Hi Michelle,

Thanks for your note. In fact, we were planning to address the issue of precalculus in our department this year, and this case is an example of the problem.

In most cases, a student who has only taken Algebra II/Trigonometry should not be taking Calculus. Unfortunately, there is no prerequisite stated in the catalog because we no longer offer Precalculus at Westmont; perhaps we should bring it back. In my syllabus for MA 9, I say that "precalculus or equivalent" is a prerequisite for the course. Others say "four years of college preparatory mathematics." Nowadays, Algebra II/Trig is not college preparatory; in fact, it is remedial in many places. College-bound students often take Algebra II/Trig in 9th grade. Students who take nothing more than Algebra II/Trig in high school are typically very weak mathematics students. I wouldn't expect a student with this background to be prepared to major in the sciences at Westmont.

It is possible to take Precalculus at a junior college over the summer, and then attempt MA 9 again.

Please let me know if you would like to discuss this further.

-dave

On Thu, Oct 23, 2008 at 2:24 PM, Michelle Hardley <mhardley@westmont.edu> wrote:

The only prerequisite for this course, to my knowledge, is for students to have taken an Algebra II/Trigonometry class, which XXXX has. Please let me know if my understanding here is in error so that I can modify the advice that I give my advisees.

Math Program Meeting 10/28/08

- Midterm Grades
- Dept Chapel - Hymn Sing - each bring hymn to share. 11/10
- Pre calculus
  How many students enroll?
  How many go on to Calc?
  Data?
  Comp. Schools offer + require
  More data?
  Proposal.

- Major - Possibly Replace 1 lab. elect. w/ MA15
  More MA15 -> Spring
  Table.
MA 8 Elementary Functions (4) Prerequisite: Fulfillment of mathematics competency requirement. Not open to those having four years of high school mathematics. Topics in advanced algebra and trigonometry. This course is designed primarily for calculus preparation and is not recommended as a final course in mathematics.

MA 9, 10 Elementary Calculus I, II (4,4) Prerequisite: MA 8 or four years of college-preparatory high school mathematics. Functions, graphs, limits, differentiation, integration, sequences, series. Introduction to numerical methods. (GE)

MA 9, 10 Elementary Calculus I, II (4,4) Prerequisite: Four years of college-preparatory high school mathematics. Functions, graphs, limits, differentiation, integration, sequences, series. Introduction to numerical methods.

MA 9, 10 Elementary Calculus I, II (4,4) Prerequisite for MA 9: Admissions math requirement. Prerequisite for MA 10: MA 9 or equivalent. Functions, graphs, limits, differentiation, integration, sequences, series. Introduction to numerical methods.
Annotated Table of Contents

Precalculus: A Study of Functions and Their Applications
Swanson, Anderson, and Easley

Chapter 1: An Introduction to Functions. Various representations of functions as well as the language and notation associated with functions are introduced. This chapter also illustrates how graphing calculators can be used and misused in the study of functions.

1.1 Functions
1.2 Graphical Representations of Functions
1.3 Calculator Graphics
1.4 Mathematical Modeling
1.5 Project: Crickets - Nature's Thermometer

Chapter 2: Families of Functions. Linear, exponential, logarithmic, periodic, and power functions are introduced. Students are shown how to recognize these functions in their various representations. Students are also shown how to obtain a formula when given a linear, exponential, or power function either numerically or graphically. This lays the groundwork for these functions and for their use throughout the remainder of the book. Examples of real-world situations are included for each type of function.

2.1 Linear Functions
2.2 Exponential Functions
2.3 Logarithmic Functions
2.4 Periodic Functions
2.5 Power Functions
2.6 Project: Newton - A Real Swinger

Chapter 3: New Functions from Old. The basic functions from chapter 2 are transformed to form new functions in a variety of ways. In particular, the relationship between a transformed function in its symbolic form is compared with its graphical form. Transformations include addition and multiplication as well as composition. The relationship between a function and its inverse is also explored.

3.1 Function Transformations: Changes in the Output
3.2 Function Transformations: Changes in the Input
3.3 Combining Functions
3.4 Composition of Functions
3.5 Inverse Functions
3.6 Project: Setting the Tone

Chapter 4: Polynomial and Rational Functions. Polynomials, introduced as transformations of particular power functions, are important enough to study as independent objects. We look at their properties as well as how they can be combined through division to form rational functions. Applications are given throughout the chapter.

