FOOTHILL COLLEGE

12345 EL MONTE ROAD, LOS ALTOS HILLS, CA 94022-4599 - foothill.edu

Effective: Fall 2018

MATH 180   **QUANTITATIVE REASONING**   **5 Unit(s)**

Grade Type: Letter Grade Only
Not Repeatable.
FHGE: Non-GE **Transferable:** None
4 hours lecture, 3 hours laboratory. (84 hours total per quarter)

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:

A. 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.
B. Collaborate to collect, assemble, discuss, and present culturally-relevant information using team member knowledge, reading strategies, and the internet.
C. Read, comprehend, and discuss quantitative situations drawn from the fields of personal finance, health and wellness, environmental technologies, and civic engagement.
D. Demonstrate an understanding of mathematics by writing complete and correct responses to questions.
E. 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.
F. Use estimation and investigation of multiple representations of numbers and functions to assess

claims from a variety of fields, such as environmental, personal finance, health and wellness.

G. Use percents, estimation, and modeling to explore personal finance options, such as how credit cards work and how taxes are computed.
H. Use graphs to describe, interpret, synthesize, and predict information.
I. Calculate, compare, and interpret measures of center and make decisions.
J. Use dimensional analysis to solve complex problems with multiple pieces of information and steps.
K. 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.
L. Identify, create and use models to predict values and solve problems in contextualized, culturally relevant settings.

Special Facilities and/or Equipment -

A. Scientific calculator.
B. Computer with internet access.

Course Content (Body of knowledge) -

A. 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.
   1. Workload analysis
      a. School/study time calculation
      b. Plotting weekly calendar
   2. Math support resources
      a. Classmates
      b. Teacher and tutors
      c. Foundations Lab
      d. Counseling
      e. Student Resource Center
   3. Learning opportunities in math
      a. Productive struggle
      b. Deliberate practice
      c. Explicit connections
      d. Collaboration and teamwork
   4. Mathematical habits of mind
      a. Interpreting contextualize problems
      b. Predicting solutions
      c. Analyzing different ideas
      d. Revising thinking and solutions

B. Collaborate to collect, assemble, discuss, and present culturally-relevant information using team member knowledge, reading strategies, and the internet.
  1. Mathematical identity development
  2. Cultural capital recognition and development
  3. Quantitative communication skill development
C. Read, comprehend, and discuss quantitative situations drawn from the fields of personal finance, health and wellness, environmental technologies, and civic engagement.
  1. Reading comprehension strategies
     a. Comprehension and Synthesis Chart
        1. Qualitative information and vocabulary
        2. Quantitative information
        3. Plan of action
     b. Reading apprenticeship routines, such as:
        1. "Think Aloud" or
        2. "Talk to the Text"
D. Demonstrate an understanding of mathematics by writing complete and correct responses to questions.
  1. Simple and complete
  2. Specific
  3. Stand-alone
E. 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.
  1. Culturally relevant issues, such as:
     a. Population
        1. Population growth
        2. Population density
     b. Allocation of resources
        1. Natural
        2. Human
        3. Per capita measures
  2. Absolute change vs. Relative change
F. Use estimation and investigation of multiple representations of numbers and functions to assess claims from a variety of fields, such as environmental, personal finance, health and wellness.
  1. Large numbers
  2. Mental math
  3. Scientific notation
  4. Tables, graphs, formulas, contexts
G. Use percents, estimation, and modeling to explore personal finance options, such as:
  1. Credit cards
  2. Tax forms
  3. Savings plans
     a. Simple interest
     b. Compound interest
  4. Consumer Price Index
     a. Base year
     b. Comparisons over time

        c. Purchasing power
        d. Interpretations
        e. Calculations
    5. Cost of Living Index
        a. Buying power
        b. Comparisons across location

H. Use graphs to describe, interpret, synthesize, and predict information.
    1. Pie chart
    2. Line graph
    3. Bar chart
    4. Pictographs
    5. Scatterplots
    6. Misleading graphs

I. Calculate, compare, and interpret measures of center and make decisions.
    1. Mean
    2. Median
    3. Mode
    4. Using formulas in a spreadsheet

