C O U R S E O U T L I N E
MT. HOOD COMMUNITY COLLEGE DISTRICT
Gresham, Oregon 97030

* New _____

*Revised _____

* Review only (no changes) 7/2007 (Date)

* COURSE TYPE Please check appropriate box:

- ☒ Lower Division Collegiate
- ☐ Occupational Supplementary
- ☐ Occupational Preparatory
- ☐ Other Education, Including General Ed & Adult Ed

COURSE TITLE Fundamentals of Elementary Mathematics I

COURSE NUMBER Mth 211 COURSE CREDIT 4

* Lecture Hours 4 | _____ Wkly/Term Lab Hours _____ | _____ Wkly/Term Seminar Hours _____ | _____ Wkly/Term

* GRADING STATUS:

☒ Letter Grade Only ☐ S/U Only ☐ Optional ☐ No Grade

* HEADCOUNT LOADING:

☐ Yes ☒ No * Factor _____

Guided Studies Requirement:
Student must be proficient in:

- ☒ Reading (RD90)
- ☒ Writing (WR90)
- ☒ Mathematics (MTH20)
- ☐ Not applicable

For Instruction Office Use Only
General Education Category
Apply general requirement or distribution to:

AA_____ AS_____ AS/OT-Bus_____

AAS_____AGS_____

VP Approval _____Date_____

Phil DeMarois	3/6/02		
1) Prepared by	Date	4) Approved by Dean	Date
2) Approved by Distance Education Admin.	Date	5) Curriculum Committee	Date
3) Approved by Department Chair	Date	6) Approved by VP for Student Learning	Date

* See legend/definition for explanation

COURSE DESCRIPTION: (for catalog)
This course is part one of a three-course sequence in mathematics for future K-8 teachers. The course includes problem solving, functions, the structure of number systems, operations on whole numbers, and number theory. Various concrete, pictorial, and heuristic problem solving strategies are used along with algorithmic problem solving. A required computer component will reinforce the concepts of the course.

PREREQUISITE:
MTH 95 with a grade of C or better, or suitable performance on the mathematics placement exam.

INSTRUCTIONAL MATERIALS REQUIRED OF STUDENT: (text, supplies, etc.)

Text as determined by instructor. Scientific calculator with fraction key.

STUDENT LEARNING OUTCOMES:

Upon successful completion of this course, the student will be able to:

1) Communicate effectively (orally and in writing) a problem solving process, results, and conclusions using mathematical terminology and correct mathematical syntax appropriate to the level of study.

2) Apply mathematical reasoning and modeling to solve problems arising from the real world.

3) Model problem situations using mathematics verbally, numerically, visually, graphically, and/or algebraically, and make connections among the four models as appropriate at this level.

4) Describe and illustrate heuristic problem solving methods.

5) Explain, illustrate, and use Polya's 4-step problem solving process.

6) Describe and illustrate heuristic problem solving methods.

7) Estimate answers and basic arithmetic problems.

8) Differentiate between inductive and deductive reasoning.

9) Use manipulative to model basic arithmetic concepts.

10) Recognize connections among structurally equivalent problems.

GENERAL INSTRUCTIONAL METHODS:

The MHCC Mathematics Curriculum emphasizes conceptual understanding, real-world applications, multiple representations of problem situations, making connections, mathematical modeling and mathematical problem solving. This represents a shift away from technique mastery and procedural skills. For students to see mathematics as an integrated whole, the above objectives should be presented in a connected fashion and not treated as discrete topics or concepts.

EVALUATION PROCESS:

Passing this course with a C or better serves as a prerequisite for MTH 212. Ensure that the grading plan will mean that students satisfying this requirement are prepared for MTH 212. This requires attention to the amount of verifiable individual work completed by the student. The instructor must give a cumulative in-class final exam to help ensure that students are truly prepared for the next course.

Grades should be based on a balanced variety of grading opportunities spread throughout the term. Although the instructor may not choose to use every method below, a variety of methods is expected. Student evaluation must include problems or activities that incorporate and integrate several outcomes, and closely resemble situations that exist in the real world.

