

MATH 267 (Sections A3, C-1) Homework No. 1

Reading

Section 2.1, up to ‘Approximate Numerical Solutions’ pg. 24,
Section 2.2
Section 2.3

Suggested Problems

Section 2.2: Example 2.26, Exercises 5, 13, 15.
Section 2.3: Exercises 9, 13.

Problems to be handed in by Thursday January 20-th (in class)

Problem 1 (23 points) Consider the O.D.E.

$$y' = \frac{1}{(1 + 2y)\cos^2(t)} \quad (1)$$

1. Give an expression for the general solution.
2. Solve the initial value problem given by equation (1) and the initial condition

$$y(0) = 1.$$

3. Find the interval of existence of the solution you have find in the previous step by
 - (a) Finding the domain of the function $y = y(t)$ you have found.
 - (b) Finding the domain where the function is differentiable.
 - (c) Veryfying that for t in the Domain you have found $y = y(t)$ is solution of (1).

Problem 2 (7 points) A coin is dropped into the ocean. The coin weight is 5 grams. You model the force acting on the coin F as

$$F = -mg + kv^2,$$

where the term $-mg$ is the gravitational force, v is the velocity of the coin (assumed equal to zero when the coin is dropped) and kv is the force due to the resistance of the water, with k a positive constant.

1. Give an expression of the velocity as a function of time with only k as a free parameter. What are the units for k ? (motivate your answer)
2. Given that a terminal velocity of $2m/s$ is observed, what is the value of k ?