F Math 12

5.4 Mutually Exclusive Events p. 328

Name _____

Date _____

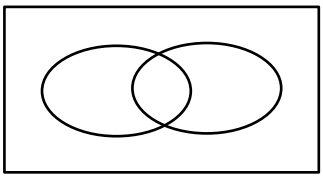
Goal: Understand and solve problems that involve mutually exclusive and non-mutually exclusive events.

1. **mutually exclusive**: Two or more events that cannot occur at the same time; for example, the Sun rising and the Sun setting are mutually exclusive events.

Probabilities of Events A or B

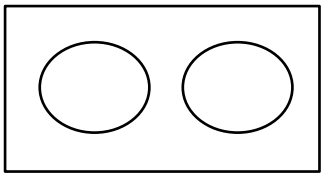
General Case:

P(A or B) =



Mutually Exclusive events:

P(A or B) =



Note: When the two events are mutually exclusive,

$n(A \cap B)$ _____; therefore, $P(A \cap B)$ _____

Example 1: One card is randomly drawn from a deck of 52 cards.

Define the following events:

S: The card is a spade
R: The card is red
F: The card is face card

Identify the events S, R, and F on the sample space.

Which of these three events are mutually exclusive?

	Club	Spade	Heart	Diamond
K	*	*	*	*
Q	*	*	*	*
J	*	*	*	*
10	*	*	*	*
9	*	*	*	*
8	*	*	*	*
7	*	*	*	*
6	*	*	*	*
5	*	*	*	*
4	*	*	*	*
3	*	*	*	*
2	*	*	*	*
A	*	*	*	*

a. Determine the following probabilities

P(S) = P(R) = P(S and R) = P(S or R) =

P(S) = P(F) = P(S and F) = P(S or F) =

b. Now determine the following probabilities using the formulas

P(S or R) =

P(S or F) =

Example 2: Using a Venn diagram to solve a probability problem that involves two events (p. 332)

A school newspaper published the results of a recent survey.

Eating Habits: Student Survey Results

- 62% skip breakfast
- 24% skip lunch
- 22% eat both breakfast and lunch

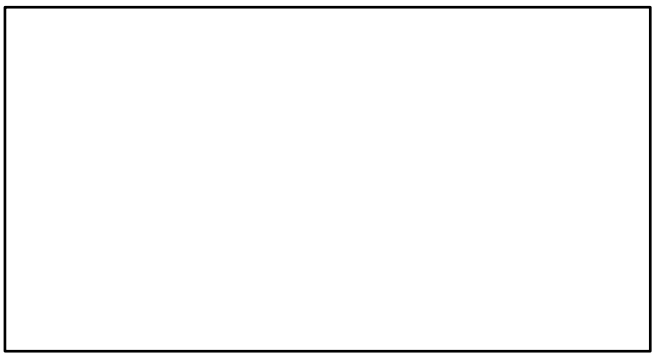
a. Are skipping breakfast and skipping lunch mutually exclusive?

b. Determine the probability that a randomly selected student skips breakfast but not lunch.

c. Determine the probability that a randomly selected student skips at least one of breakfast or lunch.

Example 3: Wilma submits bids on two web design projects. She thinks she has 70% chance of getting the first project, but just a 50% chance of getting the second. She puts only a 15% chance on getting neither of the two projects. Find the probability that she gets:

a. both projects



b. at least one of the two projects

c. only the first project

d. only one of the two project

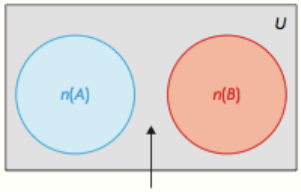
In Summary

Key Ideas

- You can represent the favourable outcomes of two **mutually exclusive events**, A and B, as two disjoint sets.

  You can represent the probability that either A or B will occur by the following formula:

$$P(A \cup B) = P(A) + P(B)$$



$n(A \cap B) = 0$
(no common elements)

- You can represent the favourable outcomes of two **non-mutually exclusive events**, A and B, as two intersecting sets.

  You can represent the probability that either A or B will occur by this formula:

$$P(A \cup B) = P(A) + P(B) - P(A \cap B)$$

  An alternative formula is

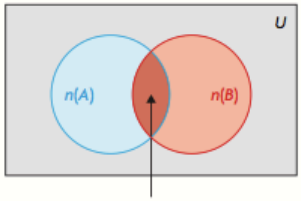
$$P(A \cup B) = P(A \setminus B) + P(B \setminus A) + P(A \cap B)$$

  When the two events are mutually exclusive, both formulas are equivalent,

$$n(A \cap B) = 0$$

  which results in

$$P(A \cap B) = 0$$



$n(A \cap B)$ has been shaded twice

Need to Know

- You can use the Principle of Inclusion and Exclusion, which is used to count the elements in the union of two sets, to determine the probability of non-mutually exclusive events.

HW: 5.4 p. 338-342 #1-5, 8 & 12-14