Quiz 1, Differential Equations (Spring 18)

This is a take home quiz. For some questions, you'll be using the DEtools software. **For these problems, summarize your answer by hand**, and take a screenshot of your computer screen (for each problem). Upload the four screenshots to your CLEO dropbox before the deadline.

Upload the screenshots on or before Wednesday, midnight. I'll collect your hand summaries on Wednesday at the beginning of class.

1. Open "TargetPractice" in the software. Press "Set Target", then select the point $(1, 1)$. Now, with $y' = y^2 - t$, find a solution curve that will go through that "target" point. Try not to simply select the target, try to hit the target by starting somewhere on the left side of the direction field. Take a screen shot of the result.

2. Similar to the last problem, but use $y' = \sin(y)$ as the differential equation (same target). Something to think about for class later: Is the solution curve ever periodic?

3. Suppose that $y' = (y^3 - y)(t - 1)$. Using `HPGSolver`, analyze the behavior of the solutions graphically using the direction field. In particular, note the different solutions you obtain at $t = 1$. Use trial and error to see if you can determine a value of $y(1)$ so that $y(t)$ stays bounded for all time, or $y(t)$ becomes unbounded.

   Note: When entering the differential equation into HPGSolver, remember that $*$ is used for multiplication, and for an exponentiation, use `^`*. For example,* `y^3`*.*

4. Consider $y' = ty^2 + 2y^2$ with $y(0) = 1$. (a) Solve this using separation of variables. (b) Using `HPGSolver`, show this solution, and estimate the values of t for which the solution exists.