CS CM 182 Lab 1

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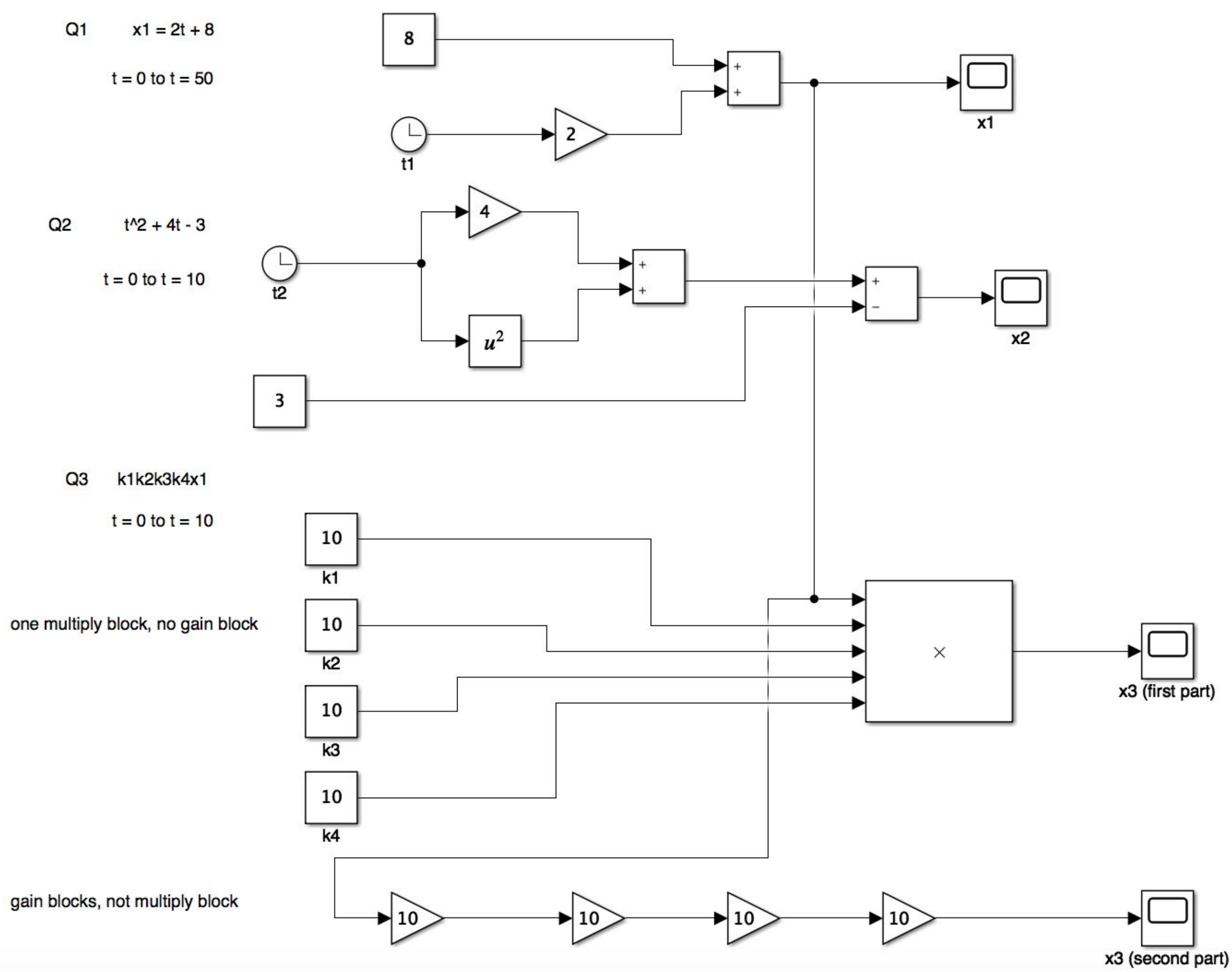
