Example 1. A large mixing tank initially holds 300 gallons of water, in which 50 pounds of salt has been dissolved. Another brine solution is pumped into the tank at a rate of 3 gal/min, and when the solution is stirred, it is pumped out at a rate of 2 gal/min. If the concentration of the entering solution is 2 lb/gal, find an expression \( A(t) \) for the amount of salt in pounds in the tank at time \( t \).
**Example 1a.** A large mixing tank initially holds 300 gallons of water, in which 50 pounds of salt has been dissolved. Another brine solution is pumped into the tank at a rate of 2 gal/min, and when the solution is stirred, it is pumped out at the same rate of 2 gal/min. If the concentration of the entering solution is 2 lb/gal, find an expression \(A(t)\) for the amount of salt in pounds in the tank at time \(t\).

**Example 2.** Solve the initial value problem
\[
\frac{dy}{dt} = 3(5 - y)(15 - y), \quad y(0) = 10.
\]
Also:
- what is the asymptotic behavior of the solution?
- determine whether the equilibrium solutions are stable or unstable.

**Example 3.** Here is an initial value problem:
\[
y \frac{dy}{dx} = x^2 + xy, \quad y(1) = 1.
\]
Can you solve it?

**Example 3a.** Here is an initial value problem:
\[
x^2 \frac{dy}{dx} = 2xy - y^2, \quad y(1) = 3
\]
First, begin to sketch a slope field for the differential equation, find a tangent line to the graph of the solution of the initial value problem, and then solve the initial value problem.
“Fun” with least squares