Problem 6

In each of Problems 5 through 10, draw a direction field for the given differential equation and state whether you think that the solutions are converging or diverging.

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

Solution

The direction field is a two-dimensional vector field that shows what the direction of the solution is at every point in a region. Every solution to the differential equation is a curve drawn such that the direction field vectors are tangent to it at every point.

$$\langle dt, dy \rangle = \left\langle 1, \frac{dy}{dt} \right\rangle dt = \langle 1, y(3 - ty) \rangle \, dt$$

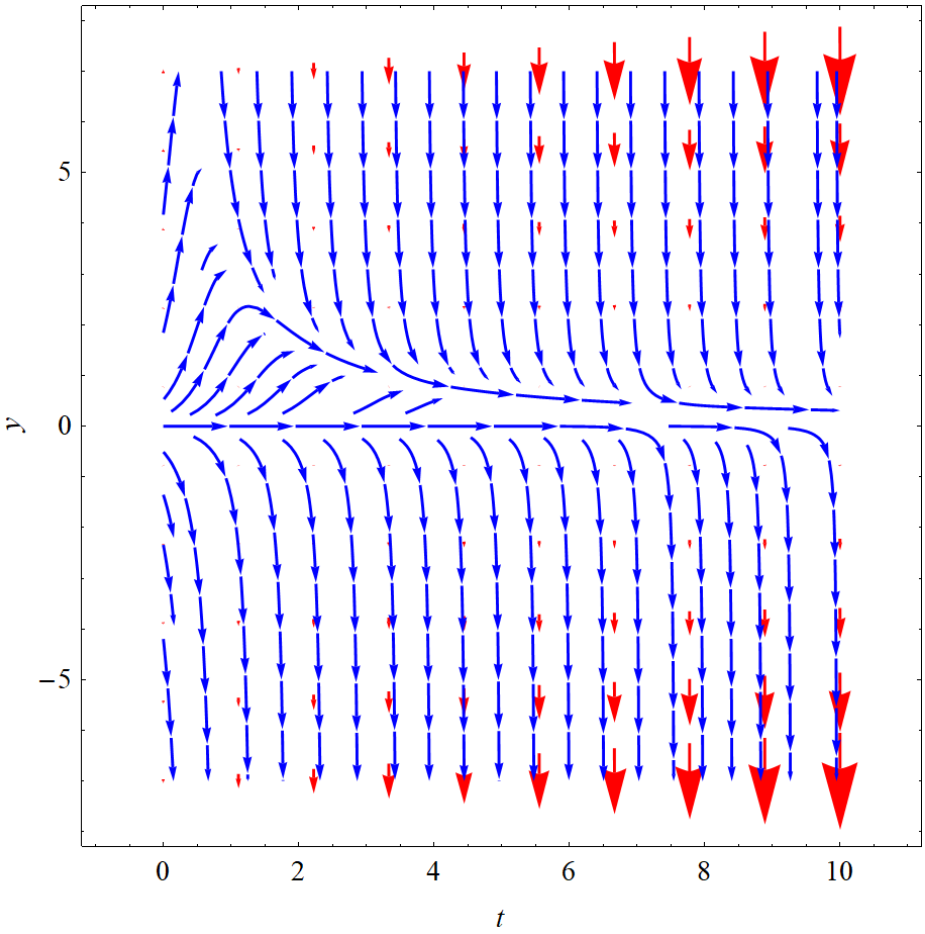

Figure 1: In red are the direction field vectors and in blue are possible solutions to the differential equation, depending what the initial condition is. Solutions with initial conditions above $y = 0$ appear to converge as $t \to \infty$, but solutions with initial conditions below $y = 0$ appear to diverge as $t \to \infty$.