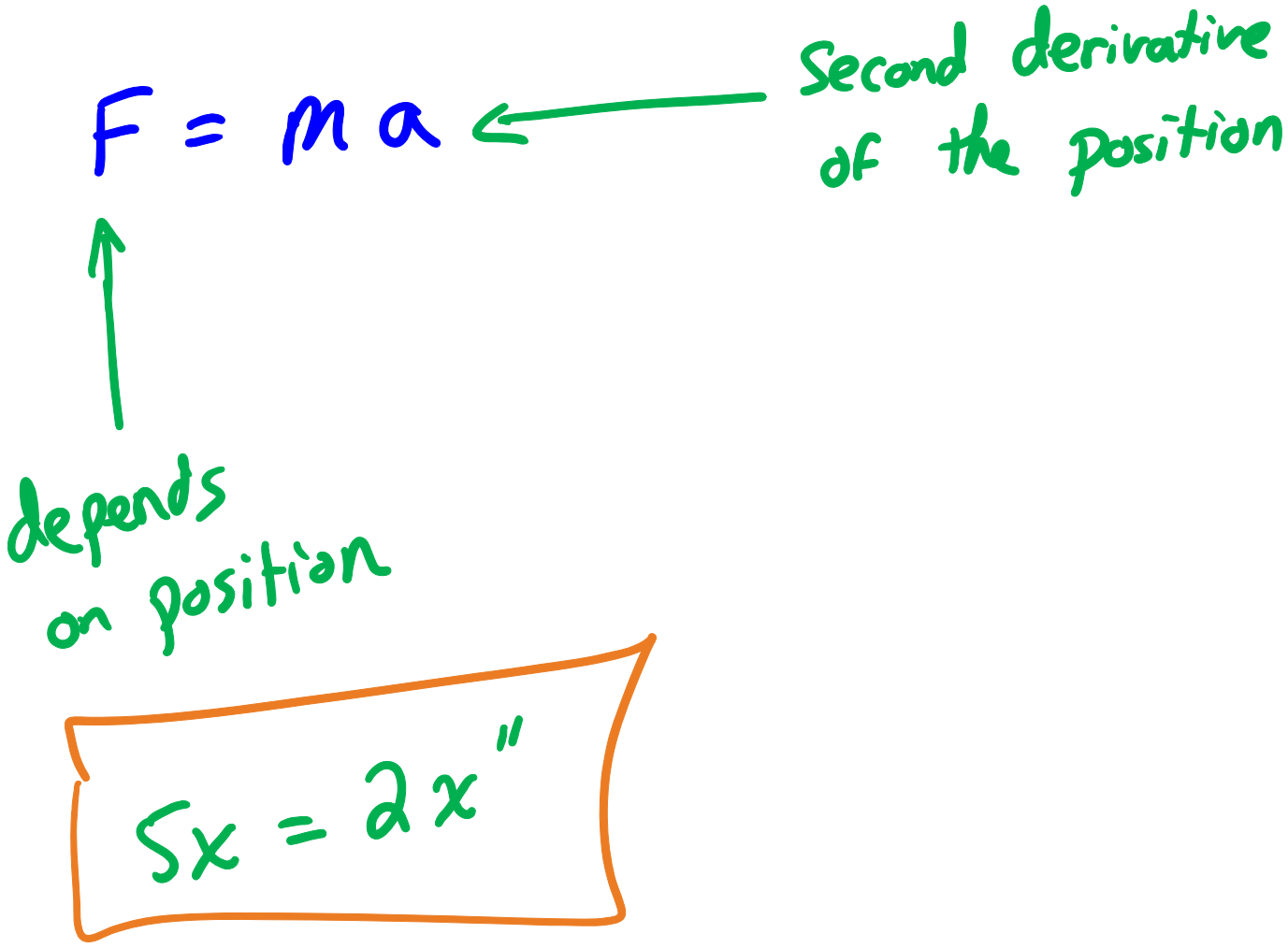
Modeling with Second Order Equations

Second order equations are also very useful in modeling situations. In general, this comes from Newton's Laws of Motion.



The first main example of this is a mass on a spring.

$$ma = F_{net} = -kx - \gamma v$$

x'' x'

Hooke's Law

k = spring Constant

Drag Force

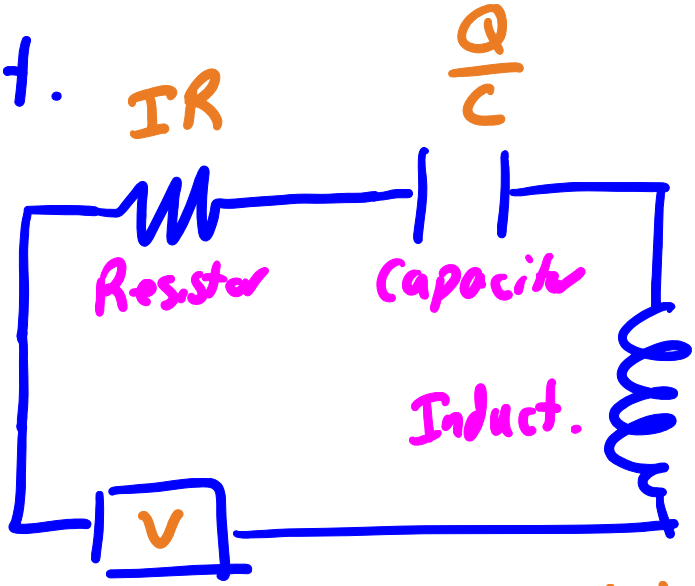
γ - drag coefficient.

$$mx'' = -kx - \gamma x'$$

A similar situation arises in circuits.

Kirchhoff's Law: Total voltage drop around a closed circuit must be zero.

RLC Circuit.



$I = \frac{dQ}{dt}$ $\frac{dI}{dt} = \frac{d^2Q}{dt^2}$

$$V + IR + \frac{Q}{C} + L\frac{dI}{dt} = 0$$

$$L \cdot \frac{d^2Q}{dt^2} + R\frac{dQ}{dt} + \frac{1}{C}Q = -V$$