4.1 Quadratic Functions
4.2 Polynomial Functions
4.3 Power Functions with Negative Exponents
4.4 Rational Functions
4.5 Project: The Amazing GolfOMeter

Chapter 5: Trigonometric Functions. The periodic functions of sine and cosine, introduced in chapter 2, are reviewed and other trigonometric functions are introduced in this chapter. These functions are introduced by using the unit circle definitions. The geometry of a circle, including arc length and area, are also explored. The transformations, introduced in chapter 3, are applied to the trigonometric functions. Trigonometric identities are introduced throughout the chapter and are the focus of section 5.4.

5.1 Two Ways of Defining Trigonometric Functions
5.2 Arc Length and Area
5.3 Transformations of Trigonometric Functions
5.4 Trigonometric Identities
5.5 Project: Looking Out to Sea

Chapter 6: Applications of Trigonometric Functions. Students look at additional types of applications for trigonometric functions by exploring triangle applications as well as periodic and "periodic-like" applications.

6.1 Right Triangle Applications
6.2 Law of Sines and Law of Cosines
6.3 Modeling Behavior with Sums of Sine and Cosine
6.4 Other Applications for Trigonometric Functions
6.5 Project: Life in the Fast Lane

Chapter 7: Solving Equations and Fitting Functions to Data. Different methods for solving equations are introduced. This structure gives students a review of the functions first introduced in chapter 2. The techniques of linear, exponential, and power regression are introduced as methods of fitting functions to data.

7.1 Introduction to Solving Equations
7.2 Solving Exponential Equations
7.3 Solving Trigonometric Equations
7.4 Regression and Correlation
7.5 Fitting Exponential and Power Functions to Data
7.6 Project: The Population Problem

Chapter 8: Getting Ready for Calculus. This chapter serves as an introduction to calculus by exploring the concept of limit, the derivative, and the integral. The focus is on these mathematical concepts with various representations of functions.

8.1 Limits
8.2 Slopes of Secant Lines and the Derivative
8.3 Sequences and Series
8.4 Area and the Integral
8.5 Project: Zero to Sixty

Chapter 9: Additional Topics. The text concludes with a look at parametric equations, vectors, and multivariable functions. A property of a conic section is the focus of the project in this chapter.

9.1 Parametric Equations
9.2 Vectors
9.3 Multivariable Functions
9.4 Project: Elliptipool
3. B. 5  Next Steps

The department now has a sustainable and meaningful assessment program. At this stage, we need to continue to collect and interpret data, refine our rubrics, and monitor our benchmarks.

**Ongoing annual assessment tasks.** The department will do the following tasks every year.

1. Administer the Major Field Test to every graduating senior in the spring. Meet to interpret results.

2. Collect mathematical writing samples from MA 108 (Spring, Odd years) or MA 110 (Spring, even years). Apply writing rubric to these samples. Interpret results.

3. Collect data each semester of the number of solutions submitted and published by students in MA 180. Meet to interpret results.

4. Collect a reflective paper or writing sample in MA 136 (Fall, odd years), MA 140 (Spring, even years), and MA 155 (Fall, even years). Apply reflective writing rubric to these samples. Interpret results.

5. Devote two meetings to informal discussions of the Communication and Creativity learning standards in the context of introductory and developmental courses.

6. Monitor course evaluations in introductory and developmental courses for evidence that the Christian Connection learning standard is being addressed.

