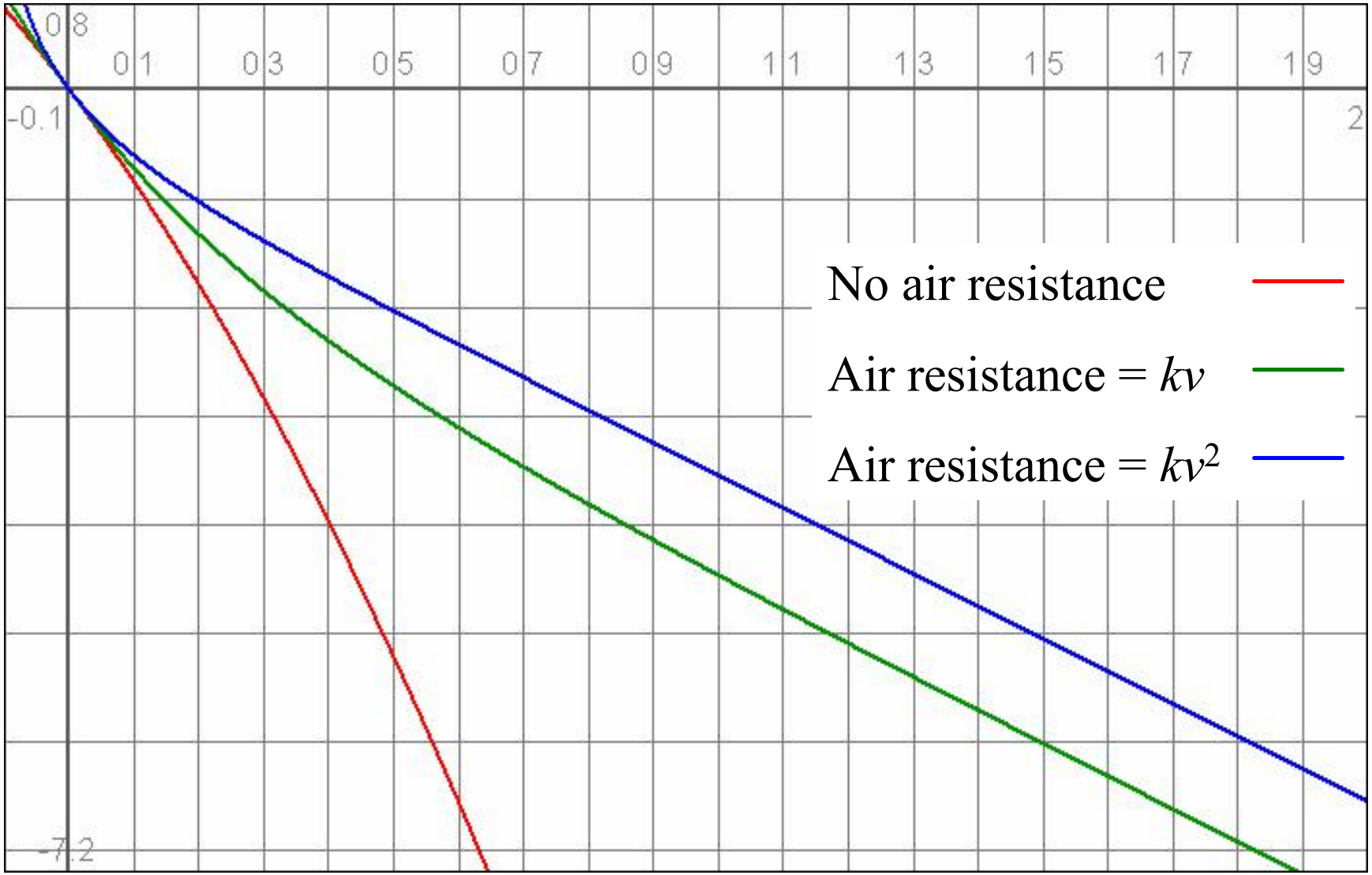
initial velocity = 8 m/s, upward; terminal speed = 3 m/s