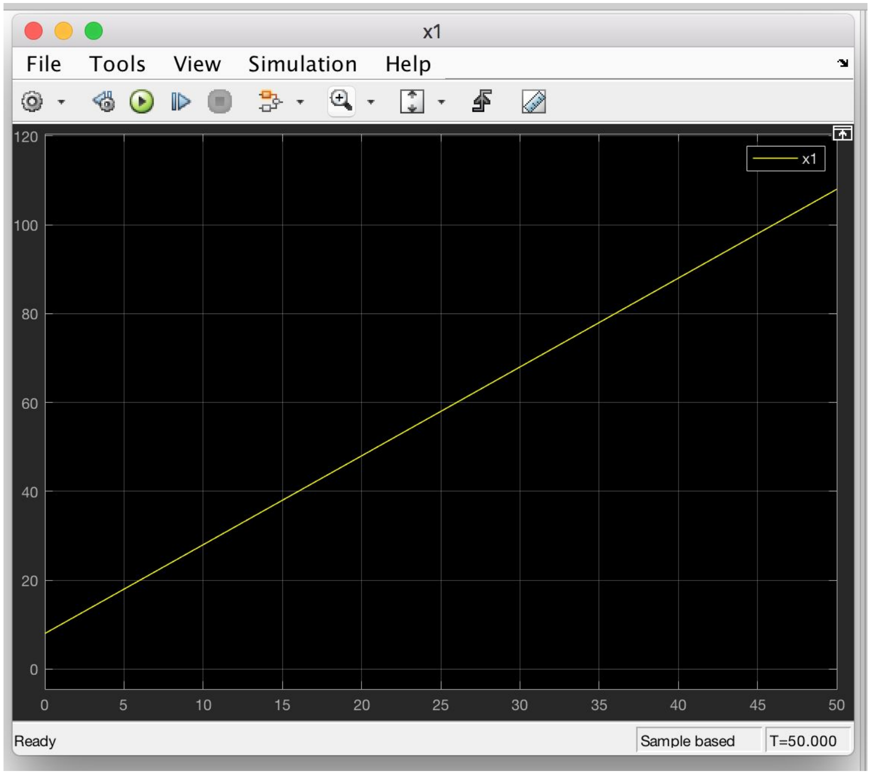
I completed this written part of the homework, lab report, or exam entirely on my own.

