Your competence will be assessed as you complete a performance assessment (HHT1). This course of study may take up to 6 weeks to complete.

**Introduction**

This course of study is aligned to the HHT1 performance assessment. The same study materials are utilized in the GAC1 objective assessment. If you have previously completed the GAC1 assessment, then you should have already completed the required study activities found in this course of study. You may wish to review the assignments here, but you are not required to repeat these activities. If you have not yet completed the GAC1 assessment, then please proceed through this course of study in full.

**Overview**

Included in this course are the following main topics: proofs, set theory, logic, number theory, mathematical systems, modular arithmetic, and graph theory.

If this is your first time taking a finite mathematics course, please follow the course of study in the order it is presented. If you have significant previous coursework or are otherwise competent in this material, please skip to the Final Review section and take the skills checks. These skills checks will help you assess your competence as well as help you determine what you need to review before attempting the pre-assessment.

**Outcomes and Evaluations**

There are 3 competencies covered by this course of study; they are listed in the "Competencies for Finite Mathematics (HHT1)" page.

**Teaching Dispositions Statement**

Please review the Statement of Teaching Dispositions.

You will complete the following assessments as you work through the course of study.

**Performance Assessment**

You will complete the following performance assessment in TaskStream:

- HHT1

Previews of task instructions and rubrics for this assessment are available in via the 'Assessment Preparation' box in the online course of study.

**Preparing for Success**

The information in this subject section is provided to help you become ready to complete this course of study. As you proceed, you will need to be organized in your studies, competent in the indicated areas, and ready to pass the final assessments.

**Your Learning Resources**
The learning resources listed in this section will be required to complete the activities in this course of study. Follow the instructions provided to access these resources as early as possible in order to give yourself time to become familiar with them.

**Automatically Enrolled Learning Resources**

You will be automatically enrolled at the activity level for the following learning resources. Simply click on the links provided in the activities to access the learning materials.

**CollegeAnywhere**
You will access the episodes in the following CollegeAnywhere course as the activity level within this course of study.

- Mathematics Illuminated

**Thinkwell**
You will access the materials in the following Thinkwell course at the activity level within this course of study. This web-based resource includes multimedia video lectures, review notes, interactive animations, and sample exercises.

- Thinkwell Prealgebra
- Thinkwell College Algebra
- Thinkwell Geometry

**Enroll in Learning Resources**

You will need to enroll in or subscribe to additional learning resources as a part of this course of study.

You may already have enrolled in these resources for other courses. Please check the "Learning Resources" tab and verify that you have access to the following learning resources. If you do not currently have access, please enroll or renew your enrollment at this time.

*Note: For instructions on how to enroll in or subscribe to learning resources through the "Learning Resources" tab, please see the "Acquiring Your Learning Resources" page.*

**Thinking Mathematically**
You will access materials in the following multimedia online textbook. This resource includes videos, practice problems, and quizzes.


**Additional Preparation**

There are many different learning tools available to you within your course of study in addition to the learning resources already discussed. Take the time to familiarize yourself with them and determine how best to fit them into your learning process.

**Message Boards, FAQs, Note-Taking Tool**
Message boards, FAQs, and a note-taking tool are available in every course of study.

Use the "Additional Learning Tools" page to review these tools. Message boards, learning communities, study notes, and FAQs are available in every course of study.

**The WGU Central Library**

The WGU Central Library is available online to WGU students 24 hours a day. The library offers access to a number of resources, including over 60,000 full-text e-books; articles from journals, magazines, and newspapers; course e-reserves; and tutorials on how to use these resources and the library. The library also includes a reference service for help with research questions or navigating the library.

For more information about using the WGU Library, view the "WGU Library: Finding Articles, Books & E-Reserves" video in the Student Resources section of The WGU Channel.

**Center for Writing Excellence: The WGU Writing Center**

If you need help with any part of the writing or revision process, contact the Center for Writing Excellence (CWE). Whatever your needs—writing anxiety, grammar, general college writing concerns, or even ESL language-related writing issues—the CWE is available to help you. The CWE offers personalized individual sessions and weekly group webinars. For an appointment, please e-mail writingcenter@wgu.edu.

**Course Mentor Assistance**

Course mentors are available to help you. Their job is to aid understanding in areas where you need to improve, and to guide you to the learning resources that will help you. Request their help as needed when preparing for assessments.

