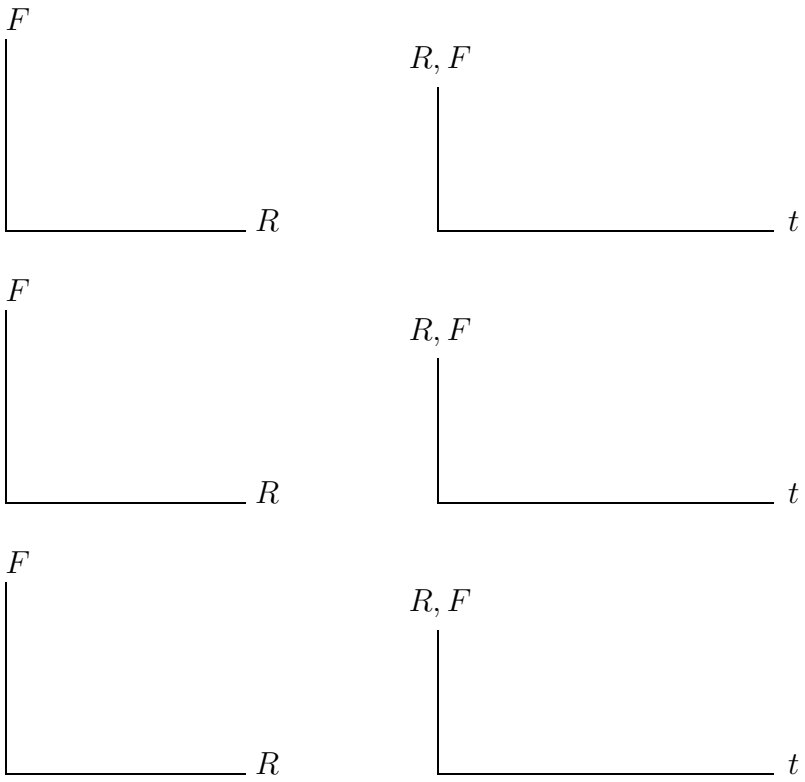
Two examples of systems

Example. Recall the predator-prey systems we discussed briefly at the start of the semester

$$\frac{dR}{dt} = aR - bRF$$
$$\frac{dF}{dt} = -cF + dRF.$$

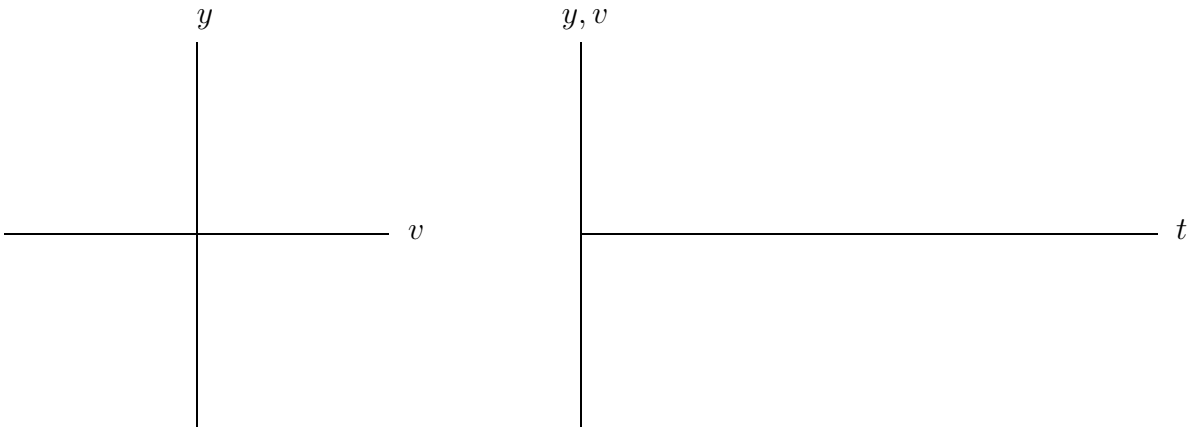


We can compute two solutions:

Example. Simple mass-spring system

Hooke's Law: The restoring force of the spring is proportional to the displacement from its rest position.

Using Newton's law $F = ma$, we get



Let's consider the special case where $k = m$. We get

$$\frac{d^2y}{dt^2} = -y,$$

and we can guess some solutions to this equation:

In what ways are these two examples similar?

An initial condition for the predator-prey system is a pair (R_0, F_0) of population values.

An initial condition for the mass-spring system is also a pair (y_0, v_0). The first number indicates the initial displacement and the second number indicates the initial velocity.

We can perform a mathematical reduction to the second-order equation for the mass-spring system so that it resembles the predator-prey system: