Quiz 3, Math 246, Professor David Levermore
Thursday, 17 September 2020

This formative assessment helps you see how well you understand the material. To get an accurate assessment please do not use books, notes, or electronic aids. Show your reasoning for full credit. Good luck!

(1) [5] A tank with a capacity of 50 liters initially contains 23 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 7 grams per liter (gr/lit) begins to flow into the tank at a constant rate of 5 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).

   (a) [1] Find $V(t)$, the volume (lit) of brine in the tank as a function of time.

   (b) [4] Give an initial-value problem that governs $S(t)$, the grams of salt in the tank for $t > 0$ until the tank overflows. (Do not solve the initial-value problem!)

(2) [5] Consider the solution $r(t)$ of the initial-value problem

$$\ddot{r} = -\frac{4}{r^3}\,, \qquad r(0) = 2\,, \quad \dot{r}(0) = 3\,.$$

Find the reduced initial-value problem satisfied by $r(t)$.