

FRANKLIN-SIMPSON HIGH SCHOOL
ALGEBRA II (POST SECONDARY)
UNIT 6 PLAN
PATTERNS AND COMPLEX NUMBERS

Quality Core Standards:

Skills Acquired by Students:

A.1.a. Identify properties of real numbers and use them and the correct order of operations to simplify expressions.

A.1.j. Use inductive reasoning to make conjectures and deductive reasoning to arrive at valid conclusions

Mathematical Processes:

B.1.a. Apply problem-solving skills (e.g., identifying irrelevant or missing information, making conjectures, extracting mathematical meaning, recognizing and performing multiple steps when needed, verifying results in the context of the problem) to the solution of real-world problems

B.1.b. Use a variety of strategies to set up and solve increasingly complex problems

B.1.c. Represent data, real-world situations, and solutions increasingly complex contexts (e.g., expressions, formulas, tables, charts, graphs, relations, functions) and understand the relationships

B.1.d. Use the language of mathematics to communicate increasingly complex ideas orally and in writing, using symbols and notations correctly

B.1.e. Make appropriate use of estimation and mental mathematics in computations and to determine the reasonableness of solutions to increasingly complex problems

B.1.f. Make mathematical connections among concepts, across disciplines, and in everyday experiences

B.1.g. Make appropriate use of technology (e.g., calculators, software programs) in mathematics (e.g., organize data, develop concepts, explore relationships, decrease time spent on computations after a skill has been established)

Foundations:

C.1.a. Identify complex numbers and write their conjugates

C.1.b. Add, subtract, and multiply complex numbers

C.1.c. Simplify quotients of complex numbers

Sequences and Series

H.2.a. Find the n th term of an arithmetic or geometric sequence

H.2.b. Find the position of a given term of an arithmetic or geometric sequence

H.2.c. Find sums of a finite arithmetic or geometric series

H.2.d. Use sequences and series to solve real-world problems

H.2.e. Use sigma notation to express sums

Common Core Standards:

The Complex Number System:

N.CN.1. Know there is a complex number i such that $i^2 = -1$, and every complex number has the form $a+bi$ with a and b real

N.CN.2. Use the relation $i^2 = -1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers

Seeing Structure in Expressions:

A.SSE.4. Derive the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems

Interpreting Functions:

F.IF.3. Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers

Purpose of the Unit:

Prerequisites:

Daily Lesson Plan:

Day 1

Lesson Content: Mathematical Patterns

Quality Core Standards:

1. **A.1.a.** Identify properties of real numbers and use them and the correct order of operations to simplify expressions
2. **A.1.j.** Use inductive reasoning to make conjectures and deductive reasoning to arrive at valid conclusions
3. **B.1.a.** Apply problem-solving skills (e.g., identifying irrelevant or missing information, making conjectures, extracting mathematical meaning, recognizing and performing multiple steps when needed, verifying results in the context of the problem) to the solution of real-world problems
4. **B.1.b.** Use a variety of strategies to set up and solve increasingly complex problems
5. **B.1.c.** Represent data, real-world situations, and solutions increasingly complex contexts (e.g., expressions, formulas, tables, charts, graphs, relations, functions) and understand the relationships
6. **B.1.d.** Use the language of mathematics to communicate increasingly complex ideas orally and in writing, using symbols and notations correctly
7. **B.1.e.** Make appropriate use of estimation and mental mathematics in computations and to determine the reasonableness of solutions to increasingly complex problems
8. **B.1.f.** Make mathematical connections among concepts, across disciplines, and in everyday experiences
9. **B.1.g.** Make appropriate role of technology (e.g., calculators, software programs) in mathematics (e.g., organize data, develop concepts, explore relationships, decrease time spent on computations after a skill has been established)
10. **H.2.d.** Use sequences and series to solve real-world problems

Common Core Standards:

F.IF.3. Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers

Focus Questions:

1. How do you find the pattern in a list?
2. How do you develop a formula to describe a sequence?

Mathematical Practices:

Look for and make use of structure (Students will discern mathematical patterns and describe them with a formula.