- Projects
- In-class Individual Exams
- In-class Team Exams
- Take-Home Individual Exams
- Take-Home Team Exams
- Writing Assignments
- Daily Homework
- Attendance
- Teamwork/Participation
- Presentations

Math 211 Course Guide

DETAILED STUDENT LEARNING OUTCOMES/INSTRUCTOR REQUIREMENTS:
The instructor is responsible to teach and measure all of the following outcomes. Upon successful completion of this course, the student will be able to:

COURSE CONTENT

1. **Overarching Objectives**
2. **Sets**
3. **Algebraic Thinking**
4. **Numeration and Number Systems**
5. **Four Fundamental Operations of Arithmetic**
6. **Number Theory**

PERFORMANCE OBJECTIVES

1. **Overarching Objectives**

> Goal: Create capable problem solvers and creative learners able to model and interpret elementary mathematics.

The student should be able to:

a) Communicate effectively (orally and in writing) a problem solving process, results, and conclusions using mathematical terminology and correct mathematical syntax appropriate to the level of study.

b) Apply mathematical reasoning and modeling to solve problems arising from the real world.

c) Model problem situations using mathematics verbally, numerically, visually, graphically, and/or algebraically, and make connections among the four models as appropriate at this level.

d) Determine if a solution is reasonable and verify results.

e) Explain, illustrate, and use Polya's 4-step problem solving process.

f) Describe and illustrate heuristic problem solving methods.

g) Estimate answers to basic arithmetic problems.

h) Differentiate between inductive and deductive reasoning.

i) Use manipulatives to model basic arithmetic concepts.

j) Recognize connections among structurally equivalent problems.

2. Sets

Goal: Develop knowledge of sets, operations on sets, and the usefulness of sets as problem solving tools.

The student should be able to:

a) Define set related terms such as: set, element, subset, empty set, one-to-one correspondence, equivalent sets, equal sets, finite sets, infinite sets.

b) Represent set relationships using Venn diagrams.

c) Perform basic sets operations.

3. Algebraic Thinking

Goal: Build familiarity with the use of algebra to represent relationships among varying quantities.

The student should be able to:

a) Use variables to represent changing quantities in a problem solving setting.

b) Recognize patterns in sequences of numbers or figures and express the patterns generally using algebra.

c) Identify functional relationships in numeric form, in symbolic form, and in graphical form.

d) Generalize common number patterns using algebra.

4. Numeration and Number Systems

Goal: Build familiarity with the history of numeration and the underlying structure of our numeration system.

The student should be able to:

a) Identify the important features that define a numeration system.

b) State the major features of common historical numeration systems.

c) Distinguish between numbers and numerals.

d) Identify the key features of the Hindu-Arabic numeration system.

e) Discuss the important role that place value plays in numeration.

f) Represent quantities using various bases other than 10.

g) Identify the elements of the natural numbers and the whole numbers.

5. Four Fundamental Operations of Arithmetic

Goal: Define and model the four basic operations on whole numbers, and analyze the basic algorithms associated with each operation.

The student should be able to:

a) Define the meaning of addition, subtraction, multiplication, and division.

b) Identify developmental steps in learning basic addition, subtraction, multiplication, and division.

c) Use manipulatives to model basic addition, subtraction, multiplication, and division.

d) Model take-away, missing addend, and comparison interpretations of subtraction.

e) Explain and illustrate partitive and quotitive approaches to division.

f) Identify the basic structure underlying algorithms for addition, subtraction, multiplication, and division.

g) Explain, illustrate and use nonstandard algorithms for the four fundamental operations.

h) Add, subtract, multiply, and divide in bases other than 10.

i) Use mental computation techniques to calculate answers to addition, subtraction, multiplication, and division problems.

j) Use estimation techniques to approximate answers to addition, subtraction, multiplication, and division problems.

k) Identify and use closure, commutative, associative, and distributive properties as related to the four fundamental operations on whole numbers.

6. Number Theory

Goal: Recognize and use fundamental concepts related to divisibility, factors, multiples, and prime numbers.

The student should be able to:

a) Illustrate and use basic divisibility tests.

b) Define and use the divides relation.

c) Test to determine if a given whole number is prime, composite, or neither.

d) Define prime number and composite number.

e) Determine the set of factors of a whole number.

f) Determine the set of multiples of a whole number.

g) Determine the greatest common factor of two or more whole numbers.

h) Determine the least common multiple of two or more whole numbers.

GENERAL INSTRUCTIONAL METHODS:

The MHCC Mathematics Curriculum emphasizes conceptual understanding, real-world applications, multiple representations of problem situations, making connections, mathematical modeling and mathematical problem solving. This represents a shift away from technique mastery and procedural skills. For students to see mathematics as an integrated whole, the above objectives should be presented in a connected fashion and not treated as discrete topics or concepts.

