MATH 3430-02 LIST OF HOMEWORK

1. Homework 1

Quiz on 01/21.

[1-1] Reading: pp. 1-9 of textbook.
Exercises: [Sec. 1.2] 1, 3, 5, 7, 18.
[1-2] Reading: pp. 20-24 of textbook.
Exercises: [Sec. 1.2] 11, 13, 15; [Sec. 1.4] 3, 7, 9, 13.

(Note: If you have previous exposure to *Mathematical Analysis*, I recommend giving Sec. 1.2 Question 19 a try. The idea is to find a T such that $|f(t)| < \epsilon$ for all $t > T$, then split the integral in $y = \frac{1}{\mu}\int_{t_0}^{t} \mu(t)f(t)\mathrm{d}t$ into two parts.)

[1-3] Reading: pp. 26-32 & pp. 55-56 of textbook.
Exercises: [Sec. 1.5] 5, 9; [Sec. 1.8] 15, 16, 17.

2. Homework 2

Quiz on 01/28.

[2-1] Reading: pp. 58-66 of textbook.
Exercises: [Sec. 1.9] 2 (Hint: Take the y-partial.), 3, 5, 7, 9, 13, 15, 19.
[2-2] Reading: pp. 67-80 of textbook. *(You can skip reading proofs, if you like, and put more attention on reading the paragraphs in pp.67-70, the statement of Theorem 2 on p.76, and the Examples.)*
Exercises: [Sec. 1.10] 1, 3, 5, 7, 11, 13, 17, 19.

Hints:

5: Choose $b = 1$;
7: Choose $b = 1$;
11: Choose $b = 0.6$;
13: Choose $b = 1/4$;

(More detail: You probably have realized that $\frac{b}{M} = \frac{b}{(1+4b)e^{2b}}$. *You want to find* b *such that* b/M *attains a maximum value for good. For this purpose, we find the extremal of* $b/((1+4b)e^{2b})$ *by taking the derivative then setting it to be zero. This way you'll find* $b = 1/4$.*)*

17: There are two approaches to a proof. **I.** Find a solution assuming that $y \neq -1$, using separation of variables, then arrive at a contradition. **II.** Consider the time t_1 when two distinct solutions $y(t), z(t)$ first disagree.

(In symbols: $t_1 = \sup\{t \geq t_0 | y(s) = z(s), \forall\ s \text{ satisfying } t_0 \leq s \leq\ t\}$. *Don't worry if these symbols look strange to you. Just use your intuition, and think about what happens if you set an initial value at time* t_1. *Use the Existence and Uniqueness Theorem.*)

19: What is the anti-derivative of $\frac{1}{\sqrt{1-y^2}}$?

3. Homework 3

Quiz on 02/04.

[3-1] Reading: pp. 96-99 of textbook.
Exercises: [Sec. 13.0] (p.100) 1, 2, 3, 5, 6
(You can write a computer program to solve these questions.)

[3-2] Reading: pp. 100-104 of the textbook. Focus on the expressions L and D on page 101 and Inequality (6) on page 102. Carefully read Examples 1 and 2. Read through the proof only when you are motivated to. To see if you understand this proof fully, you can try your hands on Q3-Q11 on our worksheet today.

Exercises: [Sec. 13.1] (p. 105) 1, 3, 5. (You don't need to regard the answer in the back as 'standard', as you may come up with some better estimates.)

4. Homework 4

Quiz on 02/11.

[4-1] No homework. (Study the lecture notes.)

[4-2] Reading: pp. 127-136 of textbook.
Exercises: [Sec. 2.1] (p.136) 1, 3, 7, 9, 11.
Comments:

9: We did this in class. Try again?
11: This example shows that the Wronskian may be constantly zero, but the list of functions may still be linearly independent.

[4-3] Reading: pp. 138-139; pp. 141-144 of textbook.
Exercises: [Sec. 2.2.0] (p.140) 1, 3, 5, 7, 9; [Sec. 2.2.1] (p.144) 1, 3, 5, 9, 13

5. Homework 5

Quiz on 02/18.

[5-1] Reading: pp. 145-149 of textbook
Exercises: [Sec. 2.2.2] (p. 149) 1, 3, 7

[5-2] Reading: pp. 146-147 (particularly the derivation of formula (5)).
Exercises: [Sec. 2.2.2] (p. 150) 9, 11, 13, 15, 17

[5-3] Reading: pp. 151-152 of textbook
Exercises: [Sec. 2.3] (p. 152) 1, 3, 5.

6. Homework 6

Quiz on 03/04.

[7-1] Reading: pp. 157-164 of textbook
Exercises: [Sec. 2.5] (p. 164) 1, 3, 7, 9, 11, 13

[7-2] Reading: pp. 165-171 of textbook
Exercises: [Sec. 2.6] (p. 172) 1, 2, 7, 11.
Question 11 amounts to solving the initial value problem:

$$my'' + cy' + ky = 1 + t + \sin 2t, \qquad y(0) = y'(0) = 0.$$

When the forcing expression is a sum, you may treat each term separately, as explained on p. 164 of the textbook.

[7-3] The material is not in our book. A good review of our class notes will suffice. If you need extra reading material, I've found (but haven't read it in detail) one via the following link: https://math.mit.edu/ jorloff/suppnotes/suppnotes03/o.pdf

7. Homework 7

Quiz on 03/11.

[8-1] Reading: pp. 185-188 of textbook.
Exercises: For the following try finding the first 3 terms in a power series solution using the method of successive differentiation. [Sec. 2.8] (p. 197) 5, 6, 7

[8-2] Reading: pp. 190-195 of textbook. (Read mainly the examples.)
Exercise: Use the method of undetermined coefficients for the following questions. [Sec. 2.8] (p. 197) 1, 3, 5, 7.

[8-3] Reading: pp.189-190 of textbook. (Read mainly the theorems and their applications.)
Exercise: (None.)

8. Homework 8

Quiz due on 03/20.

[9-1,2] Reading: pp. 225-232 of textbook.
Exercises: [Sec. 2.9] 1, 3, 7, 9, 13, 15, 17, 19.

9. Homework 9

[10-1] Reading: pp. 233-237 of textbook.
Exercises: [Sec. 2.10] 1, 3, 6, 7, 9, 11, 13, 21, 23.

[10-2] Reading: pp. 238-242 of textbook.
Exercises: [Sec. 2.11] 1, 3, 5, 7.

[10-3] Reading: pp. 243-250 (Focus more on the examples.)
Exercises: [Sec. 2.12] 5, 7, 8.

10. Homework 10

[11-1] Reading: pp. 251-256 of textbook.
Exercises: [Sec. 2.13] 1, 3, 7, 9, 12, 13, 15.

11. Homework 11

[12-1] Reading: pp. 333-340 of textbook.
Exercises: [Sec. 3.8] 1, 3, 5, 7, 9, 14.

12. Homework 12

[13-1] Reading: pp. 341-344 of textbook.
Exercises: [Sec. 3.9] 1, 3, 5, 9.

[13-2] Reading: See Class Notes. (We'll give a more elementary treatment than the book.)
Exercises: [Sec. 3.10] 3, 8 (Use the method of 'back-solving'.)