

[Hint: Fill-in the blank with the appropriate sum of derivatives-of- y times various constants.]

This TYPED IOP (Individual Optional Project) is due **2:30PM, Thur, 07Dec2017**, slid *completely* under my office door, 402 LITTLE HALL. This sheet is “Page 1/ N ”, and you’ve labeled the rest as “Page 2/ N ”... “Page N/N ”.

HONOR CODE: “I have neither requested nor received help on this exam other than from my professor (or his colleague).”
Name/Signature/Ord

V1: We have 4 brine-filled tanks. Call the ocean “tank-0”, with salinity $S_0 :: \frac{\text{lb}}{\text{gal}}$. For $j = 1, \dots, 4$, the *initial* salinity in tank- j is $S_j :: \frac{\text{lb}}{\text{gal}}$. The *initial* volume in each tank is $U := 50\text{gal}$.

For $j = 0, \dots, 4$, tank- j outputs into tank- $[j+1]$ (“tank-5” is the drain), at rate $[10 - j] \frac{\text{gal}}{\text{min}}$.

Let $\sigma_j(t)$ denote the salinity in tank- j at time t . With Large, Labelled, carefully drawn pictures, show the situation and carefully derive a DE for each $\sigma_j()$. Carefully define any additional fncs you need (such as the volume of water in a tank at a given time) so as to make your derivation clear and rigorous.

Solve the DEs as far as you can, using any of our methods from class, with explanation.

If you are unable to get exact solns for some DEs, give numerical approximations.

V2: Solve problem #36P391.NSS9, the **unit triangular pulse** problem, in a carefully written essay. Also include good pictures in your explanation.

V3: Short answer; show no work.

a U.F. $x = x(t)$ satisfies $2x^{(3)} + 5x^{(2)} - x = 0$.

Then $Y := \begin{bmatrix} x \\ x' \\ x'' \end{bmatrix}$ satisfies $Y' = M \cdot Y$, where M is this 3×3 matrix of numbers:

$$M = \begin{bmatrix} & & \\ & & \\ & & \end{bmatrix}.$$

b Let $U := 3 - 2i$ and $W := 4 + i$. The gen.soln to a CCLDE is $y_{\alpha,\beta}(t) = \alpha \cdot e^{Ut} + \beta \cdot e^{Wt}$. Thus, the CCLDE that every such $y()$ satisfies is

$$= 0.$$

Ord: _____

Folks, I've had a great time learning DfyQ material with you. Stop by in future semesters for Math/chess/coffee/frisbee....

Cheers, Prof. K