In addition to these annual tasks, the department plans to address several additional topics over the next six years. A plan for these discussions is given Table 18.
<table>
<thead>
<tr>
<th>Year</th>
<th>Program review overall</th>
<th>Details for assessment work</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Discuss admissions practices and recruitment of students.</td>
<td>Review Creativity learning standard (#3).</td>
</tr>
<tr>
<td></td>
<td>Decide whether to replace MA9 with MA15 in the major requirements.</td>
<td>Conduct graduate school content survey.</td>
</tr>
<tr>
<td>2009–10</td>
<td>Discuss vision for future department staffing.</td>
<td>Ongoing annual tasks.</td>
</tr>
<tr>
<td></td>
<td>Discuss alumni survey.</td>
<td>Review Core Knowledge learning standard (#1).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Review Christian Connection learning standard (#4).</td>
</tr>
<tr>
<td>2011–12</td>
<td>Review contributions to GE.</td>
<td>Ongoing annual tasks.</td>
</tr>
<tr>
<td></td>
<td>Decide on status of Statistics (MA 5) as an Abstract Reasoning course.</td>
<td>Review Communication learning standard (#2).</td>
</tr>
<tr>
<td>2012–13</td>
<td>Discuss vision for undergraduate research.</td>
<td>Ongoing annual tasks.</td>
</tr>
<tr>
<td></td>
<td>Discuss quality of preparation for graduate school.</td>
<td>Discuss/Revise learning standards.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Summarize assessment work from past six years.</td>
</tr>
</tbody>
</table>

Table 18: Six-year plan for assessment and program review.
MATH 101. Quantitative Skills. Topics to develop the student's quantitative competency skills, including estimation, use of calculators and computers, basic algebra, statistics, counting and probability, graphs and tables, problem-solving skills. Prerequisite: Quantitative Skills exam. (2)

MATH 115. College Algebra. Functions and transformations, linear and quadratic inequalities, systems of equations, complex numbers, polynomial and rational functions, sequences, mathematical induction, and the binomial theorem. Prerequisite: SAT Math subject test score of 500 or above, ACT Math score of 22 or above, or SAT Math score of 500 or above. (2)

MATH 125. Mathematics for Elementary and Middle Grade Education. Numeration systems, set theory, the whole number, integer number, and rational number systems with associated axioms, operations, relations, and counting principles. Topics from geometry, measurement, logic, and probability and statistics. For elementary education majors only. Prerequisite: Quantitative competency.

MATH 205. Great Ideas of Mathematics. Consideration in an historical context of some significant discoveries in mathematics and ways these discoveries have influenced our knowledge of natural phenomena and the development of culture. Not available to mathematics majors. Prerequisite: Quantitative competency. (2)

MATH 218. Introduction to Calculus with Precalculus Mathematics. Coverage of topics from precalculus mathematics that are needed for the study of calculus, along with an introduction to the main ideas of calculus. Intended as additional preparation for MATH 221 or 231, or as an intuitive introduction to calculus. Not open to those with prior study of calculus.

MATH 221. Applied Calculus. This course covers the ideas of calculus with the applications as the motivation. Covering more topics, the course differs from MATH 231 with less depth of coverage. Topics include limits, definitions and applications of the derivative and integral, and applications of the calculus to functions of several variables. Prerequisite: Precalculus mathematics. This course is not normally open to mathematics majors, and only one of MATH 221 and MATH 231 may be taken for credit. Alternate years.

MATH 231. Calculus I. The limit concept. Definitions of the derivative and integral of functions of one variable, with basic properties and applications. Transcendental functions, methods of integration, and first order differential equations. Three lectures, two hours drill. Prerequisite: MATH 218, or previous calculus experience. (2 or 4)

MATH 232. Calculus II. Infinite series, polar coordinates. Three-dimensional geometry and vector algebra, functions of two and three variables, partial differentiation, multiple integration, and line integrals. Three lectures, two hours drill. Prerequisite: MATH 231 with a minimum grade of C-, departmental validation examination, or advanced placement. (2 or 4)

MATH 245. Linear Algebra. Starting with solving systems of linear equations, matrix algebra is used to explore vector spaces and linear transformations. Emphasis is given to bases, dimension, eigenvectors, and orthogonality. Prerequisite: MATH 231. (2 or 4)
Other Information

Placement. For advising purposes, all first-year students who wish to enroll in a mathematics course must take a mathematics placement exam before registration. Most will enter 29, 30, 31, 31H, 31S, 32, 32H, 36 or 60 but alternatives may be chosen based upon departmental advising.

Departmental Policy on Grades and Prerequisite Courses. To enter 31, the grade earned in 30 must be C-minus or better; for courses numbered 32 or above, the grade earned in prerequisite courses must be C or better. Because of widely varying preparations among students in the calculus courses, it is expected that they will need to fill various gaps in their backgrounds during the semester, with help from their instructors. Students must earn a grade of C-minus or better in each of the eight upper-division mathematics courses required for the major.

