



MATH 110: General Education Math

Fall 2026

Homework 2

Name: _____

1. (6 pts) A dental clinic is hiring. It needs a receptionist and an office manager, chosen from 6 applicants for the front office, and 2 hygienists with no distinct roles, chosen from 5 applicants for the hygienist positions. No applicant can fill more than one position. In how many ways can the positions be filled?

2. (6 pts) A hospital visitor parking pass number is either a letter (A–Z) followed by two digits (0–9), such as B07, or three digits, such as 315. Letters and digits may be repeated. How many different parking pass numbers are possible?

3. (6 pts) A die is rolled 3 times. How many of the possible sequences of results include at least one 6?

4. (6 pts) A clinic has 40 staff members. Of these, 22 speak Spanish, 15 speak Polish, and 6 speak both.

(a) How many of the staff members speak at least one of the two languages?

(b) How many speak neither language?

5. (6 pts) A committee of 4 will be chosen from 5 doctors and 6 nurses, and the committee members have no distinct roles. How many different committees include at least one doctor?

6. (14 pts) A respiratory care team of 5 will be chosen from 6 nurses and 4 respiratory therapists, and the team members have no distinct roles.

(a) (2 pts) How many different teams are possible in all?

(b) (3 pts) How many teams include exactly 2 respiratory therapists?

(c) (4 pts) Split the teams into cases to find the number of teams that include at least 2 respiratory therapists.

(d) (3 pts) Find the number of teams that include at least 2 respiratory therapists again, this time using complements.

(e) (2 pts) Explain why the methods in parts (c) and (d) must give the same answer.

7. (14 pts) A nurse will work 7 shifts next week, and each shift is either a day shift (D) or a night shift (N). A schedule for the week is a sequence such as DDNDNDD.

(a) (2 pts) How many different schedules are possible?

(b) (2 pts) How many schedules have exactly 2 night shifts?

(c) (2 pts) How many schedules have at least one night shift?

(d) (3 pts) How many schedules have at least 2 night shifts?

(e) (3 pts) How many schedules have at most 5 night shifts?

(f) (2 pts) Your answers to parts (d) and (e) should be equal. Explain why.

8. (14 pts) Let A be the set of whole numbers from 1 to 200 that are divisible by 4, and let B be the set of whole numbers from 1 to 200 that are divisible by 6.

(a) (2 pts) Find $|A|$.

(b) (2 pts) Find $|B|$.

(c) (4 pts) A student says that $A \cap B$ is the set of multiples of 24, since $4 \cdot 6 = 24$. Explain why the student is wrong, and find $|A \cap B|$.

(d) (3 pts) How many whole numbers from 1 to 200 are divisible by 4 or by 6?

(e) (3 pts) How many whole numbers from 1 to 200 are divisible by neither 4 nor 6?

9. (14 pts) A hospital gives each patient an ID made of two letters (A–Z) followed by two digits (0–9), such as MM47. Letters and digits may be repeated.

(a) (2 pts) How many different IDs are possible?

(b) (3 pts) How many IDs have two different letters and two different digits?

(c) (3 pts) Use complements and your answers to parts (a) and (b) to find the number of IDs in which the two letters are the same or the two digits are the same.

(d) (4 pts) Let L be the set of IDs in which the two letters are the same, and let D be the set of IDs in which the two digits are the same. Find $|L|$, $|D|$, and $|L \cap D|$, and use the Inclusion-Exclusion Principle to find $|L \cup D|$.

(e) (2 pts) Your answers to parts (c) and (d) should be equal. Explain why.

10. (14 pts) A hospital unit has 10 nurses, including Rosa and Sam, and 6 nursing aides. Each shift needs a charge nurse, who must be one of the nurses, and 4 other team members with no distinct roles, chosen from the remaining nurses and aides. The 4 other team members must include at least one aide. In addition, Rosa and Sam refuse to work the same shift. In how many ways can a shift be staffed?

(a) (2 pts) Ignore the requirement about aides and Rosa and Sam's refusal to work together. In how many ways can the shift be staffed?

(b) (2 pts) Still ignoring Rosa and Sam's refusal to work together, in how many ways can the shift be staffed with no aides among the 4 other team members?

(c) (2 pts) Use your answers to parts (a) and (b) to find the number of ways to staff the shift with at least one aide, still ignoring Rosa and Sam's refusal to work together.

- (d) (3 *pts*) How many ways are there to staff the shift with at least one aide, if Rosa is the charge nurse and Sam is one of the 4 other team members? How many are there if Sam is the charge nurse and Rosa is one of the 4 other team members?
- (e) (3 *pts*) How many ways are there to staff the shift with at least one aide, if Rosa and Sam are both among the 4 other team members?
- (f) (2 *pts*) Use your answers to parts (c), (d), and (e) to answer the original question. Which counting principles did you use?