

Problem Set 1

(1) Equation (2.2.4) gives the response of a first-order system to a step input. Let the initial condition $y(0)$ be zero. Let the step occur at $t = 0$. Complete this table:

t/τ	$y/y(t=\infty)$
0	
1	
2	
3	
4	
5	

(2) You are making measurements in the 10.26 lab using a glopwhanger apparatus: you set a value on the porfinoz dial, wait for the resbilap indicator to stabilize, and record the new reading. You realize that the glopwhanger behaves as a first-order system with a time constant of 5 minutes. About how long will it take you to obtain 10 readings? Please explain your time estimate. Will you be on time for the team-building meeting at 4:00?

$$(3) \quad \tau \frac{dy}{dt} + y = KU(t - t_0) \quad y(0) = 0$$

(a) determine y by plugging into Equation (2.2-3).

(b) determine y by recognizing that the equation is separable, so that you can integrate without using the general integrating factor.

Please show your steps in both methods.

(4) The first-order system is

$$\frac{dy}{dt} = -\frac{y}{4} - \frac{x}{2} \quad y(0) = 1$$

The input disturbance x is initially zero. At $t = 2$, however, x undergoes a rectangular pulse of magnitude 2 and duration 2.

(a) determine y by treating the pulse as a non-smooth disturbance (Section 2.3)

(b) determine y by treating the pulse as two counteracting steps (Section 2.4)

Plot your results over an appropriate time interval.