Engagement:

1. Clear/Modeled Expectations (Students will see examples of mathematical patterns that they will solve).
2. Learning with Others (Students will work a problem with a partner)

Assessment:

1. Formative – ACT Practice Problems
2. Formative – Pattern Problem (Think, Pair, Share)

3. Formative – p569 (8-42 even, 50, 52, 65)

Day 2

Lesson Content: Arithmetic Sequences

Quality Core Standards:

1. **A.1.a.** Identify properties of real numbers and use them and the correct order of operations to simplify expressions.
2. **A.1.j.** Use inductive reasoning to make conjectures and deductive reasoning to arrive at valid conclusions
3. **B.1.a.** Apply problem-solving skills (e.g., identifying irrelevant or missing information, making conjectures, extracting mathematical meaning, recognizing and performing multiple steps when needed, verifying results in the context of the problem) to the solution of real-world problems
4. **B.1.b.** Use a variety of strategies to set up and solve increasingly complex problems
5. **B.1.c.** Represent data, real-world situations, and solutions increasingly complex contexts (e.g., expressions, formulas, tables, charts, graphs, relations, functions) and understand the relationships
6. **B.1.d.** Use the language of mathematics to communicate increasingly complex ideas orally and in writing, using symbols and notations correctly
7. **B.1.e.** Make appropriate use of estimation and mental mathematics in computations and to determine the reasonableness of solutions to increasingly complex problems
8. **B.1.f.** Make mathematical connections among concepts, across disciplines, and in everyday experiences
9. **H.2.a.** Find the n th term of an arithmetic or geometric sequence
10. **H.2.b.** Find the position of a given term of an arithmetic or geometric sequence
11. **H.2.d.** Use sequences and series to solve real-world problems

Common Core Standards:

F.IF.3. Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers

Focus Questions:

1. What makes sequences arithmetic?
2. How do you write a formula for an arithmetic sequence?

Mathematical Practices:

Attend to precision (Students will define the term “arithmetic sequence” and learn to identify arithmetic sequences).

Engagement:

1. Novelty and Variety (Discovery Activity will include a video clip).
2. Authenticity (Students will utilize their knowledge of patterns to apply them to arithmetic sequences).

Assessment:

1. Formative - Discovery Activity (Fibonacci Sequence (Video))
2. Formative – p575-576 (8-24 even, 32, 34, 36)

Days 3 and 4

Lesson Content: Geometric Sequences

Quality Core Standards:

1. **A.1.a.** Identify properties of real numbers and use them and the correct order of operations to simplify expressions.
2. **A.1.j.** Use inductive reasoning to make conjectures and deductive reasoning to arrive at valid conclusions

3. **B.1.a.** Apply problem-solving skills (e.g., identifying irrelevant or missing information, making conjectures, extracting mathematical meaning, recognizing and performing multiple steps when needed, verifying results in the context of the problem) to the solution of real-world problems
4. **B.1.b.** Use a variety of strategies to set up and solve increasingly complex problems
5. **B.1.c.** Represent data, real-world situations, and solutions increasingly complex contexts (e.g., expressions, formulas, tables, charts, graphs, relations, functions) and understand the relationships
6. **B.1.d.** Use the language of mathematics to communicate increasingly complex ideas orally and in writing, using symbols and notations correctly
7. **B.1.e.** Make appropriate use of estimation and mental mathematics in computations and to determine the reasonableness of solutions to increasingly complex problems
8. **B.1.f.** Make mathematical connections among concepts, across disciplines, and in everyday experiences
9. **H.2.a.** Find the n th term of an arithmetic or geometric sequence
10. **H.2.b.** Find the position of a given term of an arithmetic or geometric sequence
11. **H.2.d.** Use sequences and series to solve real-world problems

Common Core Standards:

A.SSE.4. Derive the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems

Focus Questions:

1. What makes sequences geometric?
2. How can geometric sequences be modeled?

Mathematical Practices:

Attend to precision (Students will define the term “geometric sequence” and write formulas to determine terms within sequences).

