

MA205 - Integral Calculus

Lesson 48: PSL VI

1. Solve the initial value problem

$$\frac{dz}{dt} + e^{z+t} = 0, z(0) = 2$$

by hand using separation of variables. Then, check your answer using Mathematica's `DSolve` command.

2. Solve the differential equation

$$y' - \cos(x)y = 2 \cos(x)$$

by hand using separation of variables. Then, check your answer using Mathematica's `DSolve` command.

3. On a cold winter morning, you pour a cup of 95°C coffee in your cold kitchen, which is a temperature of 16°C .

(a) Set up a differential equation that models the temperature change in the coffee over time.

(b) If after 10 minutes, your coffee has cooled to 80°C , what is the temperature of the coffee after 30 minutes?

4. Dead leaves accumulate on the ground in a forest at a rate of 3.75 grams per square centimeter per year. At the same time, the leaves decompose at a continuous rate of 75% per year.

(a) If there are 2 grams of leaves per square centimeter initially, set up a differential equation that models this behavior.

(b) Calculate how many grams of leaves (per square centimeter) the ground has after 3 years?

(c) Repeat part (b), but use a different method to perform your calculations.

(d) What is the long term behavior of the density of leaves?