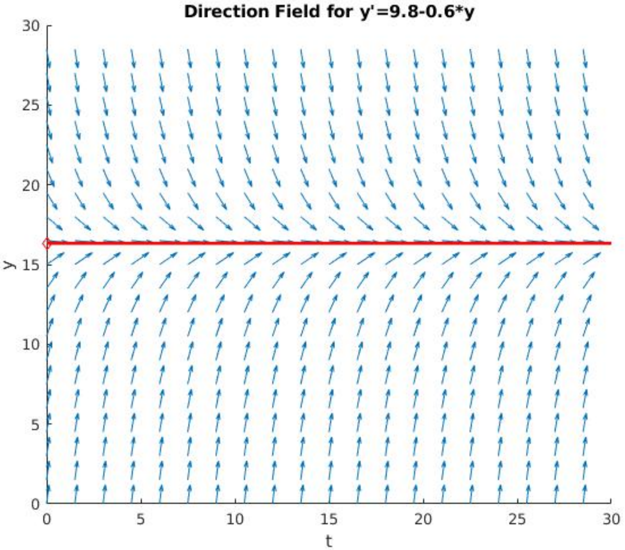
Direction Fields

Section 1.1

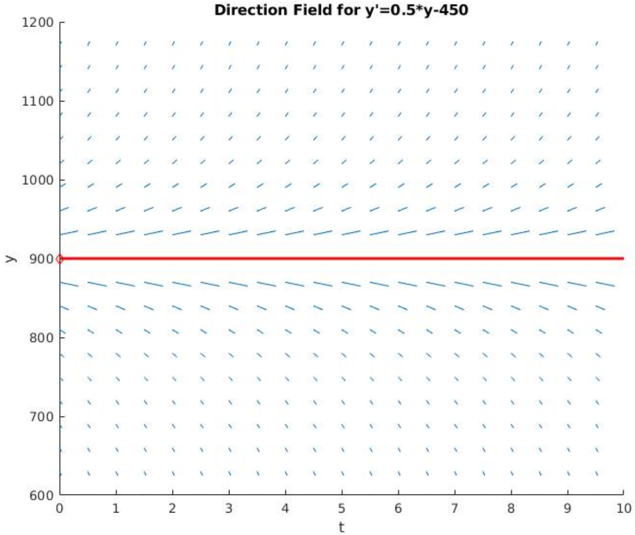
Falling Sky-diver ($\frac{dy}{dt} = g - \frac{\gamma y}{m}$) : Direction Field



Falling Sky-diver ($\frac{dy}{dt} = g - \frac{\gamma y}{m}$) : Direction Field

- The arrows represent the slope of the tangent line (accelaration or $\frac{dy}{dt}$) at each point in the *ty*-plane.
- All solutions converge to the equilibrium solution, $(16\frac{1}{3})$ m/s
- $\lim_{t\to\infty} y(t) = 16\frac{1}{3}$ m/s

Mice population ($\frac{dy}{dt} = rp - k$) : Direction Field



Mice population ($\frac{dy}{dt} = rp - k$) : Direction Field

- The arrows represent the slope of the tangent line (rate of growth of population or $\frac{dy}{dt}$) at each point on the ty-plane.
- All solutions diverge from the equilibrium solution
- If $y(0) < 900$, $\lim_{t \to \infty} y(t) = 0$ (Mice all die out!)
- If $y(0) > 900$, $\lim_{t \to \infty} y(t) = \infty$ (Mice population explodes!)

Neurology

- The level of activity of certain nerve cells in the brain can be modelled by an ODE

$$y'(t) = -y(t) + \frac{1}{e^{-15(y(t)-0.5-0.3\cos(2\pi t)}}$$

where y(t) is the percentage of cells that are active at time t.

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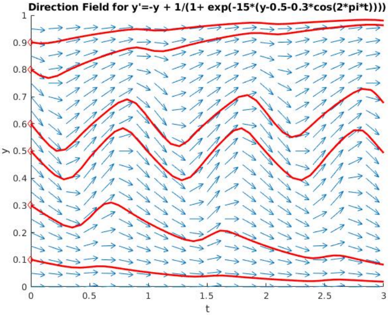
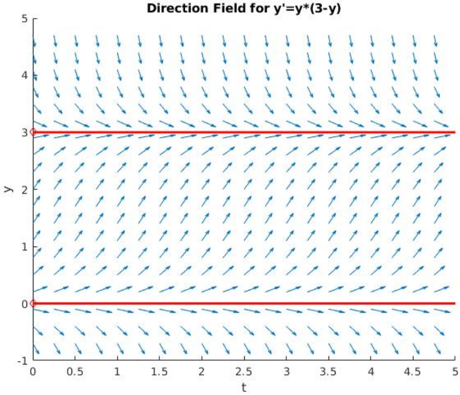


- The ODE exhibits 3 equilibrium states!

Other Examples

$$y' = y(3 - y)$$



Other Examples

$$y' = e^{-t} + y$$