If you fail assessment attempts, go through the provided feedback first, then ask specific questions. Mentors cannot guarantee you pass as they do not evaluate assessments; however, they can provide the assistance and advice necessary to help you succeed.

**Graphing Calculator**

Acquire a graphing calculator and familiarize yourself with how to use it. Refer to WGU Calculator Guidelines for details regarding calculators that are acceptable on WGU exams. If you are in a secondary mathematics program, refer to WGU Calculator Recommendations for calculator suggestions for your degree program. If you are not in a secondary mathematics program, contact your mentor to discuss calculators appropriate to your degree program.

**Problem Solving and Critical Thinking**

This section presents an introduction to inductive and deductive reasoning in mathematics, including identifying and analyzing patterns and the problem solving process.

**Induction and Deductive Reasoning**

You will learn strategies for thinking logically, view and analyze patterns, and use models and plans to problem solve in mathematics.

**Critical Thinking and Problem Solving**
Read the following sections from *Thinking Mathematically*:

- section 1.1 ("Inductive and Deductive Reasoning")
- section 1.2 ("Estimation, Graphs, and Mathematical Models")

Complete the following exercises in the homework section of Skills Checks in MyMathLab:

- sections 1.1 and 1.2

Watch the video lectures and review notes for the following section in *Thinkwell College Algebra*:

- **section 8.3 ("Induction")**

In your study notebook, explain the difference between a proof using inductive reasoning and a proof using deductive reasoning. Give an example of both.

**Rounding and Truncation**

You will discover examples of how truncation and rounding are applied.

**Rounding and Truncation**

Review the following document for rules and examples about rounding and truncation:

- "[The Rules for Rounding and Truncation](#)"

Watch the following videos with examples of using rounding in real-world scenarios:

- [Truncating and Rounding](#)
- [Estimation with Decimals](#)
- [Multiplying Whole Numbers and Applications 4](#)

In your study notebook, complete the following exercises:

- Show how truncating a number can give a different value than rounding can.
- Show how truncating a number can give the same value as rounding can.
- Are there any consequences for truncating a number vs. rounding it?
- Make a list of reasons why you would round or truncate a number.

**Task 1 Performance Task**

Complete the following portion of this task in [TaskStream](#):

- HHT1: part A

For directions on how to receive access to performance assessments, see the "[Accessing Performance Assessments](#)" page.

**Set Theory**
This study of set theory includes symbolic and graphical representations of set operations.

**Sets and Operations**
You will learn definitions and symbols associated with sets, subsets, and disjoint sets. You will also learn how to represent set relationships through Venn diagrams, find union and intersection, and apply set theory to real-world applications.

**Language, Symbols, and Application of Set Theory**

Read the following sections from *Thinking Mathematically*:

- section 2.1 ("Basic Set Concepts")
- section 2.2 ("Subsets")

Complete the following exercises in the homework section of Skills Checks in MyMathLab:

- sections 2.1 and 2.2

Define the following terms in your study notebook:

- empty set
- universal set
- subset
- disjoint set
- joint set

**Performing Set Operations**

Read the following sections from *Thinking Mathematically*:

- section 2.3 ("Venn Diagrams and Set Operations")
- section 2.4 ("Set Operations and Venn Diagrams with Three Sets")

Complete the following exercises in the homework section of Skills Checks in MyMathLab:

- sections 2.3 and 2.4

**Logic and Truth Tables**

The study of logic includes truth tables.

**Statements and Negation**
You will learn how to symbolically represent logic statements and negation.

**Statements of Symbolic Logic**

Read the following section from *Thinking Mathematically*.

- section 3.1 ("Statements, Negations, and Quantified Statements")

Complete the following exercises in the homework section of Skills Checks in MyMathLab:
section 3.1

Respond to the following prompts in your study notebook:

- What is the difference between an English sentence and a statement in the study of logic?
- Define and give examples of statements in the study of logic.
- What does negation mean?
- What is the symbol for negation in logic?

**Logical Quantifiers and Connectives**

You will learn the meanings of the following quantifiers in logic statements: some, all, and none (or no). You will also learn the different symbols and meanings used to illustrate connectives in compound logic statements: and, or, but, yet, if-then, and if and only if.

