

## Quiz 1      MAP 2302/3305 – Ordinary Differential Equations

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This is a 50 minute quiz.

1. Draw a graph that describes the equilibrium solutions and flows for the differential equation:

$$\frac{dy}{dt} = y^2(y - 1) \quad -\infty < y_0 < \infty.$$

Label the stable, semi-stable and unstable equilibrium solutions.

2. Solve the differential equation

$$y'' - 3y' + 2y = 0,$$

given the initial conditions  $y(0) = 5$  and  $y'(0) = 3$ . What happens to the solution  $y(t)$  as  $t \rightarrow \infty$ ? Draw a rough graph of  $y(t)$ .

3. Consider the differential equation  $y'' + 9y = 0$ .

(a) Show that  $y_1(t) = \cos(3t)$  and  $y_2(t) = \sin(3t)$  satisfy the differential equation.

(b) Use the Wronskian to determine whether  $y_1$  and  $y_2$  (from part 3(a)) are linearly independent. Do they form a set of fundamental solutions?

4. (Bonus) Find a differential equation that has fundamental solutions  $y_1(t) = e^{7t}$  and  $y_2(t) = e^{-3t}$ .