MATH 180: QUANTITATIVE REASONING

Foothill College Course Outline of Record

Heading	Value
Effective Term:	Summer 2023
Units:	5
Hours:	4 lecture, 3 laboratory per week (84 total per quarter)
Degree & Credit Status:	Degree-Applicable Credit Course
Foothill GE:	Non-GE
Transferable:	None
Grade Type:	Letter Grade Only
Repeatability:	Not Repeatable

Student Learning Outcomes

- Students will apply their understanding and knowledge of how to use variables (including subscripts), order of operations, and units (including dimensional analysis), growing their confidence in using formulas in any field.
- Students will develop communication strategies and skills: for comprehending quantitative contexts, discussing those contexts and the mathematics needed to address them, and reporting their findings, both verbally and in writing.
- Students will incorporate mathematical reasoning into their decision-making toolbox in all aspects of their life (personal, professional, and academic).
- Students will see and use quantitative reasoning as a tool for understanding the world.
- Students will see themselves as mathematical thinkers and creators of knowledge.

Description

Students will be able to apply mathematical reasoning in their personal, professional, and academic lives, to investigate new contexts, develop and propose possible solutions, discuss and analyze proposed plans, and make decisions. Students will learn to value the collaborative process of explaining, investigating, comparing, and assessing a variety of perspectives and approaches. Through immersion in contextualized lessons, students will practice quantitative thinking as they build skill in communication, critical and creative thinking, and computation. They will grow their knowledge and understanding of themselves, each other, and the world, through the study of culturally-relevant contexts, such as personal finance, health and wellness, membership in society, and the environment.

Course Objectives

The student will be able to:

1. Plan, implement, and assess their work cycles, at the problem, lesson, module, and course level, to develop self-efficacy through the practice of self-regulated learning
2. Collaborate to collect, assemble, discuss, and present culturally-relevant information using team member knowledge, reading strategies, and the internet
3. Read, comprehend, and discuss quantitative situations drawn from the fields of personal finance, health and wellness, environmental technologies, and civic engagement
4. Demonstrate an understanding of mathematics by writing complete and correct responses to questions
5. Apply proportional reasoning, analyze doubling times, and apply exponential and linear modeling to investigate environmental and social issues and compare issues/measures from different times or places
6. Use estimation and investigation of multiple representations of numbers and functions to assess claims from a variety of fields, such as environmental, personal finance, and health and wellness
7. Use percents, estimation, and modeling to explore personal finance options, such as how credit cards work and how taxes are computed
8. Use graphs to describe, interpret, synthesize, and predict information
9. Calculate, compare, and interpret measures of center and make decisions
10. Use dimensional analysis to solve complex problems with multiple pieces of information and steps
11. Apply algebraic and proportional reasoning techniques to analyze multivariable relationships, such as "Stopping Distance of a Car" or "Blood Alcohol Content," and investigate how the formula was developed
12. Identify, create, and use models to predict values and solve problems in contextualized, culturally-relevant settings

Course Content

1. Plan, implement, and assess work cycles, at the problem, lesson, module, and course level, to develop self-efficacy through the practice of self-regulated learning
   a. Workload analysis
      i. School/study time calculation
      ii. Plotting weekly calendar
   b. Math support resources
      i. Classmates
      ii. Teacher and tutors
      iii. Foundations Lab
      iv. Counseling
      v. Student Resource Center
   c. Learning opportunities in math
      i. Productive struggle
      ii. Deliberate practice
      iii. Explicit connections
      iv. Collaboration and teamwork
   d. Mathematical habits of mind
      i. Interpreting contextualize problems
      ii. Predicting solutions
      iii. Analyzing different ideas
      iv. Revising thinking and solutions
2. Collaborate to collect, assemble, discuss, and present culturally-relevant information using team member knowledge, reading strategies, and the internet
   a. Mathematical identity development
   b. Cultural capital recognition and development
   c. Quantitative communication skill development

