

$$\frac{dx}{dt} = \dot{x}$$

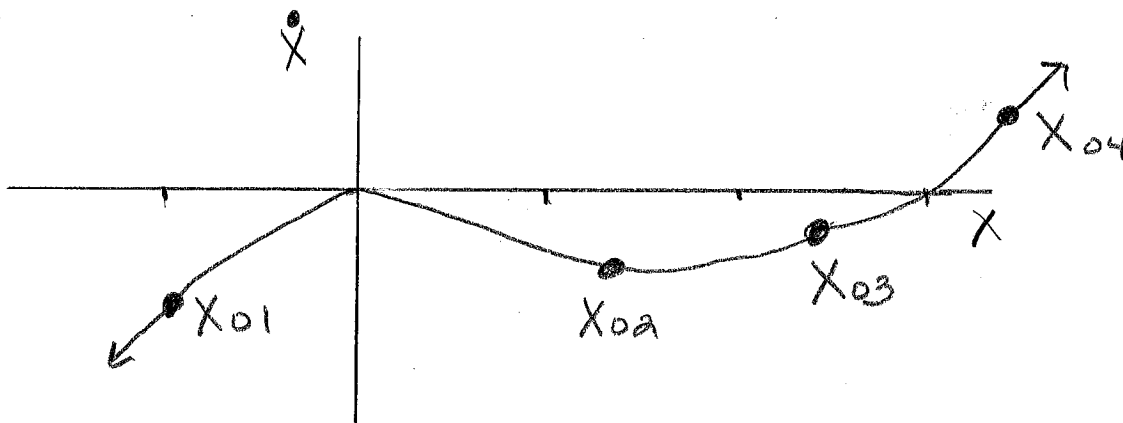
1. Solve by separation of variables and plot the solution to the ODE:

$$\dot{x} = 4x - 2; t \geq 1, x(1) = \frac{3}{4}$$

2. Solve the equation $\dot{x} = -x \ln(x), t \geq 0, x(0) = x_0$.

What is the asymptotic value of x at $t \rightarrow \infty$. EXPLAIN your answer.

3. For the given graph, re-sketch a graph for x_{01} and indicate the system progress (using arrows and EXPLAIN) from x_{01} as $t \rightarrow \infty$. Identify any critical points as stable, unstable, or semi-stable (EXPLAIN). Repeat for x_{02}, x_{03} , and x_{04} .



4. Draw and label the phase diagram (\dot{x} vs. x). Indicate the system progress (using arrows and EXPLAIN). Identify any critical points as stable, unstable, or semi-stable (EXPLAIN): $\dot{x} = \alpha_1 x - \alpha_2, \alpha_1 > 0, \alpha_2 > 0$.

5. Draw and label the phase diagram (\dot{x} vs. x) for $\dot{x} = 3x^2 - 9x$. Indicate the system progress (using arrows and EXPLAIN). Identify any critical points as stable, unstable, or semi-stable (EXPLAIN).

6. A harvesting model is represented by: $\dot{x} = \alpha_1 x - \alpha_2 x^2 - h; \alpha_1 > 0, \alpha_2 > 0, h > 0$.

a. Draw the phase diagram (\dot{x} vs. x) and label the values of the intercepts and the point of maximum \dot{x} .

b. Identify any critical points as stable, unstable, or semi-stable (EXPLAIN).

c. What values of h doom the crop to complete depletion (EXPLAIN)?

d. What is the maximum value of h that produces a critical crop level (EXPLAIN).

e. Plot \dot{x} vs. x for maximum h and determine if the critical point is stable, unstable, or semi-stable (EXPLAIN).

f. How does the maximum value of h change if α_1 , the reproduction rate parameter, increases (EXPLAIN)?

g. How does the maximum value of h change if α_1 , the reproduction rate parameter, decreases (EXPLAIN)?

7. $\dot{x} = \alpha_1 x - \alpha_2$ If x has units of ounces and \dot{x} has units of ounces per second, what are the units of α_1 and α_2 (EXPLAIN)?