

Grade 10 Mathematics Lesson Plan

Mutually Exclusive Events

Strand:	Statistics and Probability
Sub-Strand:	Probability 1: Mutually Exclusive Events
Specific Learning Outcome:	Determine the probability of mutually exclusive and independent events
Duration:	40 minutes
Key Inquiry Questions:	How is probability applied in real life situations?
Learning Resources:	CBC Grade 10 textbooks, dice, playing cards, colored markers, chart paper

Phase 1: Problem-Solving and Discovery (15 minutes)

Anchor Activity: Language Class Analysis

Objective: Students work in groups to explore the concept of mutually exclusive events through a real-world scenario, define the concept, and calculate probabilities.

Work in groups to complete the following tasks:

Task 1: Define Mutually Exclusive Events

Based on your prior knowledge or intuition, write a definition of "mutually exclusive events" in your own words.

Task 2: State One Example

Give one example of two events that are mutually exclusive. Explain why they cannot happen at the same time.

Task 3: Language Class Problem

In a class of 40 students, 18 take French, 22 take German, and no student takes both.

- What is the probability that a randomly selected student takes French or German?
- Are the events "taking French" and "taking German" mutually exclusive? Explain.

Task 4: Compare and Discuss

Compare and discuss your answers with other groups.

Discussion prompts for teachers:

- What definition did your group come up with?
- What examples did you think of? Why are they mutually exclusive?
- How did you calculate the probability in Task 3?
- Why can't a student take both French and German in this scenario?
- What pattern do you notice when calculating $P(\text{French or German})$?
- Can you think of events that are NOT mutually exclusive?

Phase 2: Structured Instruction (10 minutes)

Key Takeaways

1. Definition of Mutually Exclusive Events

Two events are mutually exclusive if they cannot occur at the same time.

This means that if one event happens, the other cannot.

2. Mathematical Property

If A and B are mutually exclusive events, then:

$$P(A \text{ and } B) = 0$$

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

Explanation: The probability of both events happening together is zero because they cannot occur simultaneously.

3. Addition Rule for Mutually Exclusive Events

The probability of either A or B occurring is:

$$P(A \text{ or } B) = P(A) + P(B)$$

Important: This addition rule ONLY works for mutually exclusive events. If events can happen together, we need a different formula.

4. Real-Life Examples

- A traffic light being red and the same traffic light being green at the exact same time
- You are sleeping and you are wide awake at the exact same moment
- A door being open and the same door being closed at the same time
- Rolling a 3 and rolling a 5 on a single die roll
- Drawing a Heart and drawing a Spade from one card

Phase 3: Practice and Application (15 minutes)

Worked Example 3.2.11 (Rolling a Die)

Problem: Roll a fair six-sided die, what is the probability of rolling either a 3 or a 5?

Solution:

Step 1: Identify the sample space

$$S = \{1, 2, 3, 4, 5, 6\}$$

Step 2: Calculate individual probabilities

$$P(3) = 1/6$$

$$P(5) = 1/6$$

Step 3: Check if events are mutually exclusive

Rolling a 3 and rolling a 5 are mutually exclusive events because you cannot roll both numbers on a single die roll.

Step 4: Apply the addition rule

$$P(3 \text{ or } 5) = P(3) + P(5)$$

$$= 1/6 + 1/6$$

$$= 2/6 = 1/3$$

Answer: The probability of rolling a 3 or 5 is $1/3$ or 33.33%

Worked Example 3.2.12 (Playing Cards)

Problem: A card is drawn from a standard deck of 52 playing cards. Let Event A be drawing a Heart and Event B be drawing a Spade. Are these events mutually exclusive? Explain.

Tasks:

1. Find $P(A)$ and $P(B)$
2. Calculate $P(A \text{ or } B)$
3. What is $P(A \cap B)$?

Solution:

First, determine if events are mutually exclusive:

A card cannot be both a Heart and a Spade at the same time, so the events ARE mutually exclusive.

1. Calculate individual probabilities:

Since there are 13 Hearts in the deck: $P(A) = 13/52$

Since there are 13 Spades in the deck: $P(B) = 13/52$

2. For mutually exclusive events, use the addition rule:

$$P(A \text{ or } B) = P(A) + P(B)$$

$$= 13/52 + 13/52$$

$$= 26/52 = 1/2$$

3. Since these events are mutually exclusive:

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

Answer: The probability of drawing a Heart or a Spade is $1/2$ or 50%

Phase 4: Assessment (5 minutes)

Exit Ticket

1. A student at Khungu Senior Secondary School tosses a coin once. Are the events "getting heads" and "getting tails" mutually exclusive?

2. A person selects one piece of fruit from a bowl containing apples, bananas, and oranges. Is selecting an apple and selecting a banana mutually exclusive events?

3. A student recorded their method of transport to school for 10 days. The methods used were:

Walk, Bus, Bus, Walk, Bike, Walk, Bus, Bike, Walk, Bus

Let Event A = "The student walked to school" and Event B = "The student took the bus to school"

a) Are events A and B mutually exclusive? Explain your answer.

b) What is the probability that the student either walked or took the bus to school on a randomly chosen day?

Differentiation Strategies

For Struggling Learners:

- Use Venn diagrams to visualize mutually exclusive events (no overlap).
- Start with concrete, everyday examples before moving to abstract probability.
- Provide a checklist: "Can both events happen at the same time? If NO, they are mutually exclusive."
- Use color coding: one color for Event A, another for Event B, show no overlap.
- Provide formula cards with $P(A \text{ or } B) = P(A) + P(B)$.

- Work in pairs with peer support.
- Use physical objects (dice, cards) for hands-on exploration.

For Advanced Students:

- Explore events that are NOT mutually exclusive and develop the general addition rule.
- Investigate three or more mutually exclusive events.
- Calculate probabilities with larger sample spaces (multiple dice, larger decks).
- Compare mutually exclusive events with independent events.
- Research real-world applications in insurance, medicine, or sports.
- Create their own word problems involving mutually exclusive events.

Extension Activity: Mutually Exclusive vs Non-Mutually Exclusive Events

Scenario: Explore the difference between mutually exclusive and non-mutually exclusive events through card experiments.

Tasks:

1. Take a standard deck of 52 playing cards.
2. Experiment 1 (Mutually Exclusive): Calculate $P(\text{Heart or Spade})$. Verify by drawing cards 20 times.
3. Experiment 2 (Non-Mutually Exclusive): Calculate $P(\text{Red card or King})$. Notice that some cards are BOTH red AND King.
4. For Experiment 2, use the general addition rule: $P(A \text{ or } B) = P(A) + P(B) - P(A \text{ and } B)$
5. Calculate: $P(\text{Red}) = 26/52$, $P(\text{King}) = 4/52$, $P(\text{Red King}) = 2/52$
6. Therefore: $P(\text{Red or King}) = 26/52 + 4/52 - 2/52 = 28/52$
7. Draw cards 20 times and record results for both experiments.
8. Compare theoretical and experimental probabilities.
9. Present findings: When do we use $P(A \text{ or } B) = P(A) + P(B)$? When do we need to subtract $P(A \text{ and } B)$?