Engagement:

1. Novelty and Variety (Students will pair up and play a game to review arithmetic sequences).
2. Learning with Others (Students will pair up and play a game while learning together).
3. Clear/Modeled Expectations (Students will see models of geometric sequences in order to solve problems).
4. Authenticity (Students will connect their knowledge of arithmetic sequences to geometric sequences).

Assessment:

1. Formative – Game: Four Thought
2. Formative – ACT Practice Problems
3. Formative – p584-585 (8-30 even, 36-44 even, 50)

Days 5 and 6

Lesson Content: Arithmetic Series

Quality Core Standards:

1. **A.1.a.** Identify properties of real numbers and use them and the correct order of operations to simplify expressions
2. **A.1.j.** Use inductive reasoning to make conjectures and deductive reasoning to arrive at valid conclusions
3. **B.1.a.** Apply problem-solving skills (e.g., identifying irrelevant or missing information, making conjectures, extracting mathematical meaning, recognizing and performing multiple steps when needed, verifying results in the context of the problem) to the solution of real-world problems
4. **B.1.b.** Use a variety of strategies to set up and solve increasingly complex problems

5. **B.1.c.** Represent data, real-world situations, and solutions increasingly complex contexts (e.g., expressions, formulas, tables, charts, graphs, relations, functions) and understand the relationships
6. **B.1.d.** Use the language of mathematics to communicate increasingly complex ideas orally and in writing, using symbols and notations correctly
7. **B.1.e.** Make appropriate use of estimation and mental mathematics in computations and to determine the reasonableness of solutions to increasingly complex problems
8. **B.1.f.** Make mathematical connections among concepts, across disciplines, and in everyday experiences
9. **B.1.g.** Make appropriate role of technology (e.g., calculators, software programs) in mathematics (e.g., organize data, develop concepts, explore relationships, decrease time spent on computations after a skill has been established)
10. **H.2.c.** Find sums of a finite arithmetic or geometric series
11. **H.2.d.** Use sequences and series to solve real-world problems
12. **H.2.e.** Use sigma notation to express sums

Common Core Standards:

F.IF.3. Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers

Focus Questions:

1. What is the difference between an arithmetic sequence and an arithmetic series?
2. How can a formula be developed that describes an arithmetic series?

Mathematical Practices:

1. Attend to precision (Students will define the term “arithmetic series” and learn to identify arithmetic series).
2. Use appropriate tools strategically (Students will use graphing calculators to perform operations with arithmetic series).

Engagement:

1. Authenticity (Students will transfer knowledge of arithmetic sequences and apply it to arithmetic series).
2. Novelty and Variety (Students will watch a video of a simulated arithmetic series to solve a problem).
3. Sense of Audience (Students will show results of solution on the document camera)

Assessment:

1. Formative – Video of Example of Arithmetic Series
2. Formative – EOC Multiple Choice Examples
3. Formative – p591-592 (8-32 even)

Days 7 and 8

Lesson Content: Review and Unit Six Mid-Unit Assessment

Quality Core Standards:

1. **A.1.a.** Identify properties of real numbers and use them and the correct order of operations to simplify expressions.
2. **A.1.j.** Use inductive reasoning to make conjectures and deductive reasoning to arrive at valid conclusions
3. **B.1.a.** Apply problem-solving skills (e.g., identifying irrelevant or missing information, making conjectures, extracting mathematical meaning, recognizing and performing multiple steps when needed, verifying results in the context of the problem) to the solution of real-world problems
4. **B.1.b.** Use a variety of strategies to set up and solve increasingly complex problems
5. **B.1.c.** Represent data, real-world situations, and solutions increasingly complex contexts (e.g., expressions, formulas, tables, charts, graphs, relations, functions) and understand the relationships

6. **B.1.d.** Use the language of mathematics to communicate increasingly complex ideas orally and in writing, using symbols and notations correctly
7. **B.1.e.** Make appropriate use of estimation and mental mathematics in computations and to determine the reasonableness of solutions to increasingly complex problems
8. **B.1.f.** Make mathematical connections among concepts, across disciplines, and in everyday experiences
9. **B.1.g.** Make appropriate role of technology (e.g., calculators, software programs) in mathematics (e.g., organize data, develop concepts, explore relationships, decrease time spent on computations after a skill has been established)
10. **H.2.a.** Find the n th term of an arithmetic or geometric sequence
11. **H.2.b.** Find the position of a given term of an arithmetic or geometric sequence
12. **H.2.c.** Find sums of a finite arithmetic or geometric series
13. **H.2.d.** Use sequences and series to solve real-world problems
14. **H.2.e.** Use sigma notation to express sums