Entire Simulink Chart (Q1 to Q3)



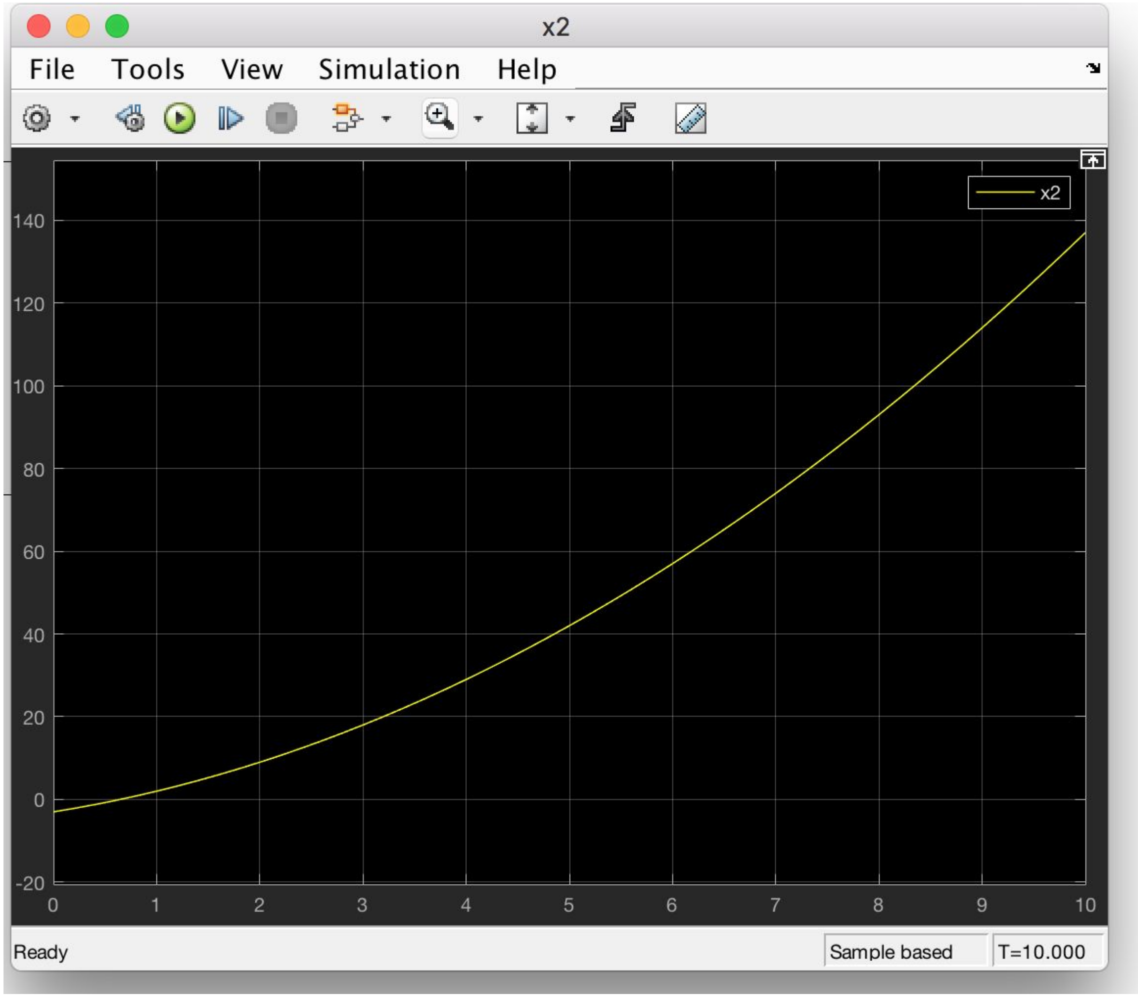
Analysis

Q1



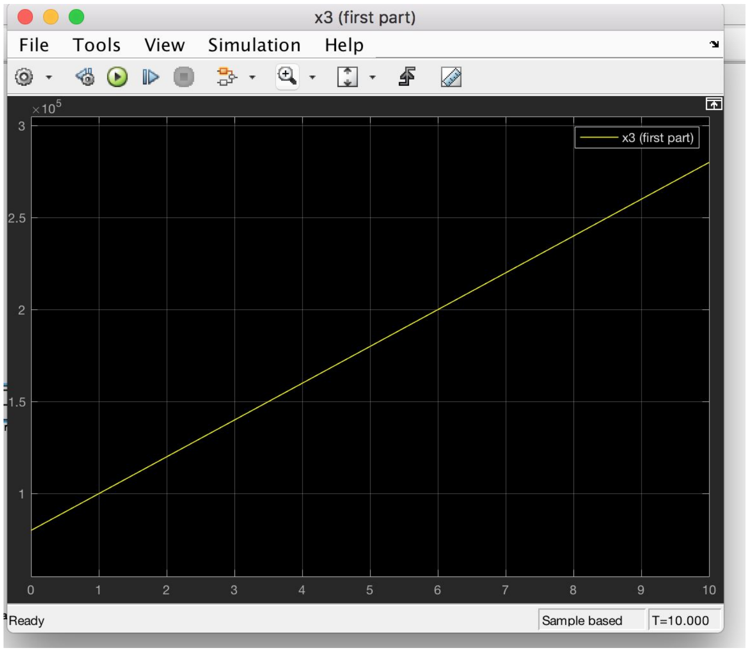
x1
File Tools View Simulation Help
x1
120
100
80
60
40
20
0
0 5 10 15 20 25 30 35 40 45 50
Ready
Sample based
T=50.000

