

### Problem 8

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.

$$y' = -ty + 0.1y^3$$

#### 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.

$$\langle dt, dy \rangle = \left\langle 1, \frac{dy}{dt} \right\rangle dt = \langle 1, -ty + 0.1y^3 \rangle dt$$

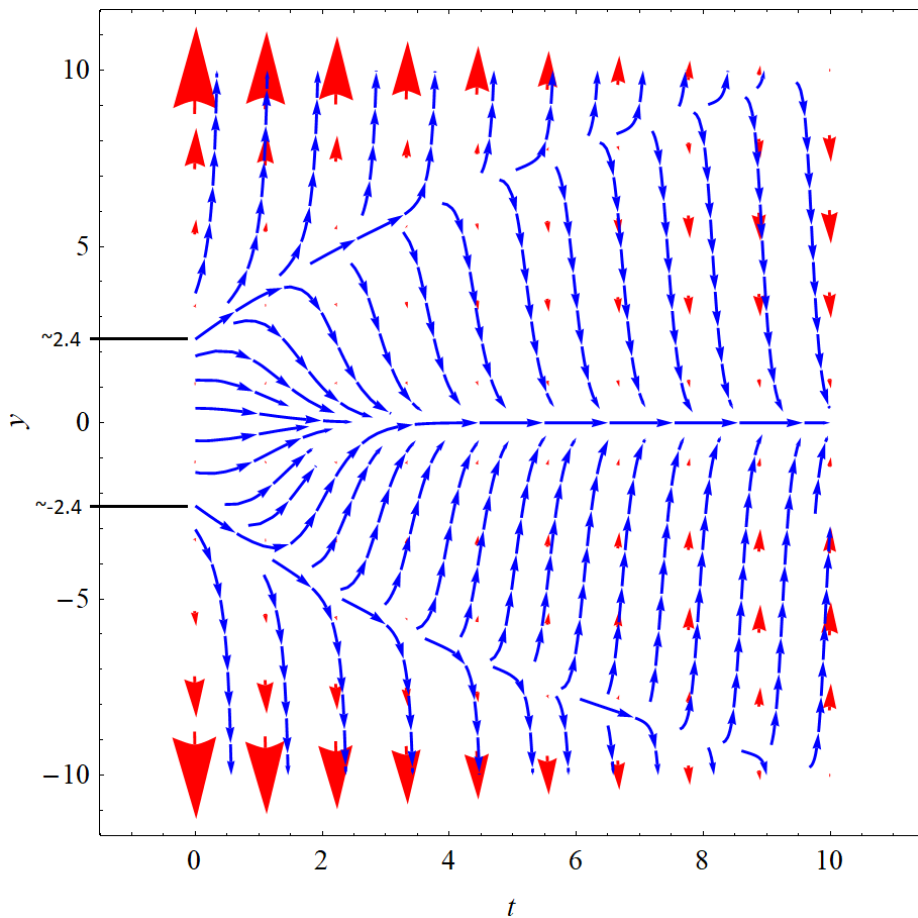


Figure 1: In red are the direction field vectors and in blue are possible solutions to the differential equation, depending what the initial condition is. Solutions with initial conditions below  $y \approx 2.4$  and above  $y \approx -2.4$  appear to converge as  $t \rightarrow \infty$ , but solutions with initial conditions above  $y \approx 2.4$  and below  $y \approx -2.4$  appear to diverge as  $t \rightarrow \infty$ .