**Working With Quantifiers**

Read the following section from *Thinking Mathematically*:

- section 3.2 ("Compound Statements and Connectives")

Complete the following exercises in the homework section of Skills Checks in MyMathLab:

- section 3.2

In your study notebook, summarize in your own words the difference between quantifiers and connectives. Can you give examples of their use in logic statements? How do you apply the dominance of connectives?

**Truth Tables**

You will learn how to determine the truth value of a logic statement by creating a truth table.

**Creating Truth Tables**

Read the following sections in *Thinking Mathematically*:

- section 3.3 ("Truth Tables for Negation, Conjunction, and Disjunction")
- section 3.4 ("Truth Tables for the Conditional and the Biconditional")

Complete the following exercises in the homework section of Skills Checks in MyMathLab:

- sections 3.3 and 3.4

**Number Theory and the Real Number System**

Number theory consists of understanding counting numbers, operations, and properties involving prime and composite numbers, odd and even numbers, factors, and multiples.

This section also encompasses the study of basic number systems and their properties.
Prime and Composite Numbers
You will define and solve problems with prime and composite numbers. Be sure that you understand and can explain the concepts of divisibility, multiples, and factors. Work to develop conceptual understanding, rather than memorization, of these numbers and properties.

Working With Prime and Composite Numbers

Watch the following video with an introduction to prime numbers and basic number theory from the series "Mathematics Illuminated" produced by Annenberg Learner:

- **Episode 101: The Primes**

Read the following section from *Thinking Mathematically*:

- section 5.1 ("Number Theory and the Real Number System")

Complete the following exercises in the homework section of Skills Checks in MyMathLab:

- section 5.1

In your study notebook, define prime and composite numbers and how they are important for divisibility of numbers. Explain how knowing divisibility of numbers will allow you to create even groups (as in problems 92 to 100 in the homework).

Explaining Proofs

In this activity, you will learn the definition of theorem. Watch the video lectures and review notes for the following chapter in *Thinkwell Geometry*:

- **chapter 2 ("Deductive Reasoning")**

The following web page gives examples of proofs in number theory. Read through these proofs to gain an understanding of how proofs are often approached in number theory.

- "Number Theory/Elementary Divisibility"

For example, read Theorem 1 on the web page above. It is very formal in its notation and structure. However, the proof can be explained less formally like so: If a number, call it \( d \), is a factor of two other numbers, call them \( a \) and \( b \), then it is also a factor of multiples \( a \) and \( b \), as well as the sum of those multiples. For example, because 3 is a factor of 6 and 9, it is also a factor of 12 (which is 2 times 6, a multiple of 6) and 36 (which is 4 times 9, a multiple of 9). Also, it is a factor of 48, which is 12 + 36.

The explanation of the proof is fairly straightforward. If \( d \) is a factor of \( a \), then it is a factor of a multiple of \( a \), call it \( ra \). Similarly, if \( d \) is a factor of \( b \), then it is a factor of a multiple of \( b \), call it \( sb \). It must also be a factor of the sum, \( ra + sb \) because if it is a factor of both \( ra \) and \( sb \), then it can be factored out of each term.
Numerous proofs involve prime and composite numbers. Here are some examples of theorems:

1. "Every positive integer greater than 1 has a prime divisor."
2. "Every composite number has two divisors less than it."
3. "The only two consecutive prime numbers are 2 and 3."
4. "There are an infinite number of composite numbers."

In your study notebook explain how to prove the example proofs listed above. Will you use induction or deduction on these proofs? Conduct an internet search for the proofs to get some hints and ideas. You will want to be able to explain how to prove a theorem involving prime and composite numbers. Use the following websites to read the formal proof, then explain how the proof works for the task.

- Infinitude of Primes
- Euclid's Proof of the Infinitude of Primes

Task 1 Performance Task

Complete the following portion of this task in TaskStream:

- HHT1: part B

For directions on how to receive access to performance assessments, see the "Accessing Performance Assessments" page.

Integers and Order of Operations

You will learn to apply the order of operations in a problem with integers. You will need to review powers and exponents.

Using Order of Operations

Watch the video lectures and review notes for the following section in Thinkwell Prealgebra:

- section 2.2 ("Operations with Integers")

In your study notebook, note how the integers differ from counting (natural) numbers.

