BAKER COLLEGE
STUDENT LEARNING OUTCOMES

MTH4150 Modern Algebra
3 Semester Hours

Student Learning Outcomes & Enabling Objectives

1. Apply formal logic to construct proofs using counterexamples, contrapositives, contradictions, trivial, vacuous, and inductive techniques.
    a. Express mathematical statements and arguments using the standard notation of logic.
    b. Evaluate the truth value of logical statements.
    c. Determine whether two statements are logically equivalent.
2. Examine the relationship between equivalence relations and partitions.
    a. Explain the reflexive, symmetric, and transitive properties.
    b. Determine whether a relation is an equivalence relation.
    c. Define an equivalence class.
    d. Define an equivalence class based on an element of a set.
3. Explore the characteristics of an operation.
    a. Categorize binary operations as closed, commutative, or associative.
    b. Determine whether a mathematical object has an identity or an inverse.
    c. Apply the principle of mathematical induction
    d. Examine the postulates for integers.
4. Solve systems of congruence classes.
    a. Define congruence of integers.
    b. Extend the properties of integers to modular arithmetic.
    c. Solve problems involving congruence.
5. Evaluate the algebraic structure of a group.
    a. Define a group, subgroup, cyclic group, or permutation group.
    b. Identify a generator of a cyclic or permutation group.
    c. Create a cyclic or permutation group.
    d. Identify normal subgroups and quotient groups.
6. Apply isomorphisms to confirm equivalent structures.
    a. Prove a mapping is a homomorphism.
    b. Characterize automorphisms, endomorphisms, epimorphisms,

monomorphisms, and isomorphisms.

c. Apply Cayley's Theorem to determine equivalent structures.
d. Utilize LaGrange's Theorem to examine the size and structure of subgroups.

7. Evaluate the algebraic structure of rings, integral domains, and fields.
    a. Apply the definitions of ring, field, and integral domains.
    b. Define a field of quotients of an integral domain.
    c. Define various ring morphisms.
8. Evaluate polynomials over a ring.
    a. Extend divisibility to polynomials.
    b. Factor polynomials over a ring.
    c. Identify zeros of a polynomial.

Big Ideas and Essential Questions

Big Ideas:

- Proofs
- Groups
- Rings
- Fields

Essential Questions:

1. How does an understanding of the structure of algebra strengthen my problem-solving capabilities?
2. How does rigorously establishing the structure of algebra help me better understand how to apply algebra?

These SLOs are not approved for experiential credit.

Effective: Fall 2017