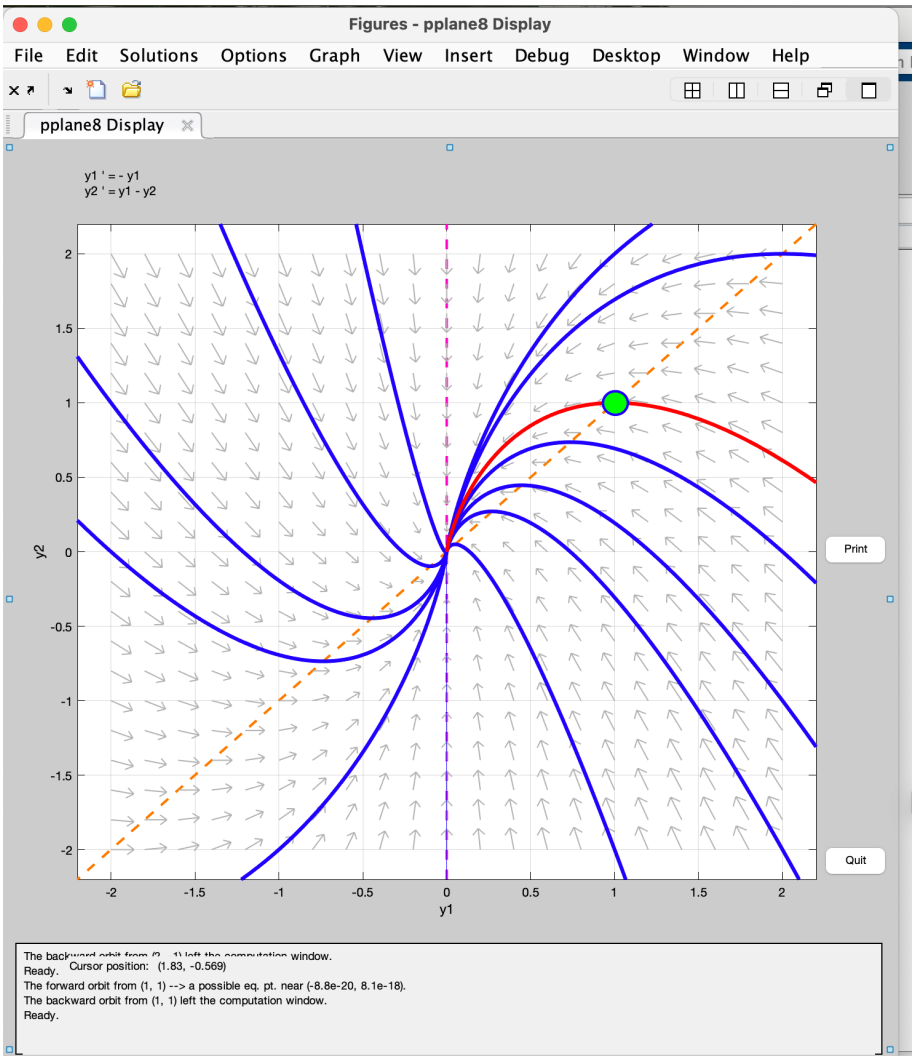
Drexel University
Office of the Dean of the College of Engineering
ENGR 232 – Dynamic Engineering Systems

Lab 8 Answer Template **Section: 61** **Name: Cole Bardin**
Water Clocks – Polyvascular Clepsydra *First* *Last*

Question 1: Record your answer for $H(t) = 1 - y_1(t)$ here. **Answer:** $H(t) = 1 - e^{-t}$

Question 2: Record your answer for $H(1)$ here. **Answer:** $H(1) = 1 - \frac{1}{e} = 0.632$
Give answer to at least three decimals.

Questions 3-4: Paste your completed phase plot here. (2 points)



Question 5: Record your solution for the two unknowns $y_1(t)$ and $y_2(t)$. The first is given for you.

Answer: $y_1(t) = e^{-t}, \quad y_2(t) = e^{-t} + t * e^{-t}$

Question 6: Record your answers for the cumulative outflows. The first is given for free.

Answer: $f_1(t) = 1 - e^{-t}, \quad f_2(t) = 2 - te^{-t} - 2e^{-t}$

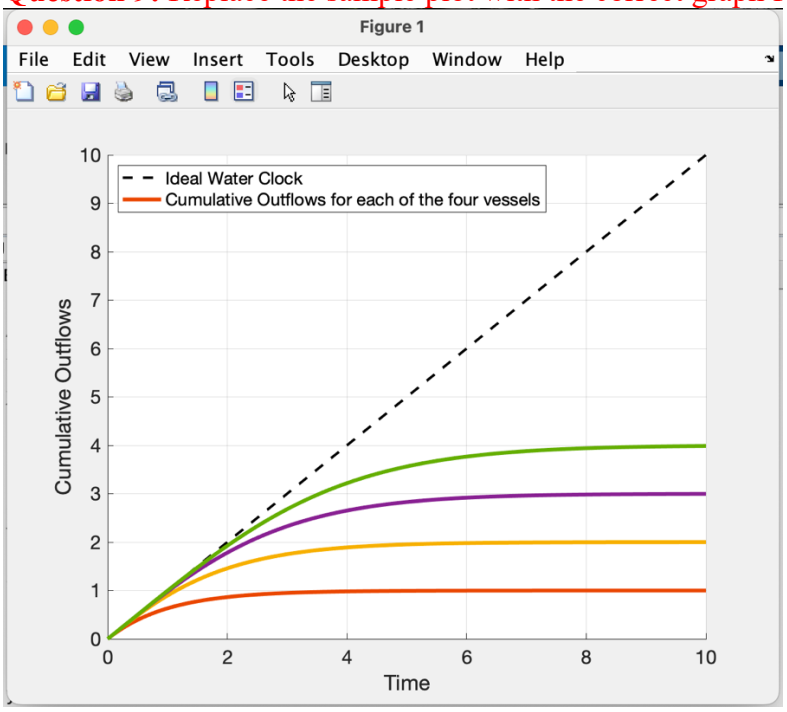
Question 7: The solution in the transform domain is:

$$\vec{\mathbf{X}}(s) = \begin{bmatrix} X_1(s) \\ X_2(s) \end{bmatrix} \text{ where } X_1(s) = \frac{1}{s+1} \text{ and } X_2(s) = \frac{1}{s+1} + \frac{1}{(s+1)^2}$$