Common Core Standards:

1. **A.SSE.4.** Derive the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems
2. **F.IF.3.** Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers

Focus Questions:

1. How do you find the pattern in a list?
2. How do you develop a formula to describe a sequence?
3. What makes sequences arithmetic?
4. How do you write a formula for an arithmetic sequence?
5. What makes sequences geometric?
6. How can geometric sequences be modeled?
7. What is the difference between an arithmetic sequence and an arithmetic series?
8. How can a formula be developed that describes an arithmetic series?

Mathematical Practices:

1. Look for and make use of structure.
2. Attend to precision.
3. Use appropriate tools strategically.

Engagement:

1. Learning with Others. (Students will work in groups of three to do review problems)
2. Sense of Audience. (Results of group will be shared with the class)

Assessment:

1. Formative – Mid-Unit Review Group Work
2. Summative – Unit Six Mid-Unit Assessment

Days 9 and 10

Lesson Content: Geometric Series

Quality Core Standards:

1. **A.1.a.** Identify properties of real numbers and use them and the correct order of operations to simplify expressions.
2. **A.1.j.** Use inductive reasoning to make conjectures and deductive reasoning to arrive at valid conclusions

3. **B.1.a.** Apply problem-solving skills (e.g., identifying irrelevant or missing information, making conjectures, extracting mathematical meaning, recognizing and performing multiple steps when needed, verifying results in the context of the problem) to the solution of real-world problems
4. **B.1.b.** Use a variety of strategies to set up and solve increasingly complex problems
5. **B.1.c.** Represent data, real-world situations, and solutions increasingly complex contexts (e.g., expressions, formulas, tables, charts, graphs, relations, functions) and understand the relationships
6. **B.1.d.** Use the language of mathematics to communicate increasingly complex ideas orally and in writing, using symbols and notations correctly
7. **B.1.e.** Make appropriate use of estimation and mental mathematics in computations and to determine the reasonableness of solutions to increasingly complex problems
8. **B.1.f.** Make mathematical connections among concepts, across disciplines, and in everyday experiences
9. **H.2.c.** Find sums of a finite arithmetic or geometric series
10. **H.2.d.** Use sequences and series to solve real-world problems
11. **H.2.e.** Use sigma notation to express sums

Common Core Standards:

A.SSE.4. Derive the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems

Focus Questions:

1. What is the relationship between a geometric sequence and a geometric series?
2. How do you develop and use a formula for a geometric series?

Mathematical Practices:

1. Attend to precision (Students will define the term “geometric series” and learn to identify geometric series).

Engagement:

1. Authenticity. (Students will transfer knowledge of geometric sequences to solve problems about geometric series).
2. Clear/Modeled Expectations (Students will be given models of finite and infinite geometric series in order to solve problems).
3. Sense of Audience – (Student Work of Constructed Response of Review Material will be shared).

Assessment:

1. Formative – ACT Practice Problems
2. Formative – EOC Constructive Problem
3. Formative – p599 (8-30 even, 32, 38)

Days 11 and 12

Lesson Content: Complex Numbers

Quality Core Standards:

1. **A.1.a.** Identify properties of real numbers and use them and the correct order of operations to simplify expressions.
2. **B.1.d.** Use the language of mathematics to communicate increasingly complex ideas orally and in writing, using symbols and notations correctly
3. **B.1.e.** Make appropriate use of estimation and mental mathematics in computations and to determine the reasonableness of solutions to increasingly complex problems
4. **B.1.g.** Make appropriate role of technology (e.g., calculators, software programs) in mathematics (e.g., organize data, develop concepts, explore relationships, decrease time spent on computations after a skill has been established)

5. **C.1.a.** Identify complex numbers and write their conjugates
6. **C.1.b.** Add, subtract, and multiply complex numbers
7. **C.1.c.** Simplify quotients of complex numbers

Common Core Standards:

1. **N.CN.1.** Know there is a complex number i such that $i^2 = -1$, and every complex number has the form $a+bi$ with a and b real
2. **N.CN.2.** Use the relation $i^2 = -1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers

Focus Questions:

How do you find and manipulate complex numbers?

