

Name: _____
M555: Differential Equations I (Spring 2018)
Instructor: Justin Ryan
Good Problems 1 – Chapter 1

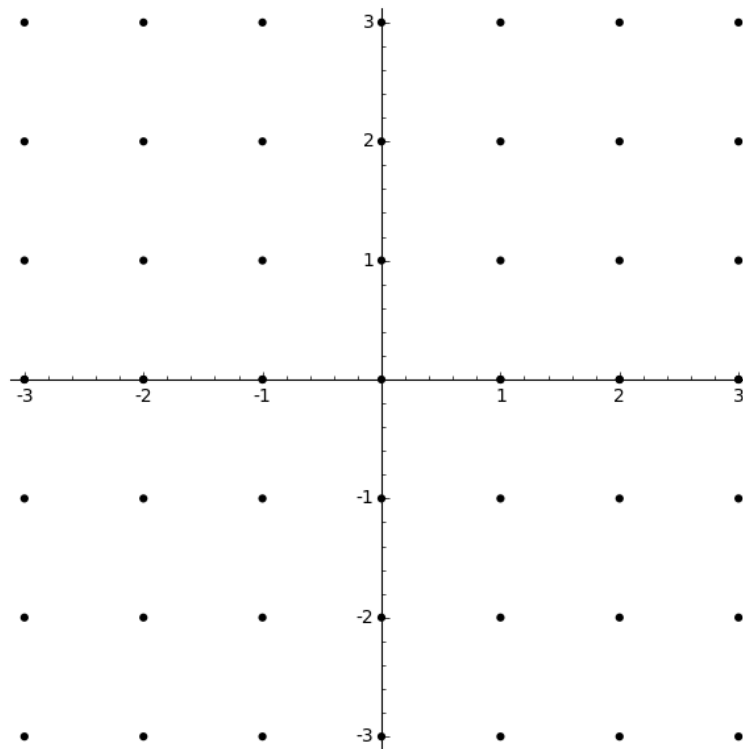


Instructions Complete all problems, showing enough work. A selection of problems will be graded based on the organization and clarity of the work shown in addition to the final solution (provided one exists).

1. Sketch the direction field for the differential equation

$$y' = 2y - 3$$

on the dot paper provided.



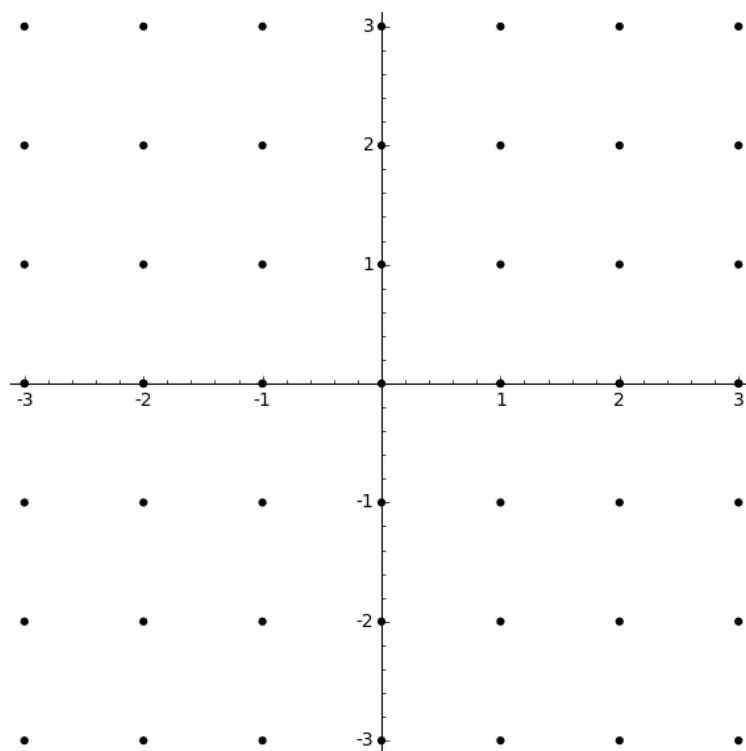
Sketch the integral curve of the DE with initial condition $y(-2) = 1$.

What is the equilibrium solution of this DE?

2. Sketch the direction field for the differential equation

$$y' = y(y - 2)$$

on the dot paper provided.



What are the equilibrium solutions?

Sketch three integral curves: one that is bounded only below by an equilibrium solution; one that is bounded only above; and one that is bounded between the equilibria. Give criteria on the initial conditions that will result in each of the cases described above. Can anything else happen?

3. Consider the differential equation $y' = ay - b$, where a and b are fixed real numbers and $a \neq 0$.
- Find the equilibrium solution φ_e .
 - For any other solution φ of the differential equation, put $Y(t) = \varphi(t) - \varphi_e(t)$. Thus Y measures the deviation of φ from equilibrium. Write down the differential equation satisfied by Y ; solve it using principals from Calc I/II; then rearrange to determine φ .
 - Use your result from part b) to find a formula for the particular solution to the initial value problem satisfying $y(t_0) = y_0$, where y_0 is not the equilibrium value.