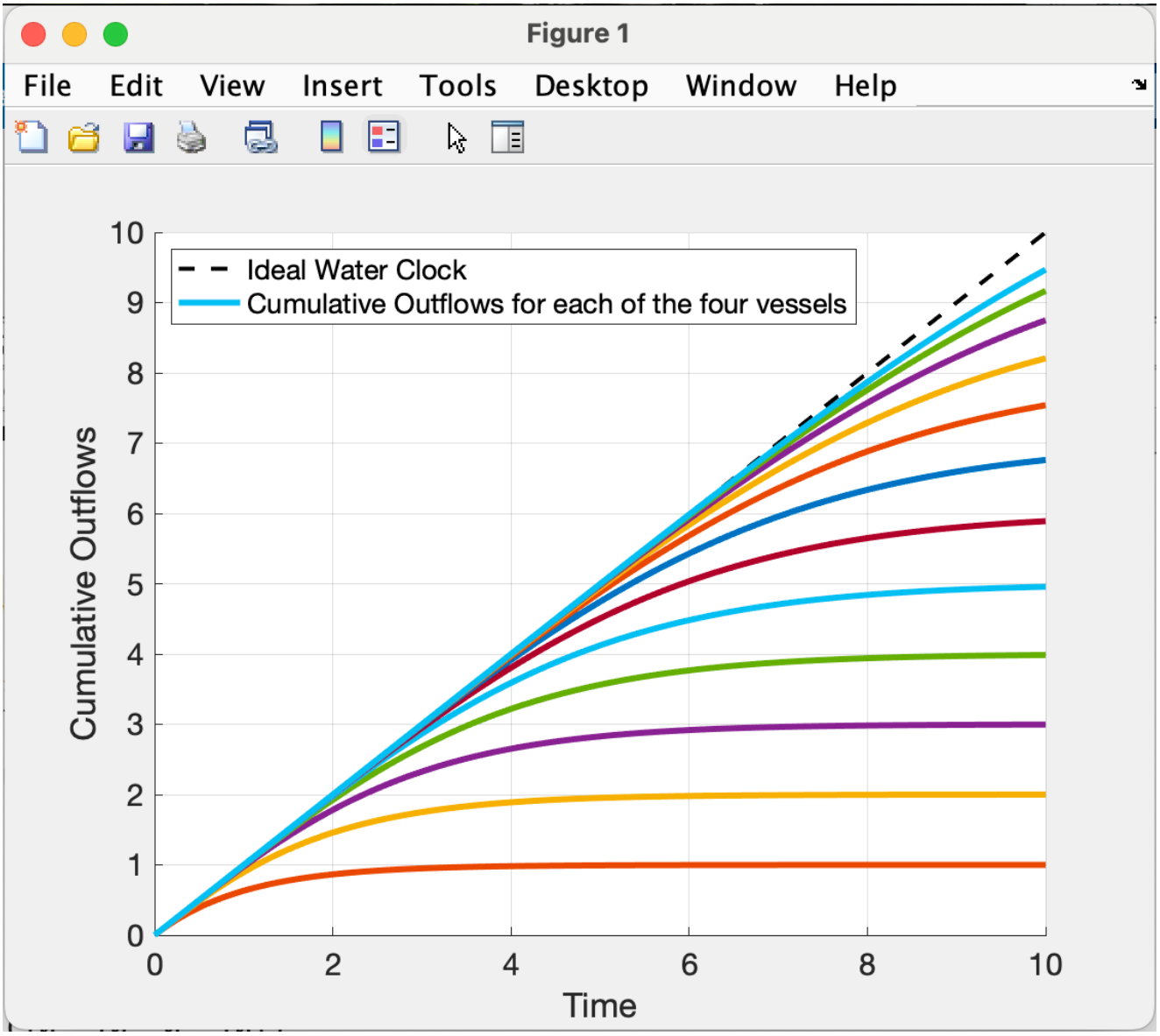
Question 8: Complete this code to find the cumulative flow vector $\vec{\mathbf{f}}(t)$ using Laplace transforms:

```
syms s
A=[-1 0; 1 -1] % system matrix
x0 = [1;1] % initial conditions
X =  inv((s*eye(2) - A))*x0 % find X here using inv()
F = X / s % find F here. Integration is division by s.
f = ilaplace(F) % find f here using ilaplace.
```

Question 9: Replace the sample plot with the correct graph for a clepsydra with **four** vessels. (not 6!)



Question 10: Paste your completed cumulative flow graph for a clepsydra with **twelve** vessels here.



Ready to Submit?

Be sure all ten questions are answered. When your lab is complete, be sure to submit three files:

1. Your **completed Answer Template** as a PDF file
2. A copy of your **MATLAB Live Script**
3. A **PDF** copy of your **MATLAB Live Script** (Save-Export to PDF…)

The due date is the day after your lab section by **11:59pm** to receive full credit. You have one more day, to submit the lab (but with a small penalty), and then the window closes for good and your grade will be zero.