

**Quiz 2, Math 246, Professor David Levermore
Tuesday, 10 September 2019**

Your Name:

Discussion Instructor (circle one): Sam Potter Nathan Yu David Russell
Discussion Time (circle one): 9:00 11:00 12:00

**No books, notes, calculators, or any electronic devices.
Show your reasoning for full credit. Good luck!**

- (1) [5] Sketch the phase-line portrait for the equation

$$\frac{dw}{dt} = \frac{(w+4)(w+1)^3(w-5)^2}{(1+w^2)^2(w-2)}.$$

- (a) [3] Identify each stationary point as being either stable, unstable, or semistable.
(You do not have to find the solution!)
- (b) [2] How does $w(t)$ behave as $t \rightarrow \infty$ if $w(3) = 0$? if $w(-3) = 4$?

- (2) [5] A tank with a capacity of 25 liters initially contains 13 liters of brine (salt water) with a salt concentration of 3 grams per liter (gr/lit). At time $t = 0$ brine with a salt concentration of 5 grams per liter (gr/lit) begins to flow into the tank at a constant rate of 4 liters per minute (lit/min) and the well-stirred mixture flows out of the tank at a constant rate of 2 liters per minute (lit/min). Write down an initial-value problem that governs the grams of salt in the tank for $t > 0$ until the tank overflows. (Do not solve the initial-value problem!)