J. Use dimensional analysis to solve complex problems with multiple pieces of information and steps.
    1. Units
        a. Conversions
        b. Equivalencies
    2. Application to real life problems, such as medical dosages
    3. Equations and proportions

K. 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.
    1. Variables
        a. Subscripts
    2. Order of operations
    3. Units and dimensional analysis
    4. Role of each variable
    5. Relationship between two variables in a multi-variable formula
    6. Solving for an unknown variable or quantity
        a. Using square roots to solve an equation
    7. Inequalities
    8. Evaluating formulas
    9. Decision making using formulas

L. Identify, create and use models to predict values and solve problems in contextualized, culturally relevant settings.
    1. Connections between four representations of a function
        a. Contextual situations
        b. Table
        c. Graph
        d. Equation
    2. Units

3. Vertical intercept
   a. Connection to graph
   b. Connection to equation
4. Horizontal intercept
   a. Connection to graph
   b. Connection to equation
5. Limitations of models based on data
   a. Interpolation
   b. Extrapolation
6. Linear models
   a. Rate of change as slope
   b. Interpretations of slopes and intercepts
7. Exponential models
   a. Percentage change
   b. Pattern recognition
   c. Growth
   d. Decay
   e. Financial models

Methods of Evaluation -

The student will demonstrate proficiency by participating in a variety of assessments, such as:

A. Ongoing, formative classroom assessments
B. Participation in group and class discussions
C. Checkpoint quizzes
D. Preparatory assignments
E. Homework
F. Lab work
G. Module tests
H. Final exam
I. Projects
J. Presentations
K. Portfolio development

Representative Text(s) -

Carnegie Foundation for the Advancement of Teaching. Quantway 1. XanEdu, 2018.

Disciplines -

Mathematics

Method of Instruction -

A. 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.
B. Students will reflect on their thinking and on problem ideas individually and in pairs.
C. Students will address mathematical sticking points through discussion and short, targeted, small group or whole class lectures.
D. 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.
E. Guest lectures, tours, and laboratory activities will support development of mathematical identity and self-efficacy.
F. 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.
G. Students will make group presentations of minor or major projects and problems followed by in-class discussion and evaluation.

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.

A. Learning opportunities and classroom norms
    1. Productive struggle
    2. Deliberate practice: Extending what we learn
    3. Explicit connections and wrap-up
    4. Collaboration and teamwork: Some agreements
B. Workload analysis
    1. Collecting data
    2. Plotting time commitments
    3. Analyzing resources
    4. Tools and technologies
C. Making a plan: Calendars and logs
    1. Exploration: Map of current commitments
    2. Consultation: Reviewing recommendations/expert advice/Carnegie Units
    3. Reflect/revise plan
D. Building a network for mathematical success: Academic
    1. In the classroom (building peer groups)
    2. Beyond the classroom (office hours, interview instructors)

     3. Tutors
     4. Labs and library
     5. Counselors
E. Financial planning
     1. Costs (collecting data and predicting expenses)
     2. Sources of support: Financial Aid
     3. The basics of credit cards
     4. Basic budget development
F. Building a network for mathematical success: Financial (in consultation with campus resources)
     1. Financial Aid
     2. EOPS
     3. Scholarships and campus jobs
G. Building success habits for learning math
     1. Foundations Lab (developing skills for exploratory learning and practice)
     2. Tutor relationships (what the tutors recommend, habits for successful students)
H. Building a network for mathematical success: Registration (can be in consultation with DRC, Admissions and Records, Counselors)
     1. Evaluating math courses to determine next quarter options
     2. Drafting timelines for individual enrollment dates
I. Resources in case you forget the math
     1. On campus
     2. Online
J. Leveraging student success factors to support mathematical learning
     1. Connected, nurtured, valued
        a. Looking back at the quarter's math experiences
        b. Strategies for success with the next math experience

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

A. Deliberate practice: Daily homework designed to extend concept and skill development.
B. Preparatory homework designed to prepare students for the next lesson.
C. Module reviews designed to prepare students for module quizzes and exams.
D. Online module checkpoint quizzes.
E. Portfolio development.
F. Lesson preview reading.

FOOTHILL COLLEGE - 12345 EL MONTE ROAD, LOS ALTOS HILLS, CA 94022-4599 - foothill.edu

©