

Math 2080: Differential Equations

Worksheet 1.2: Plotting solutions to differential equations

NAME:

Consider the ODE $y' = y - t$.

1. Draw the ty -plane (i.e., t on the x -axis, and $y(t)$ on the y -axis). Draw a dot at each integer lattice point at each (t, y) , where $t, y = -1, 0, 1$. At each of these nine points, compute $y'(t)$. On the ty -plane, draw a “hash mark” at (t, y) with slope $y'(t)$.

2. In this problem, we will use a better method to sketch the slope field of $y' = y - t$ using isoclines.

(a) Determine the set of points for which $y' = 0$ (it will be a line – set $y' = 0$ and solve for y .)

(b) Repeat the previous step except for $y' = c$, for various values of c : 1, 2, 3, -1 , $-\frac{1}{2}$.

- (c) Sketch the lines you found above on the ty -plane, which are called *isoclines*. Along each isocline, sketch the hash-marks of the corresponding slope, $y' = c$.
- (d) In the slope field above, sketch the three particular solution curves that satisfy $y(0) = 1$, $y(0) = -\frac{3}{4}$, and $y(1) = -\frac{3}{4}$, respectively.
3. Find the steady-state solutions to the autonomous ODE $y' = (y+2)(y-1)$. Sketch these solutions on the ty -plane, as well as the curves of three particular solutions that satisfy $y(0) = -3$, $y(0) = 0$, and $y(0) = 3$, respectively.