6. [6 points] Consider the following differential equation

$$\frac{dy}{dx} = (x - y)(y - 2)$$

a. [2 points] Find all the equilibrium solutions of the differential equation (if any). If the differential equation has no equilibrium solutions, write none.

Solution: $y = 2$

b. [4 points] Use inequalities to describe the regions in the slope field of the differential equation where the solution curves are increasing.

Solution: The regions in the slope field in which the solution curves are increasing can be determined by finding where

$$\frac{dy}{dx} = (x - y)(y - 2) > 0.$$

Region 1: $x - y > 0$ and $y - 2 > 0$. In other words $x > y$ and $y > 2$.

Region 2: $x - y < 0$ and $y - 2 < 0$, or $x < y$ and $y < 2$