Q2

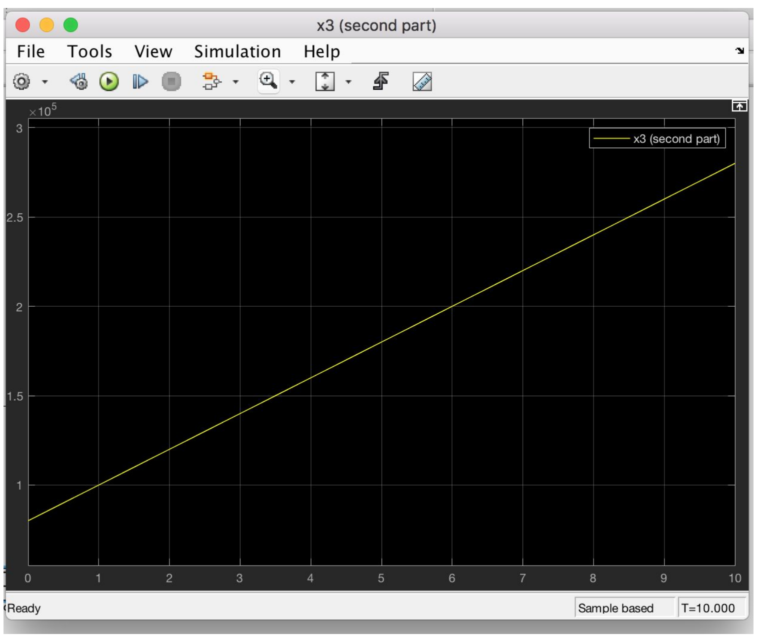


x2
File
Tools
View
Simulation
Help
x2
140
120
100
80
60
40
20
0
-20
0
1
2
3
4
5
6
7
8
9
10
Ready
Sample based
T=10.000

Q3



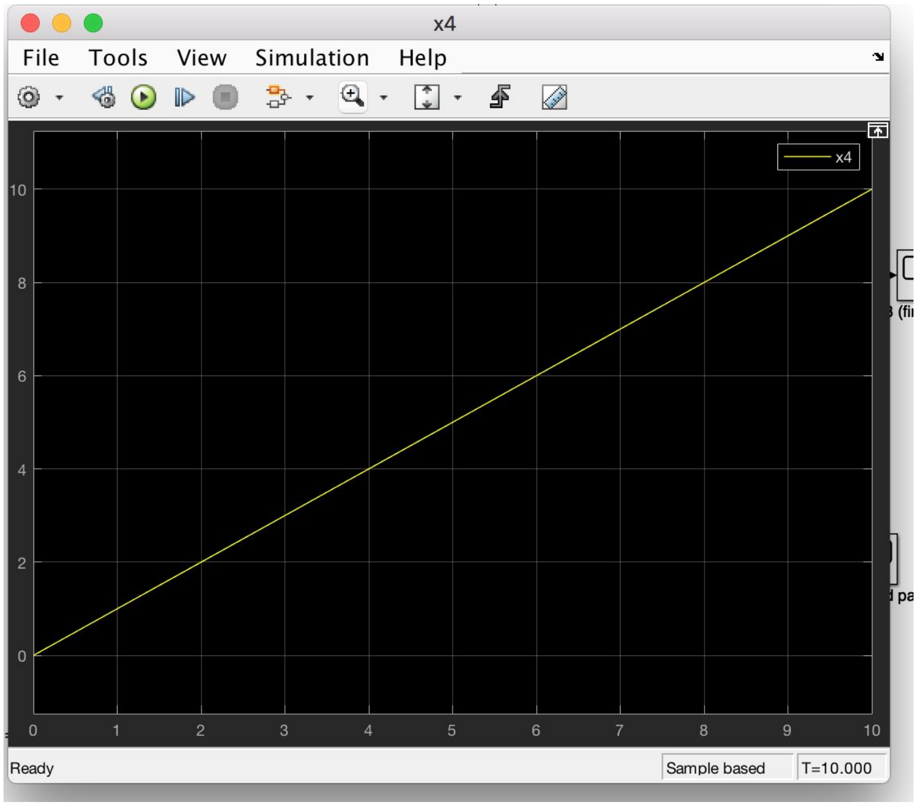
(use one multiply block)



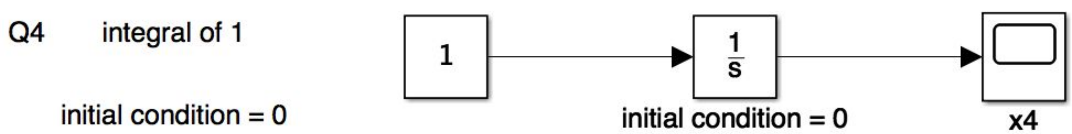
(use gain block, no multiply)

The method with using gain blocks and no multiply blocks is more cleaner because the total used blocks is one less than the method using one multiply block and no gain blocks. The total used blocks with just using gain blocks are 5 while the total used blocks with just using one multiply block are 6. Also, the structure is sequential and looks more straightforward.

