Teacher Preparation Lesson Plan

Subject Area: Mathematics
Unit Title: Introduction to Combinatorics
Grade Level: 9th Grade
Lesson Number: 1 of 10

Duration: 60 minutes
Date: March 12, 2024
Teacher: John Doe
Room: Room 101

Curriculum Standards Alignment

Content Standards:

- CCSS.Math.Content.HSS-CP.A.1: Describe the concept of permutations and combinations.
- CCSS.Math.Content.HSS-CP.A.2: Calculate the number of permutations and combinations for a given set of objects.

Skills Standards:

- CCSS.Math.Content.HSS-CP.B.5: Use permutations and combinations to solve problems.

Cross-Curricular Links:

- Science: Data analysis and probability
- Computer Science: Algorithms and programming

Essential Questions & Big Ideas

Essential Questions:

- What is the difference between permutations and combinations?
- How can permutations and combinations be used to solve real-world problems?

Enduring Understandings:

- Permutations and combinations are fundamental concepts in mathematics.
- Permutations and combinations have numerous applications in various fields.

Student Context Analysis

Class Profile:

- Total Students: 25
- ELL Students: 5
- IEP/504 Plans: 3
- Gifted: 2

Learning Styles Distribution:

- Visual: 40%
- Auditory: 30%
- Kinesthetic: 30%

Pre-Lesson Preparation

Room Setup:

- Arrange desks in a U-shape to facilitate group work and discussion.
- Ensure all students have access to a calculator and pencil.

Technology Needs:

- Computer with internet access for online resources.
- Calculator for each student.

Materials Preparation:

- Whiteboard and markers.
- Printed copies of the lesson plan and worksheets.

Safety Considerations:

- Ensure all students are aware of the classroom rules and expectations.
- Encourage students to ask questions and seek help when needed.

Detailed Lesson Flow

Introduction (5 minutes)

- Introduce the concept of permutations and combinations.
- Ask students to share examples of permutations and combinations in real-life scenarios.

Direct Instruction (15 minutes)

- Explain the formula for calculating permutations: n! / (n-r)!
- Explain the formula for calculating combinations: n! / (r!(n-r)!)!
- Provide examples and have students work in pairs to practice calculating permutations and combinations.

> **Engagement Strategies:**
>
> - Think-pair-share to encourage student discussion and participation.
> - Group work to facilitate collaboration and problem-solving.

Guided Practice (15 minutes)

- Provide students with a worksheet containing permutation and combination problems.
- Have students work in pairs to solve the problems and discuss any questions or concerns.

> **Scaffolding Strategies:**
>
> - Provide additional support for struggling students by offering one-on-one assistance.
> - Encourage advanced students to create their own permutation and combination problems.

Independent Practice (10 minutes)

- Provide students with a real-world scenario that requires the use of permutations and combinations.
- Have students work individually to solve the problem and present their solution to the class.

Closure (5 minutes)

- Review the key concepts and formulas covered in the lesson.
- Ask students to reflect on what they learned and how they can apply it in the future.

Differentiation & Support Strategies

For Struggling Learners:

- Provide additional support by offering one-on-one assistance.
- Use visual aids and real-world examples to help students understand the concepts.

For Advanced Learners:

- Encourage students to create their own permutation and combination problems.
- Provide additional challenges and extensions to the lesson.

ELL Support Strategies:

- Provide visual aids and graphic organizers to help students understand the concepts.
- Use simple language and definitions to explain the formulas and concepts.

Social-Emotional Learning Integration:

- Encourage students to work in pairs and groups to develop teamwork and communication skills.
- Provide opportunities for students to reflect on their learning and set goals for themselves.

Assessment & Feedback Plan

Formative Assessment Strategies:

- Observe student participation and engagement during the lesson.
- Review student worksheets and provide feedback on their understanding of the concepts.

Success Criteria:

- Students can calculate permutations and combinations using the formulas.
- Students can apply permutations and combinations to real-world scenarios.

Feedback Methods:

- Verbal feedback during the lesson.
- Written feedback on student worksheets.

Homework & Extension Activities

Homework Assignment:

Have students complete a worksheet containing permutation and combination problems.

Extension Activities:

- Have students research and present on a real-world application of permutations and combinations.
- Have students create their own permutation and combination problems and share them with the class.

Parent/Guardian Connection:

Encourage parents/guardians to ask their child about what they learned in the lesson and how they can apply it in their daily lives.

Teacher Reflection Space

Pre-Lesson Reflection:

- What are the key concepts and formulas that I want students to understand?
- How can I differentiate instruction to meet the needs of all students?

Post-Lesson Reflection:

- What went well during the lesson?
- What could be improved for future lessons?

Introduction to Combinatorics

What is Combinatorics?

Combinatorics is the study of counting and arranging objects in various ways. It involves the use of permutations, combinations, and other mathematical concepts to solve problems.

Permutations

A permutation is an arrangement of objects in a specific order. For example, if we have three objects - A, B, and C - there are six possible permutations: ABC, ACB, BAC, BCA, CAB, and CBA.

Combinations

A combination is a selection of objects without regard to order. For example, if we have three objects - A, B, and C - there are three possible combinations: AB, AC, and BC.

Permutations and Combinations Formulas

Permutations Formula

The formula for calculating permutations is n! / (n-r)!, where n is the total number of objects and r is the number of objects being chosen.

Combinations Formula

The formula for calculating combinations is n! / (r!(n-r)!), where n is the total number of objects and r is the number of objects being chosen.

Examples and Practice

Provide students with examples and practice problems to help them understand and apply the permutations and combinations formulas.

Permutations in Real-World Scenarios

Permutations are used in various real-world scenarios, such as arranging people in a line, scheduling tasks, and creating passwords.

Combinations in Real-World Scenarios

Combinations are used in various real-world scenarios, such as selecting a team, choosing a committee, and creating a playlist.

Case Studies

Provide students with case studies that demonstrate the use of permutations and combinations in real-world scenarios.

Conclusion

In conclusion, permutations and combinations are fundamental concepts in mathematics that have numerous applications in various fields. Students should now be able to calculate permutations and combinations using the formulas and apply them to real-world scenarios.

Assessment

Assess student understanding of permutations and combinations through a quiz or test. Provide feedback and guidance to students who need additional support.

Extension Activities

Provide students with extension activities, such as researching and presenting on a real-world application of permutations and combinations, or creating their own permutation and combination problems.

References

"Combinatorics" by R. P. Stanley

"Introduction to Combinatorics" by D. G. Hoffman

Online Resources

GeoGebra: An online platform for interactive mathematics and science.

Wolfram Alpha: A computational knowledge engine that can be used to calculate permutations and combinations.

Khan Academy: A free online platform that provides video lectures and practice exercises on permutations and combinations.

Glossary of Terms

Permutation: An arrangement of objects in a specific order.

Combination: A selection of objects without regard to order.

Combinatorics: The study of counting and arranging objects in various ways.

Appendix A: Worksheets

Provide students with worksheets that contain permutation and combination problems.

Appendix B: Case Studies

Provide students with case studies that demonstrate the use of permutations and combinations in real-world scenarios.