Acceleration vs. Time for a Balloon



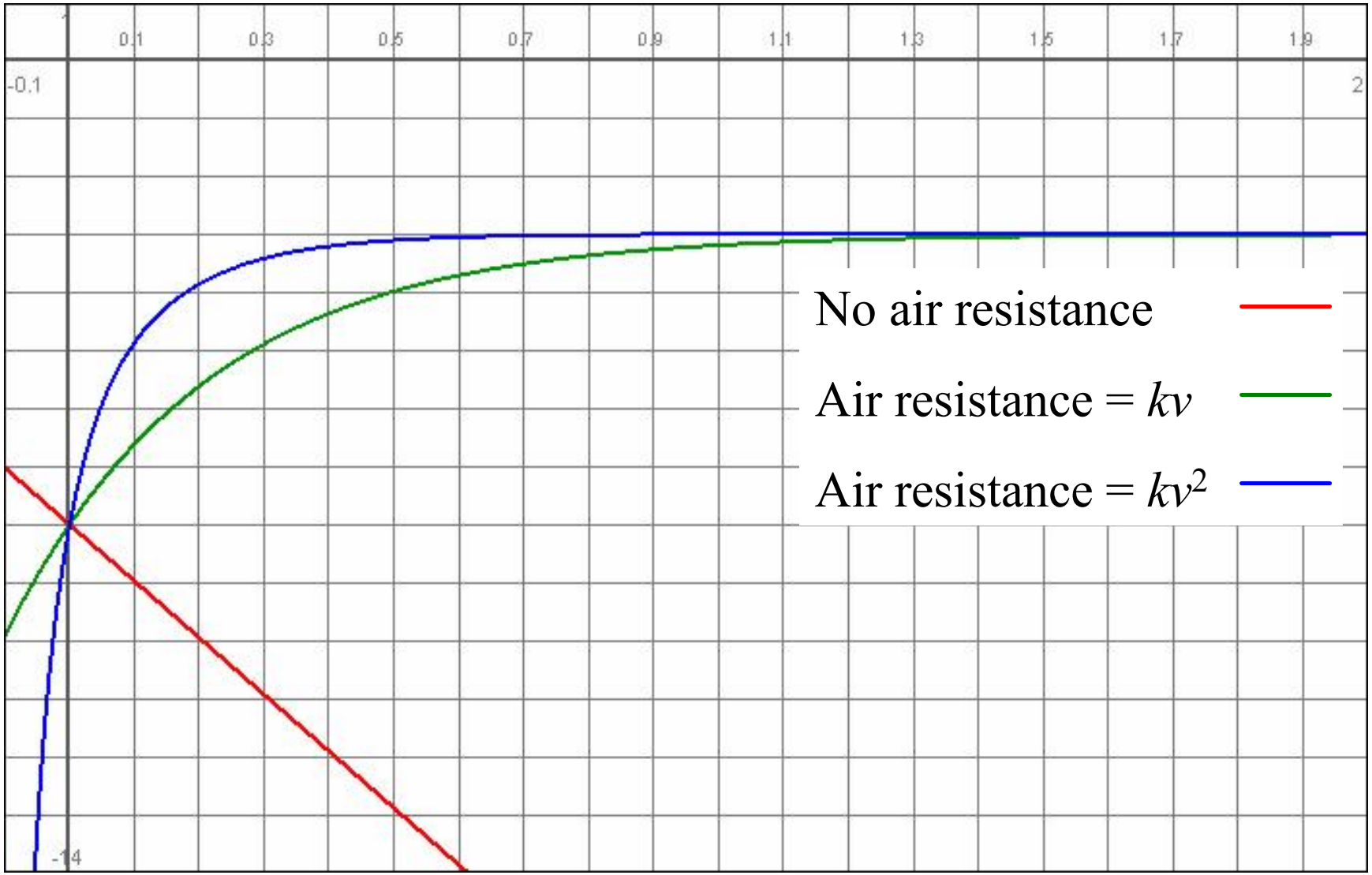
initial velocity = 8 m/s, upward; terminal speed = 3 m/s

