

DIFFERENCE AND SUM TYPE DIFFERENTIAL EQUATIONS

1. Dead leaves accumulate on the ground at a rate of 4 grams per square centimeter per year. At the same time they are decomposing at a continuous rate of 64% per year.

A. Write an initial value problem for the amount of dead leaves (per square centimeter) at time t .

B. Find the equilibrium solution. What happens to the amount of dead leaves on the ground if the initial amount is more than the equilibrium? less than the equilibrium? Is the equilibrium stable?

2 An investor has \$1000 to open a bank account and plans to add \$800 per year. All funds in the account will earn 5% annual interest compounded continuously.

A. Write an initial value problem for the amount of money in the account at time t .

B. Solve the initial value problem.

3. A 120 gallon tank is full of water in which S_0 pounds of salt are dissolved. Starting at time $t = 0$ minutes, a salt solution containing $1/2$ pound of salt per gallon is added to the tank at a rate of 6 gallons per minute. Assume the solution mixes instantly and any excess drains off.

A. Write an initial value problem for the amount of salt in the tank at time t .

B. Write an initial value problem for the concentration of salt in the tank at time t .

4. Biologists introduced a new variety of fish into a lake. Their model predicts that the population should double every 18 months. Assuming $k > 0$ and A_L is the limiting population that the lake can maintain, which model are the biologists using? In each case, write a general solution.

$$\frac{dA}{dt} = k$$

$$\frac{dA}{dt} = kA$$

$$\frac{dA}{dt} = k(A_L - A)$$