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 x-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 automonous ODE $y' = (y+2)(y-1)$. Sketch these solutions on the ty-plane, as well as the curves of three three particular solutions that satisfy $y(0) = -3$, $y(0) = 0$, and $y(0) = 3$, respectively.