

MATH 232 Discrete Math

Homework 2

Basic Information

This assignment is due in Gradescope by 10 PM on the dates below.

Make sure you understand MHC [honor code](#) and have carefully read and understood the additional information on the [class syllabus](#) and the [grading rubric](#). I am happy to discuss any questions or concerns you have!

You are always welcome to ask me for small hints or suggestions on problems.

Problems

Reading Problem 2M (Due: Sunday, September 14)

Explain in an English sentence what the sets $A = \{6x : x \in \mathbb{Z}\}$ and $B = \{3x : x \in \mathbb{Z}\}$ represent. Then explain using the “for all” definition of subsets why $A \subseteq B$. (The reading for Monday will give you some guidelines on proving that one set is a subset of another.)

Wednesday Problems HW2 (Due: Wednesday, September 17)

For each problem below don't forget to explain your answer in words even if the problem doesn't explicitly say to do so.

1. Determine if the following sets A are subsets of the set B . Explain why you think your answer is correct. (An explanation in words is fine, we don't yet need a formal proof.)

(a) $A = \{(x, y) \in \mathbb{R}^2 : x^2 - x = 0\}$ and $B = \{(x, y) \in \mathbb{R}^2 : x - 1 = 0\}$

(b) $A = X - R$ and $B = X - S$ where S and R are sets so that $S \subseteq R$.

2. Let A and B be sets, and $|A| = m$ and $|B| = n$ where m and n are positive integers.

(a) What is $|\mathcal{P}(A \times \mathcal{P}(B))|$?

(b) What about $|\{X \in \mathcal{P}(A) : |X| \leq 1\}|$?

3. For each $n \in \mathbb{N}$ let $A_n = \{-2n, 0, 2n\}$.

(a) What is $\bigcup_{i \in \mathbb{N}} A_i$?

(b) What is $\bigcap_{i \in \mathbb{N}} A_i$?

4. (8 pg 41 MR). Each of the following statements is true.

- *Laura is in the seventh grade.*
- *Laura got an A on the math test or Sarah got an A on the math test*
- *If Sarah got an A on the math test, then Laura is not in the 7th grade.*

If possible, determine the truth value of each of the following statements based on the 3 statements above. Carefully explain your reasoning.

- (a) Laura got an A on the math test.
- (b) Sarah got an A on the math test
- (c) Either Laura or Sarah did not get an A on the math test.

5. Negate the following statements. You do not need to prove or disprove the statements, simply write the negation so that no “not” appears.

- (a) For all $x \in \mathbb{R}$, we have $x^3 \geq x^2$.
- (b) There exists an $x \in \mathbb{Z}$ such that for all $y \in \mathbb{Z}$ we have $2x + 3y = 1$.

6. Prove or disprove the following statement:

There exists an $n \in \mathbb{N}$ such that $n^2 - 1 = 0$.

Reading Problem 2F (Due: Thursday, September 18)

Prove the following statement:

If $a \mid b$ and $b \mid a$, then $a = \pm b$.