STANDARD DECK OF CARDS

A♥, 2♥, 3♥, 4♥, 5♥, 6♥, 7♥, 8♥, 9♥, 10♥, J♥, Q♥, K♥,
A♦, 2♦, 3♦, 4♦, 5♦, 6♦, 7♦, 8♦, 9♦, 10♦, J♦, Q♦, K♦,
A♣, 2♣, 3♣, 4♣, 5♣, 6♣, 7♣, 8♣, 9♣, 10♣, J♣, Q♣, K♣,
A♠, 2♠, 3♠, 4♠, 5♠, 6♠, 7♠, 8♠, 9♠, 10♠, J♠, Q♠, K♠

SUIT:
♥ Heart (Red)
♦ Diamond (Red)
♣ Club (Black)
♠ Spade (Black)

RANK:
A (Ace),
2,3,4,5,6,7,8,9,10,
J (Jack)
Q (Queen)
K (King)

Math 3150 **Exam 2 Practice**, March 2026, 13 problems, 75 minutes

Read these instructions:

- Leaving the testing room results in a new exam given for the unfinished problems.
- Two detached sheets of notes allowed.
- No electronics.
- Raise your hand for questions or more paper.

Problem 1. A and B are sets within the universe U. You know that $|A| = 7$ and $|B| = 13$, $|U| = 20$, and $|A \cup B| = 15$. Determine the cardinality of each set below.

- $\sim B$
- $A \cap B$
- $A - B$
- $B - A$

Problem 2. A and B are sets within the universe U. You know that $|A| = 10$, $|B| = 13$, $|\sim (A \cup B)| = 5$, and $|A \cap B| = 3$. Determine the cardinality of each set below.

- $A \cup B$
- $A - B$
- $B - A$
- $\sim B$
- U

Problem 3. A moderation bot scans **1,000** recent comments. Of these, **450** comments contain **Profanity**, **320** comments contain **Targeted Harassment** keywords, and **400** comments are completely "Clean" (contain **neither**).

- How many comments are "Double Violations" (containing **both** profanity and harassment)?
- How many comments contain profanity but not targeted harassment?

Problem 4. How many ways can you rearrange the letters in the word "PROPOSITION"?

Problem 5. How many standard playing cards are red or are royal (J, Q, K)?

Problem 6.

- How many 3-digit hexadecimal numbers start and end with a 1?
- How many 3-digit hexadecimal numbers start with a 1 or end with a 1?
- How many 3-digit hexadecimal numbers contain at least one 1?

Problem 7. A photography company will put 2 portrait and 3 landscape photos on their website, selected from 5 portraits and 7 landscape photos. How many different options are possible?

Problem 8. How many subsets of $\{1, 2, 3, 4, 5, 6, 7\}$ contain at least one multiple of 3 as an element?

Problem 9. We draw 5 cards from a standard deck of 52 playing cards. How many 5-card hands have exactly 4 hearts cards?

Problem 10. At a party with 20 people, everyone shakes hands with everyone else exactly once. How many handshakes occur?

Problem 11. How many ways can one Treasurer and one Historian be selected from a club of 15 members? (Assume no one person can assume both roles in the club.)

Problem 12. A family of six (two parents and four children) sit in a row of six seats at a movie theater. If the two parents must sit in adjacent seats, how many seating arrangements are possible?

Problem 13. (Challenge) In how many ways can we put 3 rooks on an 8×8 chessboard so that no two rooks share the same row or column? (I.e. each rook occupies its own row and column.)