Calculator: The calculator is required for the course to support a focus on conceptual understanding and applications rather than emphasizing algorithms. The calculator should be used as a tool to clarify material and speed computation, not as a substitute for explaining the reasons behind the mathematics. Estimating skills (without the calculator) and reality checks should be emphasized to verify calculator results. In addition, technology is a component of the real world for which we are preparing our students. We must encourage technological as well as mathematical literacy.

Language: Use the language of mathematics. For example, refer to the denominator of a fraction as the denominator more and more frequently through the term (rather than as the "bottom").

Learning Environment: Students learn in many different ways: by writing, by listening, by discussing, by asking, by explaining, by reading, etc. The classroom should be structured to support these many learning styles. Since this course is designed for future teachers, it is critical that the instructor model exemplary teaching practices.Thus, teaching should involve a variety of presentations including such methods as:

- Activity Follow-Ups
- Assessment (for teacher information)
- Cooperative Team Problem Solving/Applications
- Data-Gathering Experiments
- Evaluation (graded work)
- Games with an Objective
- Guided Discovery Activities
- Hands-on Activities
- Interactive Lecture
- Lecture
- Questions & Answers on Homework
- Reviewing Evaluation Efforts/Feedback
- Student/Team Presentation of Homework
- Student/Team Presentations
- Team Discussions
- Team-Building Activities
- Team-work at Blackboards
- Use of Technology
- Whole-Class Discussions

In addition, out of class work should also include a variety of learning approaches including:

- Daily Homework
- Hands-On Measurement/Data Gathering
- Individual Evaluation
- Out-of-Class Team Activities (limited)
- Reading Textbook
- Research
- Team Collaboration (Phone, Meetings, etc.)
- Team-Based Evaluation
- Writing Assignments

The classroom should be a cooperative environment managed by the instructor, but focused on the students. Thus, neither a complete lecture format nor a team-based classroom left alone is a successful model. Balance of learning environments and instructor supervision and contribution are necessary components. Although the balance of activities in a classroom varies between instructors, a successful learning environment will certainly include the following essential components:

- **Problem solving activities** must be provided for the students to develop and apply a variety of strategies to solve problems, verify and interpret results with respect to the original problem situation, and generalize solutions and strategies to new problem situations. Through this experience students acquire confidence in using mathematics meaningfully and are able to formulate and solve problems as they exist in the real world and in their field or area of interest.
- Concepts presented in a class should be connected to the **students' future role as educators**.
- **Guided discovery** learning activities must be provided to help the student take responsibility for his/her learning and develop a mechanism to "learn how to learn." By investigating patterns and exploring concrete, pictorial, and graphical models, students create their own understanding of mathematical concepts. Discovery activities also teach students to be adventuresome in their approach to problems - that they need not know the answer before beginning to try something. Manipulatives must be available to aid guided discovery learning activities.
- **Teams** should be constructed to best allow for whole team discussion without any students being left out. Teams should work together in class most days on tasks furthering their understanding of the material and their problem solving/communication abilities. Most discovery activities are completed in teams. (It is recommended that teams be comprised of no more than five students due to the tables used in our classrooms.)
- Although teams are an extremely important and valuable learning environment, they cannot replace **whole class discussions** where students share their insights in an interactive lecture with the instructor as the knowledgeable authority. Team activities (especially discovery activities) need to be followed by a discussion/lecture to ensure that all students understand the material.
- To help coordinate these follow-up efforts and to ensure that the class is learning the material, the instructor should be constantly **assessing** their progress while students are working in teams. Teamwork is not a break for the instructor. The instructor needs to be available to answer questions, sometimes guide discussions, facilitate good team behaviors as needed, and gather information about the students' comprehension and ideas.

  This type of assessment will help the instructor select and set up the next learning environment wisely (or adjust the current one as necessary). As students are working on an activity, the instructor may realize that some instructor-led discussion is necessary in the middle rather than just at the end (as might have been planned). The instructor can use observations to decide whether the instructor should follow a team problem solving session with a class discussion, a lecture, or by having each team put their solution on the board and giving the teams an opportunity to present their approaches. Flexibility is an extremely important part of teaching in a student-centered learning environment.

Although flexibility is important, the instructor must remember that the course outline must be covered by the end of the term. Sometimes the instructor may need to leave a topic that students are not comfortable with and continue covering material. It is important to spiral back and address these weaker points as the term continues.

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Presentations