**Answer Template for Lab 1  
ENGR 232 – Dynamic Engineering Systems**

**Lab #1:Bertalanffy Model Lab Section: 61 Name: Cole Bardin**

**Summer 2022** *first last*

**Question 1:** The integral *Y* is: C + 25\*atan(x) + 50\*atanh(x)

clc, clear, close all

syms x C;

y = (75 + 25\*x\*x)/(1-x\*x\*x\*x)

Y = int(y, x) + C

**Question 2.** The general solution is: 3\*t + (C1\*exp(-5\*t))/5 + 2

clc, clear, close all

syms y(t);

DE = diff(y,t) + 5\*y == 13 + 15\*t

sol = dsolve(DE)

**Question 3.** The solution satisfying is 3\*t - 2\*exp(-5\*t) + 2

syms y(t);

DE = diff(y,t) + 5\*y == 13 + 15\*t

sol\_spec = dsolve(DE, y(0)==0)

**Question 4.** The solution satisfying the initial condition is: -(exp(-t/6) - 2)^3

**Paste your code here:**

a = 1; b = a/2;

syms V(t)

% Now enter the Bertalanffy differential equation and name it DE.

DE = diff(V,t) == a\*(V^(2/3)) - b\*V;

% Take only the real solution. Ignore the two imaginary solutions.

sol = dsolve(DE, V(0)==1);

sol = sol(1) % Parse out first real answer

**Question 5:** Paste your completed image here, showing the solution with for the Bertalanffy Model.

Chart

Description automatically generated

**Part B: Qualitative Analysis**

**Questions 6-7: Paste your completed image in the Answer Template.**

Use the **View > Property Editor** so **all** the necrotic curves are shown in **red** and the growing tumors are shown in **blue**.

Graphical user interface

Description automatically generated

**Question 8: Stability: Stable or Unstable?**

The critical value *V* = is: Semi-stable

**Question 9:** Paste in the code you added to solve for the volume V at which the tumor grows the fastest.

**Question 9: Paste your code here.**

df = diff(f,V)

% Find the volume where the tumor grows the fastest using solve().

df = diff(f,V);

V\_max\_growth = solve(df, V)

% Paste in MATLAB's answer for **V\_max\_growth.**

**(8\*a^3)/(27\*b^3)**

**Question 10: Paste your completed code in the answer template.**

%% Question 10. Linearized Bertalanffy Differential Equation

clear, clc

a = 1, b = a/2

syms r(t) pi % Be sure to make pi symbolic!

a1 = sym(a \* (1/(36\*pi))^(1/3)), b1 = sym(b/3)

% Enter the linearized Bertalanffy DE here.

DE = diff(r,t) == a1 - b1\*r;

% Use dsolve to find the solution with r(0)==(3/(4\*pi))^ (1/3)

rt = dsolve(DE, r(0)==(3/(4\*pi))^ (1/3) )

% Compute and simplify V(t) using the formula for the volume of a sphere of radius r.

Vt = simplify((4\*pi/3)\*(rt^3))

**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. An **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.