1. **Review problems:**
   - from Hw 1: # 4, 6-10
   - from Hw 2 # 1-4, 6a, 7
   - from Chapter 6, PMA #4, 5, 7, 8, 11, 15.

2. **Know** the proofs of the following theorems:
   - The Riemann Integral 6.6, 6.8, 6.20, 6.21.
   - The union of two measurable sets is a measurable set (using the definition of measurable set).
   - The sums and the products of measurable functions are measurable functions.

3. **Know Definitions, Theorems, Propositions, Examples** as presented in class.
   Do not miss:
   - The Riemann Integral (not the Stieltjes part). 6.1, 6.3-6.7, 6.11-6.13
   - Integration and Differentiation, the Fundamental Theorem of Calculus; 6:20, 6:2, 6:22.
   - Outer measure on \( \mathbb{R} \): definition and properties.
   - Measurable sets: definition and properties.
   - The Lebesque measure on \( \mathbb{R} \): definition and properties.
   - There are non-measurable subsets of \( \mathbb{R} \).
   - The characterization of measurable functions.
   - Properties of of measurable functions.
   - Measurability of limits of sequences of measurable functions.

4. **Decide if** the following statements are **True or False** and **justify** your answer:
1) If \( f, g : [a, b] \to \mathbb{R} \) are functions such that \( |f(x)| \leq g(x) \leq 1 \) for all \( x \in [a, b] \), and the function \( g \) is Riemann Integrable on \([a, b]\), then the function \( f \) is also Riemann Integrable on \([a, b]\).

2) If \( f : [a, b] \to [0, \infty) \) is Riemann Integrable on \([a, b]\), then the function \( \sqrt{f} \) is also Riemann Integrable on \([a, b]\).

3) A function that is zero except at 2015 points in \([0, 1]\) is Riemann Integrable.

4) Any function that is zero almost everywhere is Riemann Integrable.

5) If \( f : [a, b] \to [0, \infty) \) is such that \( f^3 \) is Riemann Integrable on \([a, b]\), then the function \( f \) is also Riemann Integrable on \([a, b]\).

6) If \( f : \mathbb{R} \to \mathbb{R} \) is measurable, then \( f^3 \) is also measurable.

7) The set \( \mathbb{R} \setminus \mathbb{Q} \) is measurable.

8) Any measurably set of measure zero is countable.

9) Any subset of a measurable set is measurable.

10) If \( \{E_n\} \) is a sequence of measurable sets such that \( E_{n+1} \subset E_n, n = 1, 2, \ldots \), then \( m(\cap_{n=1}^{\infty} E_n) = \lim_{n \to \infty} m(E_n) \).

11) There exist two subsets \( B \) and \( C \) of \( \mathbb{R} \) such that \( m^*(B \cup C) < m^*(B) + m^*(C) \).

12) If \( f : \mathbb{R} \to \mathbb{R} \) is measurable, and \( g : \mathbb{R} \to \mathbb{R} \) is continuous then \( g \circ f \) is measurable.

13) If \( f : \mathbb{R} \to \mathbb{R} \) is measurable, then \( |f| \) is also measurable.

14) \( \lim_{n \to \infty} 2^n \sum_{k=1}^{2^n} \frac{1}{k^2 + 4^n} = \frac{\pi}{4} \).

15) Any bounded measurable function \( f : [a, b] \to \mathbb{R} \) is Riemann integrable.

16) There are countable measurable subsets of \( \mathbb{R} \) that are not measurable.

17) Any monotonic function \( f : \mathbb{R} \to \mathbb{R} \) is measurable.

18) If \( f, g : \mathbb{R} \to \mathbb{R} \) and \( f = g \text{ a.e.} \) and \( g \) is continuous then \( f \) is measurable.

19) If \( f, g : [a, b] \to \mathbb{R}, f = g \text{ a.e.} \) and \( g \) is Riemann integrable then \( f \) is Riemann integrable.

20) Any unbounded measurable subset of \( \mathbb{R} \) has the Lebesgue measure \( \infty \).

21) \( m([0, 1] \cap (\mathbb{R} \setminus \mathbb{Q})) = 1 \).