Position vs. Time for a Balloon



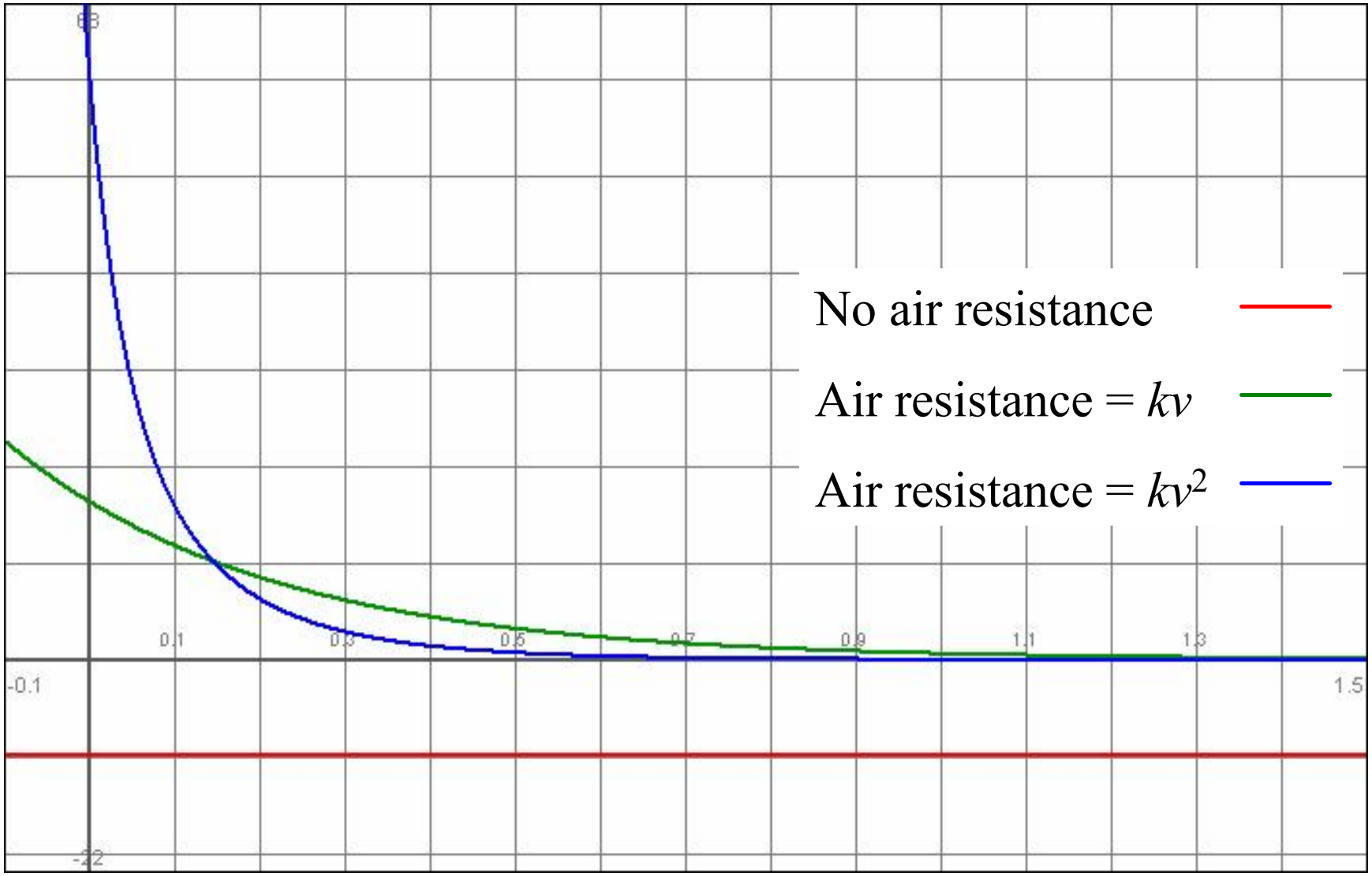
initial velocity = 8 m/s, downward; terminal speed = 3 m/s

Velocity vs. Time for a Balloon



initial velocity = 8 m/s, downward; terminal speed = 3 m/s

Acceleration vs. Time for a Balloon



initial velocity = 8 m/s, downward; terminal speed = 3 m/s