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 II

COURSE NUMBER Mth 212 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 two of the three-course sequence in mathematics for future K-8 teachers. The course includes problem solving, the structure of the integer, rational, and real number systems, operations on integers, fractions and decimals, ratio and proportion, the meaning and use of percent, and introductory statistics and probability. 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 211 with a grade of C or better, or consent of instructor.**

INSTRUCTIONAL MATERIALS REQUIRED OF STUDENTS: (test, 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) Determine if a solution is reasonable and verify results.

5) Describe and illustrate heuristic problem solving methods.

6) Estimate answers to basic arithmetic problems involving negative numbers, fractions, decimals, and percent.

7) Use manipulatives to model basic concepts involving integers, fractions, decimals, and percent.

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 213. Ensure that the grading plan will mean that students satisfying this requirement are prepared for MTH 213. 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 Team Exams
- Writing Assignments
- Daily Homework
- Attendance
- Teamwork/Participation

- Presentations

Math 212 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. **Integers**
3. **Fractions and Rational Numbers**
4. **Decimals, Exponents, and Real Numbers**
5. **Ratio and Proportion**
6. **Percent**
7. **Basic Statistics**
8. **Basic Probability**

II. 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) Describe and illustrate heuristic problem solving methods.

f) Estimate answers to basic arithmetic problems involving negative numbers, fractions, decimals, and percent.

g) Use manipulatives to model basic concepts involving integers, fractions, decimals, and percent.

2. Integers

Goal: Build familiarity with the set of integers including models and algorithms for operations on integers.

The student should be able to:

a) Define the set of integers.

b) Distinguish between the set of integers and the set of whole numbers.

c) Use various models, such as colored chips, to represent integers.

d) Model the four fundamental operations on integers.

e) Explain and use the closure, commutative, associative, and distributive properties appropriately in the context of integer operations.

3. Fractions and Rational Numbers

Goal: Build familiarity with the set of rational numbers including models and algorithms for operations on fractions.

The student should be able to:

a) Define the set of rational numbers.

b) Distinguish between the set of integers and the set of rational numbers.

c) Identify the unit when working with fraction concepts.

d) Use various models to represent fractions.

e) Demonstrate fraction sense by ordering a set of fractions.

f) Model the four fundamental operations on fractions.

g) Efficiently perform the four fundamental operations on fractions.

h) Explain and use the closure, commutative, associative, density, and distributive properties appropriately in the context of operations on fractions.

4. Decimals, Exponents, and Real Numbers

Goal: Build familiarity with decimals including models and algorithms for operations on decimals.

Goal: Build familiarity with the meaning and use of exponents, including simplification properties.

The student should be able to:

a) Define the set of real numbers.

b) Distinguish between the set of real numbers and the set of rational numbers.

c) Identify when a fraction can be represented as a terminating decimal vs. a repeating decimal.

d) Use various models, especially base 10 blocks, to represent decimals.

e) Demonstrate decimal sense by ordering a set of decimals.

f) Model the four fundamental operations on decimals.

g) Efficiently perform the four fundamental operations on decimals.

h) Relate computational operations on decimals to the corresponding computational operations on fractions.

i) Convert between decimals and fractions.

j) Round decimals.

k) Define and justify the meaning of whole number exponents.

l) Define and justify the meaning of integer exponents.

m) Justify and use basic exponent properties.

5. Ratio and Proportion

Goal: Build familiarity with the meaning of ratios and proportions along with techniques for using ratios and proportions to represent and solve problems.

The student should be able to:

a) State the definition of ratio.

b) Interpret the meaning of a ratio in a problem situation.

c) State the definition of proportion.

d) Distinguish between ratios and rates.

e) Differentiate between additive comparisons and multiplicative comparisons.

f) Use proportions as a problem solving tool.

6. Percent

Goal: Build familiarity with the meaning of percent, the equivalence among percents,

The student should be able to:

a) Define the meaning of percent.

b) Use models, particularly base 10 blocks, to represent percents.

c) Conceptually demonstrate how to convert among decimals, fractions, and percents.

d) Solve problems involving percent, including percent change.

7. Basic Statistics

Goal: Build familiarity with basic statistical concepts related to the shape of a distribution, the center of a distribution, and the spread of a distribution.

The student should be able to:

a) Organize and summarize information using bar graphs, circle graphs, line graphs, histograms, stem and leaf plots, and scatterplots.

b) Give examples of how each type of graph can be deceptive.

c) Identify the shape of a distribution of data as uniform, skewed, bimodal, or normal.

d) Compute mean, median, and mode for a set of data.

e) Identify the advantages and disadvantages of using mean, median, and mode as a measure of the center of the data.

f) Calculate measures of dispersion, particularly range, interquartile range, and standard deviation.

g) Formally define the meaning of an outlier.

h) Interpret the meaning of quartiles and percentiles in context of given data.

i) Interpret z-scores for given data.

j) Describe the normal distribution in terms of mean, standard deviation, and z-scores.

k) Differentiate between a sample and a population.

l) Differentiate between random sampling and stratified sampling.

8. Basic Probability

Goal: Build familiarity with basic counting techniques related to computing probabilities of events.

The student should be able to:

a) Define probability.

b) Differentiate between theoretical probability and inferential probability.

c) Use simulation to estimate the probability of an event.

d) Explain and compute expected values of experiments.

e) Define experiment, sample space, outcome, and event.

f) Explain and give examples of an event with probability zero or one.

g) Construct tree diagrams to represent the outcomes in a sample space.

h) Explain and apply the fundamental counting principle.

i) Solve problems involving permutations.

j) Solve problems involving combinations.

k) Construct probability tree diagrams.

l) Determine probabilities of complementary events.

m) Compute probabilities of events with equally likely outcomes.

n) Explain, in basic language, the Law of Large 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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