

## M 345 Problem set 1

For each of the following four equations:

- a. Sketch the direction field. Tell whether the equation is autonomous or not and explain what this implies about the direction field. Sketch two solution curves.
- b. Use integration to find a general solution for the equation. Explain what it means to say the general solution is a "1 parameter family" of solutions
- c. Find a solution that satisfies the initial condition  $y(1) = 4$ . What is the interval of existence?
- d. Find a solution that satisfies the initial condition  $y(t_0) = y_0$ . What is the interval of existence?
- e. Tell whether the equation is linear or nonlinear and show that the nonlinear equations have a solution that satisfies  $y(t_0) = 0$  that is not a member of the family of general solutions.

1.  $\frac{dy}{dt} = \sqrt{y(t)}$

2.  $\frac{dy}{dt} = 1 - y(t)$

3.  $\frac{dy}{dt} = y(t)^3$

4.  $\frac{dy}{dt} = (1 + t^2)y(t)$