3. Read, comprehend, and discuss quantitative situations drawn from the fields of personal finance, health and wellness, environmental technologies, and civic engagement
    a. Reading comprehension strategies
        i. Comprehension and Synthesis Chart
            1. Qualitative information and vocabulary
            2. Quantitative information
            3. Plan of action
        ii. Reading apprenticeship routines, such as:
            1. "Think Aloud"
            2. "Talk to the Text"
4. Demonstrate an understanding of mathematics by writing complete and correct responses to questions
    a. Simple and complete
    b. Specific
    c. Stand-alone
5. Apply proportional reasoning, analyze doubling times, and apply exponential and linear modeling to investigate environmental and social issues and compare issues/measures from different times or places
    a. Culturally-relevant issues, such as:
        i. Population
            1. Population growth
            2. Population density
        ii. Allocation of resources
            1. Natural
            2. Human
            3. Per capita measures
    b. Absolute change vs. Relative change
6. Use estimation and investigation of multiple representations of numbers and functions to assess claims from a variety of fields, such as environmental, personal finance, and health and wellness
    a. Large numbers
    b. Mental math
    c. Scientific notation
    d. Tables, graphs, formulas, contexts
7. Use percents, estimation, and modeling to explore personal finance options, such as:
    a. Credit cards
    b. Tax forms
    c. Savings plans
        i. Simple interest
        ii. Compound interest
    d. Consumer Price Index
        i. Base year
        ii. Comparisons over time
        iii. Purchasing power
        iv. Interpretations
        v. Calculations
    e. Cost of Living Index
        i. Buying power
        ii. Comparisons across location
8. Use graphs to describe, interpret, synthesize, and predict information
    a. Pie chart
    b. Line graph
    c. Bar chart
    d. Pictographs
    e. Scatterplots
    f. Misleading graphs
9. Calculate, compare, and interpret measures of center and make decisions
    a. Mean
    b. Median
    c. Mode
    d. Using formulas in a spreadsheet
10. Use dimensional analysis to solve complex problems with multiple pieces of information and steps
    a. Units
        i. Conversions
        ii. Equivalencies
    b. Application to real life problems, such as medical dosages
    c. Equations and proportions
11. Apply algebraic and proportional reasoning techniques to analyze multivariable relationships, such as "Stopping Distance of a Car" or "Blood Alcohol Content," and investigate how the formula was developed
    a. Variables
        i. Subscripts
    b. Order of operations
    c. Units and dimensional analysis
    d. Role of each variable
    e. Relationship between two variables in a multi-variable formula
    f. Solving for an unknown variable or quantity
        i. Using square roots to solve an equation
    g. Inequalities
    h. Evaluating formulas
    i. Decision making using formulas
12. Identify, create, and use models to predict values and solve problems in contextualized, culturally-relevant settings
    a. Connections between four representations of a function
        i. Contextual situations
        ii. Table
        iii. Graph
        iv. Equation
    b. Units
    c. Vertical intercept
        i. Connection to graph
        ii. Connection to equation
    d. Horizontal intercept
        i. Connection to graph
        ii. Connection to equation
    e. Limitations of models based on data
        i. Interpolation
        ii. Extrapolation
    f. Linear models
        i. Rate of change as slope
        ii. Interpretations of slopes and intercepts
    g. Exponential models
        i. Percentage change
        ii. Pattern recognition
        iii. Growth

iv. Decay
v. Financial models

Lab Content

Students will plan, implement, and assess their work cycles, at the course level, to develop self-efficacy in their math studies through the practice of self-regulated learning.

1. Learning opportunities and classroom norms
   a. Productive struggle
   b. Deliberate practice: extending what we learn
   c. Explicit connections and wrap-up
   d. Collaboration and teamwork: some agreements
2. Workload analysis
   a. Collecting data
   b. Plotting time commitments
   c. Analyzing resources
   d. Tools and technologies
3. Making a plan: calendars and logs
   a. Exploration: map of current commitments
   b. Consultation: reviewing recommendations/expert advice/ Carnegie Units
   c. Reflect/revise plan
4. Building a network for mathematical success: academic
   a. In the classroom (building peer groups)
   b. Beyond the classroom (office hours, interview instructors)
   c. Tutors
   d. Labs and library
   e. Counselors
5. Financial planning
   a. Costs (collecting data and predicting expenses)
   b. Sources of support: Financial Aid
   c. The basics of credit cards
   d. Basic budget development
6. Building a network for mathematical success: financial (in consultation with campus resources)
   a. Financial Aid
   b. EOPS
   c. Scholarships and campus jobs
7. Building success habits for learning math
   a. Foundations Lab (developing skills for exploratory learning and practice)
   b. Tutor relationships (what the tutors recommend, habits for successful students)
8. Building a network for mathematical success: registration (can be in consultation with DRC, Admissions and Records, Counselors)
   a. Evaluating math courses to determine next quarter options
   b. Drafting timelines for individual enrollment dates
9. Resources in case you forget the math
   a. On campus
   b. Online
10. Leveraging student success factors to support mathematical learning
    a. Connected, nurtured, valued
       i. Looking back at the quarter's math experiences
       ii. Strategies for success with the next math experience

Special Facilities and/or Equipment

1. Scientific calculator.
2. Computer with internet access.
3. When taught via Foothill Global Access, on-going access to computer with email software and hardware; email address.

Method(s) of Evaluation

Methods of Evaluation may include but are not limited to the following:

Ongoing, formative classroom assessments
Participation in group and class discussions
Checkpoint quizzes
Preparatory assignments
Homework
Lab work
Module tests
Final exam
Projects
Presentations
Portfolio development

Method(s) of Instruction

Methods of Instruction may include but are not limited to the following:

Students will be engaged in small group discussion of contextualized, culturally-relevant problems, followed by wrap-up discussions of group findings and important mathematical ideas related to contextualized problems
Students will reflect on their thinking and on problem ideas individually and in pairs
Students will address mathematical sticking points through discussion and short, targeted, small group or whole class lectures
Students will experience short lectures and discussion of aspects of self-regulated learning and aspects of self-efficacy: as a mathematical thinker, as a student, and as a member of society
Guest lectures, tours, and laboratory activities will support development of mathematical identity and self-efficacy
Students will engage in in-class readings of contextualized, culturally-relevant problems and participate in short, targeted lectures on reading comprehension strategies which they will then apply
Students will make group presentations of minor or major projects and problems, followed by in-class discussion and evaluation

Representative Text(s) and Other Materials

Carnegie Math Pathways from WestEd. Quantitative Reasoning, XanEdu. 2018.

Types and/or Examples of Required Reading, Writing, and Outside of Class Assignments

1. Deliberate practice: daily homework designed to extend concept and skill development
2. Preparatory homework designed to prepare students for the next lesson

3. Module reviews designed to prepare students for module quizzes and exams
4. Online module checkpoint quizzes
5. Portfolio development
6. Lesson preview reading

Discipline(s)

Mathematics