

# MAT-235: HOMEWORK 1

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DUE: 8/31/2018

## Book Problems

Please do each of the following problems from the class book [1]:

Section 1.1: 43, 46, and 47

Section 1.2: 16, 40, and 44

Section 1.3: 6, 7 (Use DFIELD app to recreate slope field and additional orbits, print out and turn in with homework), 11, 14, 15, 16, and 26 (Use DFIELD app to create slope field with appropriate window, print out and turn in with homework)

Section 1.4: 11, 17, 25, 27, 29, 46, and 47

Section 1.5: 19, 22, 23, 29, 33, 37, 46

## Other Problems

I. The following problem was taken from [2]: By inspection find a solution of the initial-value problem

$$\begin{aligned}y' &= |y - 1| \\ y(0) &= 1.\end{aligned}$$

State why the conditions of [1, Theorem 1, Section 1.3] do not hold for this differential equation. Although we shall not prove it, the solution to this initial-value problem is unique.

II. The following problem was taken from [2]: Consider the differential equation

$$\frac{dy}{dx} = 1 + y^2.$$

- (a) Determine a region of the  $xy$ -plane for which the equation has a unique solution through a point  $(x_0, y_0)$  in the region.
- (b) Show that  $y = \tan(x)$  satisfies the differential equation and condition  $y(0) = 0$ .
- (c) Explain why  $y = \tan(x)$  is not a solution of the initial-value problem

$$\begin{aligned}\frac{dy}{dx} &= 1 + y^2 \\ y(0) &= 0\end{aligned}$$

on the interval  $-2 < x < 2$ .

- (d) Explain why  $y = \tan(x)$  is a solution of the initial-value problem in (c) on the interval  $-1 < x < 1$ .

## References

- [1] C. H. Edwards, D. E. Penny, and D. T. Calvis, *Differential equations and boundary value problems, computing and modeling*, 5th ed., Pearson Education, Upper Saddle River, NJ, 2019.
- [2] D. G. Zill, *A first course in differential equations with applications*, 2nd ed., PWS Publishers, Boston, MA, 1982.