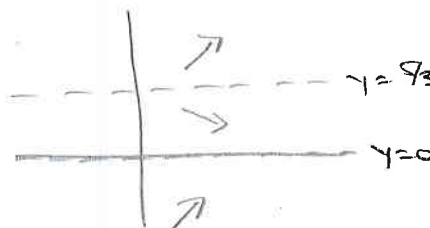
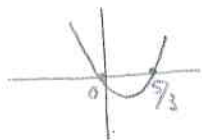


Instructions: You must show all work to receive full credit for the problems below. You may check your work with a calculator, but answers without work will receive minimal credit. Use exact answers unless the problem starts with decimals or you are specifically asked to round.

1. Sketch the direction field for the equation $\frac{dy}{dt} = y(3y - 5)$.
- Is the equation autonomous?
 - How many equilibria does the equation have? What are they?
 - For each equilibrium point, is it stable, unstable or semi-stable?
 - Can any of the equilibrium points be considered a carrying capacity or a threshold? If so, which equilibrium and which term applies?

$$0 = y(3y - 5) \quad y = 0 \quad y = \frac{5}{3}$$



- a). yes
 b) 2 ; $y = 0$, $y = \frac{5}{3}$
 c) for $y = 0$: stable ; $y = \frac{5}{3}$ unstable
 d) for $y = \frac{5}{3}$, threshold

2. Solve the differential equation $\frac{dy}{dt} = 4 + y$ for the analytic solution. Solve for the missing constant if the initial condition is $y(0) = 1$.

$$\frac{dy}{dt} = 4 + y \Rightarrow \int \frac{dy}{4+y} = \int dt \Rightarrow \ln|4+y| = t + C \Rightarrow$$

$$4+y = e^{t+C} \Rightarrow 4+y = Ae^t \Rightarrow y = Ae^t - 4$$

$$1 = Ae^{(0)} - 4 = A - 4 \quad A = 5$$

$$\boxed{y = 5e^t - 4}$$