Q4



x4
File Tools View Simulation Help
x4
10
8
6
4
2
0
0 1 2 3 4 5 6 7 8 9 10
Ready
Sample based
T=10.000



Q4 integral of 1
initial condition = 0
1
1/s
initial condition = 0
x4

Integrate 1 by hand

$\int 1 \, dt \to t + C$ → $C = 0$ (initial condition $= 0$)

$x_4(t) = t$

$x_4(10) = 10$

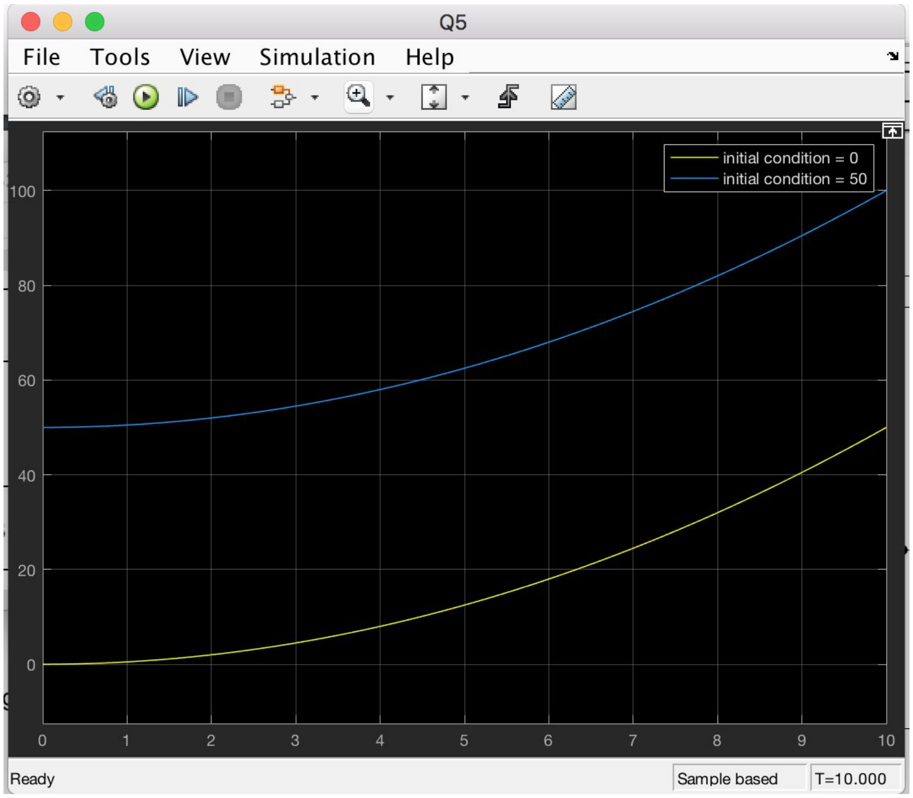
$x_4(2) = 2$

$$\int_0^5 1 \, dt \to t \Big|_0^5 \quad 5 - 0 = \boxed{5}$$

$$\int_0^2 1 \, dt \to t \Big|_0^2 \quad 2 - 0 = \boxed{2}$$

Verification by taking integral by hand with two points

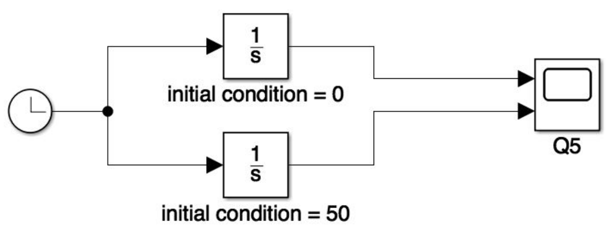
Q5



Q5 integral of t

initial condition = 0

initial condition = 50



Integrate t by hand

$$\int t\,dt \rightarrow \frac{t^2}{2} + C$$

a)

$$\int_0^5 t\,dt \rightarrow \frac{t^2}{2}\Big|_0^5 \quad \frac{5^2}{2} - \frac{0^2}{2} = \frac{25}{2} = \boxed{12.5}$$

b)

$$\int_0^2 t\,dt \rightarrow \frac{t^2}{2}\Big|_0^2 \quad \frac{2^2}{2} - \frac{0^2}{2} = \boxed{2}$$