Order of Operations of Integers

Read the following section from Thinking Mathematically:

- section 5.2 ("The Integers; Order of Operations")

Watch the video lectures and review notes in the following chapter at Thinkwell Prealgebra:

- chapter 2 ("Integers")

Complete the following exercises in the homework section of Skills Checks in MyMathLab:
section 5.2

Rational Numbers
You will learn the meaning of a rational number. You will also learn how to reduce, convert between mixed numbers and improper fractions, and perform basic operations. You should become proficient at identifying and solving problems with equivalent forms of numbers, such as equivalent fractions and rational numbers as decimals.

Fractions and Decimals
Watch the video lectures and review notes in the following chapters at Thinkwell Prealgebra:

- chapter 3 ("Fractions")
- chapter 4 ("Decimals")

Practice rational number operations and changing to decimals.

Rational Numbers
Read the following section in Thinking Mathematically:

- section 5.3 ("The Rational Numbers")

Complete the following exercises in the homework section of Skills Checks in MyMathLab:

- section 5.3

In your study notebook, explain how a repeating decimal occurs and how it’s different than a terminating decimal.

Irrational Numbers
You will define irrational number.

Irrational Numbers
Read the following section in Thinking Mathematically:

- section 5.4 ("The Irrational Numbers")

Complete the following exercises in the homework section of Skills Checks in MyMathLab:

- section 5.4

In your study notebook, explain the difference between a rational number and an irrational number. What is meant by rationalizing a denominator?

Real Numbers
You will learn, not only to define real numbers, but also to distinguish between the relationships between natural numbers, whole numbers, integers, rational numbers, irrational numbers, and real number systems and subsets.

Examining Number Systems
Read the following section of *Thinking Mathematically*:

- section 5.5 ("Real Numbers and Their Properties")

Complete the following exercises in the homework section of Skills Checks in MyMathLab:

- section 5.5

In your study notebook, create a Venn diagram of all the different types of numbers: real numbers, irrational numbers, rational numbers, integers and natural numbers. Do an internet search for hints on how these sets of numbers are related.

**Scientific Notation**
You will learn how to read and interpret scientific notation, and how to conduct operations using scientific notation.

**Exponents and Scientific Notation**

Watch the videos and read the notes from the following section in *Thinkwell Prealgebra*:

- section 10.1 ("Exponents and Polynomials")

**Scientific Notation**

Read the following section of *Thinking Mathematically*:

- section 5.6 ("Exponents and Scientific Notation")

Complete the following exercises in the homework section of Skills Checks in MyMathLab:

- section 5.6

In your study notebook, explain the reason scientists use scientific notation, and give some examples of its use in practice.

**Powers and Roots**
Calculating powers and roots has applications in several areas of mathematics. You will review how to calculate powers and roots.

**Powers and Roots**

In your study notebook, list some applications in which it is necessary to use powers and roots.

Review section 5.4 ("Irrational Numbers") in *Thinking Mathematically* to recall how to find square roots. Also review section 5.6 ("Exponents and Scientific Notation") in *Thinking Mathematically* to recall how to calculate with exponents.

For additional practice with roots, watch the following videos in section 9.4 ("The Pythagorean Theorem") in *Thinkwell Prealgebra*:
Ratio, Proportion, Percent

In this subject, you will learn how to set up ratios, proportions, and percents to solve problems.

Ratio, Proportion, and Percent
Ratio is the foundational topic both for setting up proportions and solving problems with percent.

Watch the video lectures and review the notes in the following chapter at *Thinkwell Pre-algebra*
Online:

- chapter 7 ("Ratios, Proportions, and Percents")

Solving Problems

Read the following section of *Thinking Mathematically*:

- section 6.4 ("Ratio, Proportion, and Variation")

Complete the following exercises in the homework section of Skills Checks in MyMathLab:

- section 6.4

Read the following section in *Thinking Mathematically*:

- section 8.1 ("Percent, Sales Tax, and Income Tax")

Complete the following exercises in the homework section of Skills Checks in MyMathLab:

- section 8.1

Mathematical Systems and Modular Arithmetic

You will explore the concepts of modular arithmetic and closure. You will also review the following properties: associativity, commutativity, and distributivity.

Mathematical Systems
You will apply closure and other properties to new mathematical constructs.

Mathematical Systems

Read the following section of *Thinking Mathematically*:

- section 13.1 ("Mathematical Systems")

Also watch the following video explanations of mathematical systems:
- **Introduction to Mathematical Systems**

The following presentation shows some examples of mathematical systems:

- "**Examples of Mathematical Systems**"

Complete the following exercises in the homework section of Skills Checks in MyMathLab:

- section 13.1

In your study notebook, explain a mathematical system and give an example of one. What is the difference between a closed system and an open system? For example, what does it mean that whole numbers are closed under addition, but not under subtraction?

