

CBC Grade 10 Mathematics Lesson Plan

Probability Spaces

Strand	Statistics and Probability
Sub-Strand	Probability 1: Probability Spaces
Specific Learning Outcome	Generate probability space of different events
Key Inquiry Questions	How is probability applied in real life situations?
Learning Resources	CBC Grade 10 textbooks, coins, dice, spinners
Lesson Duration	40 minutes

Lesson Structure Overview

Phase	Activity	Duration
Phase 1	Problem-Solving and Discovery (Anchor Activity)	15 minutes
Phase 2	Structured Instruction (Key Takeaways)	10 minutes
Phase 3	Practice and Application (Worked Examples)	15 minutes
Phase 4	Assessment (Exit Ticket)	5 minutes

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

Anchor Activity: Coin Toss Experiment

Work in groups

Materials needed: 1 coin per group

Instructions:

Task 1: Conduct the Experiment

- Toss a coin 20 times and record how many times it lands on heads and tails.
- Create a tally chart to track your results.

Task 2: Discussion Questions

- Give the sample space (all possible outcomes).
- Compare your sample spaces with other groups.
- Did everyone get the same number of heads and tails? Why or why not?

Teacher Guidance for Anchor Activity

This anchor activity introduces students to the concept of random experiments and sample spaces through hands-on exploration. Students discover that while individual results vary, the possible outcomes remain constant.

Facilitation Strategy:

- • Ensure each group has a coin and recording sheet
- • Demonstrate proper coin tossing technique
- • Circulate to observe recording methods
- • Ask probing questions: "What are ALL the possible outcomes?" "Can you get any other result besides heads or tails?"
- • Guide students to distinguish between actual results (which vary) and possible outcomes (which are fixed)
- • Use student observations as a bridge to formal probability concepts

Phase 2: Structured Instruction (10 minutes)

Key Takeaways

After students have explored through the anchor activity, formalize their discoveries with these key concepts:

1. Random Experiment

A random experiment is a process that can be repeated and has a well-defined set of possible outcomes, but the outcome of any particular trial cannot be predicted with certainty.

Examples: tossing a coin, rolling a die, drawing a card from a deck, spinning a spinner.

2. Sample Space

A sample space is a set containing all possible outcomes of a random experiment. It is usually denoted by Ω (omega) or S .

Example: For tossing a coin, $S = \{\text{Heads, Tails}\}$ or $S = \{H, T\}$

3. Outcome

An outcome is a single result from a trial of a random experiment.

Example: When you toss a coin once, "Heads" is one outcome.

4. Event

An event is a collection of outcomes from the sample space. An event can consist of one outcome or multiple outcomes.

Example: When tossing a coin, the event "getting heads" consists of the single outcome H. When tossing two coins, the event "getting at least one head" consists of the outcomes HH, HT, and TH.

5. Probability Basics

- The probability of any outcome is a number between 0 and 1
- The probabilities of all outcomes add up to 1
- The probability of any event A is the sum of the probabilities of the outcomes in A

Scaffolding Strategies

Address common misconceptions revealed during the anchor activity:

- Clarify that sample space lists what CAN happen, not what DID happen in the experiment
- Emphasize that different trials can give different results, but the sample space stays the same
- Use set notation {H, T} to formalize the sample space
- Connect everyday language ("all possible outcomes") to mathematical terminology ("sample space")

Phase 3: Practice and Application (15 minutes)

Worked Examples

Example 1: Rolling a Die

Consider the experiment of rolling a 6-sided die.

- What is the sample space for this experiment?
- Write down the event of observing an even number.
- Calculate the probability of observing an even number.

Solution:

- The sample space is $S = \{1, 2, 3, 4, 5, 6\}$
- The event of observing an even number is $A = \{2, 4, 6\}$
- $P(A) = \text{Number of favorable outcomes} / \text{Total outcomes} = 3/6 = 1/2 = 0.5 = 50\%$

Example 2: Ballgum Selection

Mutuse's bag contains 3 red ballgums, 2 blue ballgums, and 1 green ballgum. If one ballgum is drawn at random, give the possible outcomes (the probability space).