~~init~~ initial condition = 0 (C = 0)

a) 12.5 + 0 = 12.5

b) 2 + 0 = 2

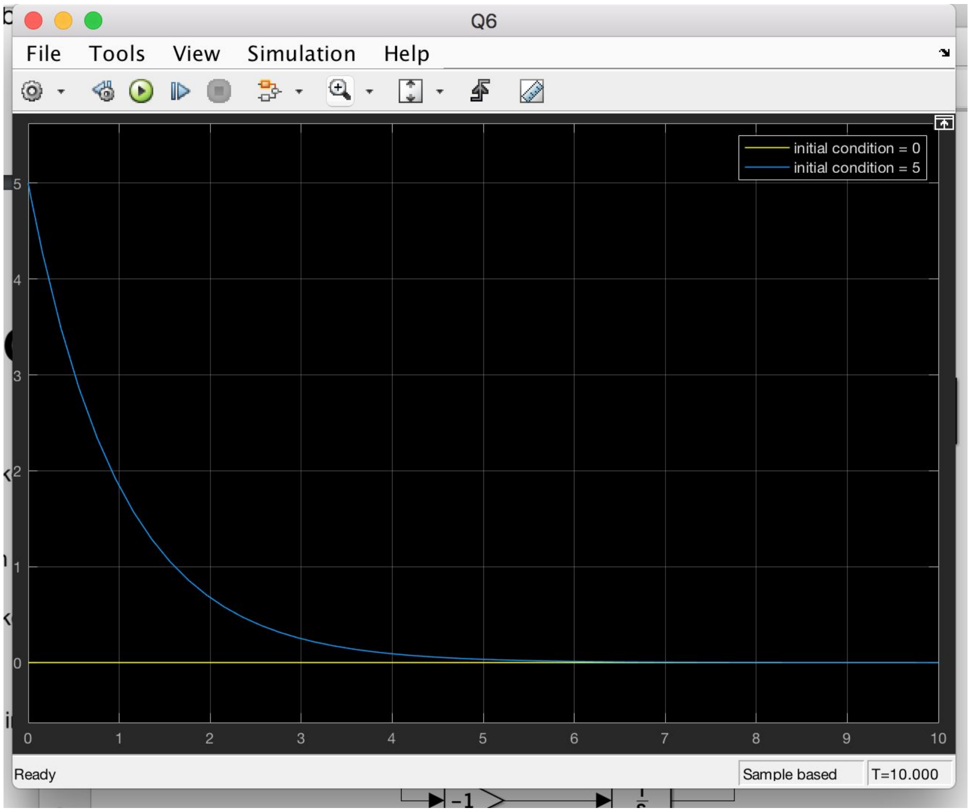
initial condition = 50 (C = 50)

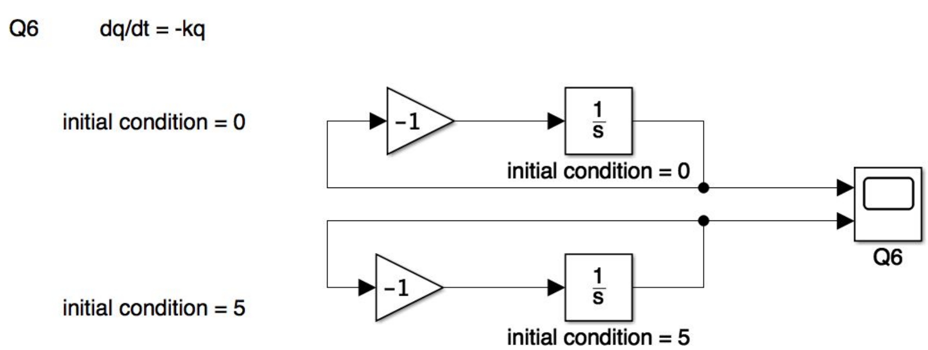
a) 12.5 + 50 = 62.5

b) 2 + 50 = 52

Verification by taking integral by hand with two points

Q6





k is a parameter and q is a state variable.

The difference I see between the two plots are their own shape and structure. The plot with initial condition = 0 shows as a flat horizontal line on the x-axis. The plot with initial condition = 5 is first concave up and then approaching zero as x-axis goes to infinity. The blue plot looks like a negative exponential function. The two plots start with different initial conditions which contribute to starting at different y-axis values (initial condition, c) and integrate under different areas of the equations. Different initial conditions for order differential equations yield uniquely different future motions. Order differential equations have different solution trajectories for $t > 0$, starting from different initial conditions, different starting states.

In terms of equations, we have $q = C * e ^ {(-t)}$
For the yellow plot with initial condition = 0 and C = 0, the equation becomes $q = 0$
For the blue plot with initial condition = 5 and C = 5, the equation becomes $q = 5e ^ {(-t)}$.