Mathematical Practices:

Attend to precision (Students will use a clear definition of the imaginary unit and explicitly utilize it in their answers).

Engagement:

1. Clear/Modeled Expectations (Teacher will model examples of manipulating complex numbers).
2. Authenticity (Students will transfer knowledge of polynomials to manipulate complex numbers).

Assessment:

1. Formative – Polynomial Review
2. Formative – ACT Practice Problems
3. Formative – p253-254 (8-32 even, 48-54 even)

Days 13 and 14

Lesson Content: Review and Unit Six Assessment

Quality Core Standards:

1. **A.1.a.** Identify properties of real numbers and use them and the correct order of operations to simplify expressions.
2. **A.1.j.** Use inductive reasoning to make conjectures and deductive reasoning to arrive at valid conclusions
3. **B.1.a.** Apply problem-solving skills (e.g., identifying irrelevant or missing information, making conjectures, extracting mathematical meaning, recognizing and performing multiple steps when needed, verifying results in the context of the problem) to the solution of real-world problems
4. **B.1.b.** Use a variety of strategies to set up and solve increasingly complex problems
5. **B.1.c.** Represent data, real-world situations, and solutions increasingly complex contexts (e.g., expressions, formulas, tables, charts, graphs, relations, functions) and understand the relationships
6. **B.1.d.** Use the language of mathematics to communicate increasingly complex ideas orally and in writing, using symbols and notations correctly
7. **B.1.e.** Make appropriate use of estimation and mental mathematics in computations and to determine the reasonableness of solutions to increasingly complex problems
8. **B.1.f.** Make mathematical connections among concepts, across disciplines, and in everyday experiences
9. **B.1.g.** Make appropriate use of technology (e.g., calculators, software programs) in mathematics (e.g., organize data, develop concepts, explore relationships, decrease time spent on computations after a skill has been established)
10. **C.1.a.** Identify complex numbers and write their conjugates
11. **C.1.b.** Add, subtract, and multiply complex numbers
12. **C.1.c.** Simplify quotients of complex numbers
13. **H.2.a.** Find the n th term of an arithmetic or geometric sequence
14. **H.2.b.** Find the position of a given term of an arithmetic or geometric sequence

15. **H.2.c.** Find sums of a finite arithmetic or geometric series
16. **H.2.d.** Use sequences and series to solve real-world problems
17. **H.2.e.** Use sigma notation to express sums

Common Core Standards:

1. **N.CN.1.** Know there is a complex number i such that $i^2 = -1$, and every complex number has the form $a+bi$ with a and b real
2. **N.CN.2.** Use the relation $i^2 = -1$ and the commutative, associative, and distributive properties to add, subtract, and multiply complex numbers
3. **A.SSE.4.** Derive the formula for the sum of a finite geometric series (when the common ratio is not 1), and use the formula to solve problems
4. **F.IF.3.** Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers

Focus Questions:

1. How do you find the pattern in a list?
2. How do you develop a formula to describe a sequence?
3. What makes sequences arithmetic?
4. How do you write a formula for an arithmetic sequence?
5. What makes sequences geometric?
6. How can geometric sequences be modeled?
7. What is the difference between an arithmetic sequence and an arithmetic series?
8. How can a formula be developed that describes an arithmetic series?
9. What is the relationship between a geometric sequence and a geometric series?
10. How do you develop and use a formula for a geometric series?
11. How do you find and manipulate complex numbers?

Mathematical Practices:

1. Look for and make use of structure.
2. Attend to precision.
3. Use appropriate tools strategically.

Engagement:

1. Learning with Others. (Students will work in groups of three to do review problems)
2. Sense of Audience. (Results of group will be shared with the class)

Assessment:

1. Formative – Unit Review Group Work
2. Summative – Unit Six Unit Assessment