Solution:

$$S = \{\text{Red, Blue, Green}\}$$

The sample space consists of three possible outcomes.

Note: We list each color once, even though there are multiple ballgums of some colors.

Example 3: Rolling Two Dice

Consider the experiment of rolling a pair of 6-sided dice. We write outcomes as ordered pairs like (2, 5).

- (a) What is the sample space for this experiment?
- (b) Write down the event of observing the same number on both dice.
- (c) Write down the event of observing numbers that sum to 4.

Solution:

(a) $S = \{(1,1), (1,2), (1,3), (1,4), (1,5), (1,6), (2,1), (2,2), \dots, (6,6)\}$

There are 36 possible outcomes in total.

(b) Event $A = \{(1,1), (2,2), (3,3), (4,4), (5,5), (6,6)\}$

(c) Event $B = \{(1,3), (2,2), (3,1)\}$

Individual Practice (Students work independently)

Provide students with similar problems to solve:

1. 1. A standard die is rolled. List the sample space and the event "rolling a prime number"
2. 2. A bag has tiles numbered 1, 2, 3. Two tiles are drawn with replacement. List the sample space
3. 3. A spinner has sections Red, Blue, Green. List the sample space when spinning once

Phase 4: Assessment - Exit Ticket (5 minutes)

Students complete individually to demonstrate understanding:

Question 1: If a day of the week is randomly selected, what is the sample space for the chosen day?

Question 2: A restaurant offers three choices of main course: chicken, fish, or vegetarian. What is the sample space for the main course a customer might order?

Question 3: A traffic light can show green, yellow, or red. What is the sample space for the possible colors the traffic light can display?

Question 4: A store sells t-shirts in sizes small, medium, and large. What is the sample space for the t-shirt sizes sold?

Question 5: A person spins a spinner with sections labeled A, B, C, and D. What is the sample space for the outcome of the spin?

Exit Ticket Answer Key

Question 1: $S = \{\text{Monday, Tuesday, Wednesday, Thursday, Friday, Saturday, Sunday}\}$

Question 2: $S = \{\text{Chicken, Fish, Vegetarian}\}$

Question 3: $S = \{\text{Green, Yellow, Red}\}$

Question 4: $S = \{\text{Small, Medium, Large}\}$

Question 5: $S = \{A, B, C, D\}$

Differentiation Strategies

For Struggling Learners:

- Start with simple experiments (coin toss, single die)
- Use physical manipulatives to conduct experiments
- Provide sentence frames: "The sample space is $S = \{\underline{\quad}\}$ "
- Create visual aids showing sample spaces for common experiments
- Allow students to draw pictures of outcomes
- Focus on listing outcomes before introducing set notation

For Advanced Learners:

- Introduce compound experiments (tossing two coins, rolling two dice)
- Challenge with experiments involving replacement vs. without replacement
- Explore calculating probabilities from sample spaces
- Investigate the relationship between sample space size and probability
- Create their own probability experiments and determine sample spaces
- Explore conditional probability scenarios

Extension Activity

Design Your Own Probability Game

Objective: Apply understanding of sample spaces to create an original probability game.

Activity Description:

1. In groups, design a simple game using coins, dice, spinners, or cards.
2. Clearly define the random experiment in your game.
3. List the complete sample space for your game.
4. Define at least three different events that could occur in your game.
5. Create rules for winning based on specific events.
6. Present your game to the class, explaining the sample space and events.
7. Play another group's game and verify their sample space is complete.

Real-World Investigation: Probability in Daily Life

Students identify and analyze real-world situations involving probability:

- Weather forecasts (probability of rain)
- Sports (probability of winning)
- Games and lotteries

- • Medical tests (probability of accuracy)
- • Traffic patterns (probability of delays)

For each situation, students identify:

- • What is the random experiment?
- • What is the sample space?
- • What events are of interest?

Post-Lesson Reflection for Teachers

- • Did students successfully distinguish between actual results and possible outcomes?
- • Were students able to list complete sample spaces for various experiments?
- • What misconceptions emerged during the lesson?
- • How well did students understand the difference between outcomes and events?
- • Did students grasp the concept that sample spaces remain constant across trials?
- • What adjustments are needed for future lessons on this topic?