**Modular Arithmetic**

You will learn how to add and multiply with mod $n$.

**Modular Arithmetic Resources**

Access the following web pages for an introduction to modular arithmetic.

- "**The Math Dude – What Is Modular Arithmetic?**"
- "**Modular Arithmetic Examples**"

Use this link to get an introduction to modular addition with negative numbers and modular multiplication.

- "**Clock Arithmetic Demonstration**"

Use this link to get a visual of clock arithmetic and practice adding and multiplying in different bases.

- "**Modular Addition, Multiplication, and Exponentiation**"

Use this link to calculate modular additions and subtraction.

These web pages give an overview of modular arithmetic. You should read the materials found on these sites, play around with the applets, and reflect upon what modular arithmetic means and how to compute within a modular system.

**Modular Operations**

Read the following section of *Thinking Mathematically*:

- section 13.2 ("Rotational Symmetry, Groups, and Clock Arithmetic")

*Note: You do not need to read the beginning section on groups; skip to "Modular Systems."
Complete the following exercises in the homework section of Skills Checks in MyMathLab:

- section 13.2

Task 1 Performance Task

Complete the following portion of this task in TaskStream:

- HHT1: part C

For directions on how to receive access to performance assessments, see the "Accessing Performance Assessments" page.

Graph Theory

Graph theory includes sketching graphs from data sets, recognizing patterns, and analyzing circuits, paths, networks, and other similar visual representations of data, as well as making predictions and generalizations.

Finite Graphs, Paths, Circuits, Trees

You will learn how to construct a finite graph demonstrating relationships with a given set of data.

Watch the following video in Mathematics Illuminated, which introduces the mathematical study of "connectedness:"

- Episode 111: Connecting with Networks

Graphs, Paths, and Circuits

Read the following section in Thinking Mathematically:

- section 15.1 ("Graphs, Paths, and Circuits")

Complete the following exercises in the homework section of Skills Checks in MyMathLab:

- section 15.1

Answer the following questions in your study notebook:

- What is the definition of a finite graph?
- What are vertices, edges, and loops?
- How do you recognize equivalent graphs?
- How does a finite graph differ from circle, bar, or line graphs?
- What is a path?
- What is the difference between a path and a circuit?

Euler Paths and Euler Circuits
Read the following section in *Thinking Mathematically*:

- section 15.2 ("Euler Paths and Euler Circuits")

Complete the following exercises in the homework section of Skills Checks in MyMathLab:

- section 15.2

Answer the following questions in your study notebook:

- What are the benefits of trial and error in solving circuit problems?
- What are the drawbacks of using trial and error in solving circuit problems?
- How do you know, without finding it, whether a path is an Euler path?
- How do you know, without finding it, whether a circuit is an Euler circuit?

**Hamilton Paths and Hamilton Circuits**

Read the following section in *Thinking Mathematically*:

- section 15.3 ("Hamilton Paths and Hamilton Circuits")

Complete the following exercises in the homework section of Skills Checks in MyMathLab:

- section 15.3

Answer the following questions in your study notebook:

- What is the Brute Force method?
- What is the Nearest Neighbor method? How does it compare to the Brute Force method?

**Final Steps**

Congratulations on completing the activities in this course of study! This section will guide you through the assessment process.

**Assessment Information**

The activities in this course of study have prepared you to complete the HHT1 performance assessment. If you have not already completed the assessment, you will do so now.

**Skills Checks**

Complete the following skills check in MyMathLab:

- Finite Mathematics Skills Check: Discrete Math
- Finite Mathematics Skills Check: Real Numbers
- Finite Mathematics Skills Check: Number Theory

Refer to "Using Skills Checks" for information about how to appropriately use this learning
resource tool.

**Accessing Performance Assessments**

You should have completed the following tasks as you worked through this course of study. If you have not completed the tasks in TaskStream, do so now.

- HHT1: Task 1

For directions on how to receive access to performance assessments, see the "Accessing Performance Assessments" page.

**Feedback**

To provide feedback on this course of study, please use the Teachers College Course of Study Feedback form.

**ADA Requirements**

Please review the University ADA policy.