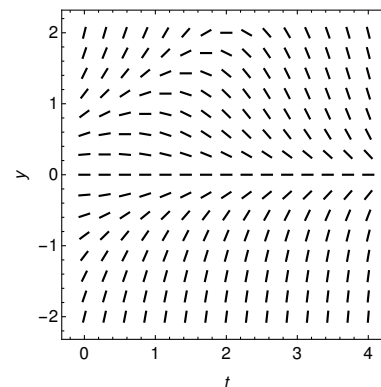


3. [12 points] In each of the following we consider a first order differential equation $y' = f(t, y)$. In these, the functions $f(t, y)$ and $g(t, y)$ are different functions.

- a. [6 points] The direction field for the equation $y' = f(t, y)$ is shown to the right. For each of the following, explain if the statement is true, false, or if you cannot tell.

- (1) The equation is autonomous, that is, $f(t, y)$ is actually only a function of y .
- (2) The equation is linear.
- (3) The initial value problem $y' = f(t, y)$, $y(0) = y_0$ has a unique solution for all y_0 between -2 and 2 .



- b. [6 points] Let $y' = g(t, y) = y(y^3 - a^3)$, where a is a real number. Identify all a for which it is true both there is a critical point other than $y = 0$, and that $y = 0$ is stable. Be sure it is clear how you arrive at your conclusion. Draw a phase line for this situation, or explain why it is impossible.