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WHAT UNIVERSITY GENERAL EDUCATION OUTCOMES GUIDE STUDENT LEARNING IN COURSES THAT CARRY MATHEMATICAL SCIENCES CREDIT?

The vision of the University of Arkansas Mathematical Sciences Department is to empower students to become mathematically proficient self-directed learners that will enable them to use quantitative reasoning and critical thinking skills to solve personal and societal problems. The mathematics core courses were designed with the following goals in mind:

1. Cultivate an appreciation of mathematical concepts and processes as powerful tools with broad applications in a societal and technological context.
2. Develop a recognition of mathematics as an abstract formal system that reflects and describes the physical world.
3. Enable students to solve problems and understand the world using quantitative and critical thinking skills.

Upon completion of three hours of mathematics courses, students will be able to:

- (MATH LO1) Demonstrate an understanding of college-level mathematical concepts and tools.
- (MATH LO2) Demonstrate fluency with the language and notation of mathematics.
- (MATH LO3) Formulate and solve a problem in mathematical terms, using appropriate tools and methods.
- (MATH LO4) Formulate decisions and solutions based on critically thinking, reasoning and analysis.
- (MATH LO5) Develop models to solve real-life problems.
- (MATH LO6) Express quantitative and logical ideas with precision.

HOW DOES THE DEPARTMENT OF MATHEMATICAL SCIENCES INTEND TO ASSESS STUDENT LEARNING OF THESE OUTCOMES IN MATH 1203/1204/1313?

Assessment in MATH 1203 and 1204 consists of two modalities: a Pre-Assessment Test that is keyed to the Final Exam and a Concepts Exam. Since Fall 2009, students enrolled in MATH 1203 and 1204 take a 10 question Pre-Assessment Test at the start of the semester. Variations of these same 10 questions are contained in the Final Exam. Since Fall 2014, students enrolled in MATH 1203 and 1204 take a Concepts Exam that is administered at the end of the semester. Students complete 5 of the exam's 7 questions. Questions for both exams were written and agreed upon by the faculty teaching the courses. The questions encompass the essential and universal components of the courses. The Pre-Assessment Test and Final Exam are computer-based whereas the Concepts Exam is paper-based and students are required to show their work.

Assessment in MATH 1313 consists of a Final Exam. Specific Final Exam questions will be drafted Fall 2016 by the faculty teaching sections of MATH 1313. The Final Exam will contain written exercises that require students to write 1–3 paragraphs that have significant quantitative content.

**HOW IS THE ASSESSMENT INSTRUMENT KEYED TO THE UNIVERSITY
GENERAL EDUCATION CORE CURRICULUM LEARNING OUTCOMES FOR
MATHEMATICAL SCIENCES?**

MATH 1203/1204 Pre-Assessment Test (similar questions appear in Final Exam): question themes are included below keyed to learning outcomes.

1. Use the graph of a function to find values and zeros of the function. (MATH LO1; MATH LO2)
2. Find the perimeter of a rectangle given its area and a linear relationship between its sides. (MATH LO3; MATH LO4; MATH LO5)
3. Find the average rate of change of a function. (MATH LO1; MATH LO2; MATH LO6)
4. Compute amount of money in an interest-bearing account. (MATH LO3; MATH LO4; MATH LO6)
5. Express English sentences as a system of equations and solve. (MATH LO1; MATH LO4; MATH LO5)
6. Rewrite a linear equation in slope-intercept form and plot the line. (MATH LO1; MATH LO2)
7. Find the maximum height and flight duration for a rocket launched from a platform. (MATH LO1; MATH LO4; MATH LO6)
8. Solve a transcendental equation. (MATH LO1; MATH LO2; MATH LO6)
9. Given membership fees and dues for a club, determine which is more cost effective for certain durations. (MATH LO3; MATH LO4; MATH LO5)
10. Match graphs of functions to formulas. (MATH LO1; MATH LO2)

MATH 1203/1204 Concepts Exam: question themes are included below keyed to learning outcomes.

1. Use functions to model a real-world situation and use them to investigate function composition and inverses (MATH LO3; MATH LO4; MATH LO5; MATH LO6)

2. Express in English sentences the effect of specific functions transformations and compositions. (MATH LO1; MATH LO2)
3. Relate mathematical concepts such as x- and y-intercepts, average rate of change, slope and domain to data represented graphically (MATH LO1; MATH LO2; MATH LO4; MATH LO6)
4. Explain graphically what it means to be a solution to a non-linear system and create systems with a given number of solutions. (MATH LO1; MATH LO2; MATH LO4)
5. Construct polynomials with specific features and describe the behavior of rational functions (MATH LO1; MATH LO2; MATH LO3)
6. Analyze a system of linear equations, in particular its dependence on certain parameters. (MATH LO1; MATH LO2; MATH LO3; MATH LO4)
7. Formulate a model using exponential and logarithmic functions and use it to make predictions (MATH LO1; MATH LO3; MATH LO5)

MATH 1313 Final Exam questions will be drafted Fall 2016. They will be keyed to the Learning Outcomes as done for MATH 1203/1204.

HOW WILL THE DEPARTMENT OF MATHEMATICAL SCIENCES USE THE DATA GENERATED BY THIS INSTRUMENT TO PLAN CURRICULAR AND PEDAGOGICAL CHANGES THAT MIGHT BE NECESSARY IN MATH 1203/1204/1313?

Analysis of student performance will be based on overall performance on these exams and writing samples as well as performance on individual questions. After reviewing the results of the assessment tools and determining that some of the Mathematical Sciences Learning Outcomes are not being achieved, suggestions for improvement will be compiled from the faculty. These suggestions will be reviewed by the faculty in charge of coordination of instruction in MATH 1203/1204/1313 to determine the ones there are most likely to be effective. Such changes will be implemented.