Courses

Mathematics (MATH) courses satisfy Area 5 of the Breadth of Study Requirements.

PZ 1. Mathematics, Philosophy and the Real World. Ms. J. Grabiner. Throughout history, mathematics has changed the way people look at the world. This course focuses on two examples: Euclidean geometry, and probability and statistics. Readings and problems from Euclid’s Elements of Geometry, modern elementary works on probability and its applications, and the writings of philosophers whose views were strongly influenced by mathematics. Prerequisite: high-school algebra. Offered jointly by Pitzer and Pomona colleges. Fall 2006.

PZ 7. Mathematics of Games and Gambling. Mr. Hoste. Introduction to probability and game theory. Topics include combinations, permutation, probability, expected value, Markov chains, graph theory and game theory. Specific games will be analyzed. Excellent preparation for statistics courses, as well as for use of game theory in the social sciences. Prerequisite: PZ 20 or an acceptable score on the mathematics placement exam. Offered jointly by Pitzer and Pomona colleges. Fall 2007; offered alternate years.

PZ 10B. Cartography. Mr. Bachman. Study various aspects of the history and mathematics of map making. Topics include surveying, finding longitude and latitude, globe projections and spherical trigonometry. Spring 2007.

PZ 10G. Mathematics in Many Cultures. Ms. J. Grabiner. Mathematical ideas are found in many cultures, among both literate and non-literate peoples. This course examines both the mathematics and the role it plays in the cultures. Examples chosen from the mathematical ideas of present-day peoples of Africa, Asia, Oceania and the Americas, as well as historic Egypt, Mesopotamia, Greece, Islam and China. Spring 2008.

29. Problem Solving in the Sciences. Mr. Flapan. Course will enhance students’ problem-solving skills in mathematics, science and economics. Students learn to use mathematical reasoning and techniques to solve challenging problems that arise in the real world. Emphasis will be placed on students developing their own approach to problem solving. Fall 2006.

30. Calculus I. Ms. Kurt, Mr. Flapan. 30, 31 and 32 comprise a standard course in the calculus of one and several variables. This course focuses on limits, derivatives, integrals, mean-value theorems and the Fundamental Theorem of Calculus. Prerequisite: satisfactory score on placement examination. Each semester.

30H. Honors Calculus I. Staff. This course provides a deeper look at the standard topics in Differential Calculus. Topics include limits, derivatives and their applications, integrals and the Fundamental Theorem of Calculus. Prerequisite: satisfactory score on placement exam and some previous experience with calculus. Fall 2007.

31. Calculus II. Mr. Garcia, Mr. Grabiner, Ms. Kurt. Transcendental functions, techniques of integration, infinite series and related material. Prerequisite: 30, 30H (C-minus or better) or satisfactory score on placement examination. Each semester.
Courses of Study

31H. Honors Topics in Calculus II. Mr. Satarriari. Explores selected topics from Calculus II in greater depth than 31, and relates these topics to other areas of mathematics. This course is intended for students who have already seen some of the Calculus II material but are not yet ready for Calculus III or Linear Algebra. Prerequisite: 20, 30H (C-minus or better) or a satisfactory score on the placement examination. Fall 2006.

31S. Calculus II with Applications to the Life Sciences. Mr. Rambos. This course presents the core topics of 31, as well as an introduction to modeling, differential equations, matrix algebra, and computing, in the context of problems from the life sciences. It provides an excellent background for students who intend to go on to 32, and exposes students who intend to take no further mathematics courses to the depth and excitement of the discipline by showing them its relevance in the world around us. Prerequisite: 30, 30H (C-minus or better) or satisfactory score on placement examination. Fall 2007.

32. Calculus III. Mr. Elderkin, Ms. Karnaolu, Mr. Sarkis. Vectors and vector functions, partial derivatives and differentiability of functions of several variables, multiple integrals. Prerequisite: one of 31, 31H, 31S (C or better) or satisfactory score on placement examination. Students can receive credit for only one of 32, 32H or 107. Each semester.

32H. Honors Calculus III. Mr. S. Grabiner. Course builds on Calculus I and II (both of which study functions of a single variable) to develop calculus for functions of n variables. We start by studying n-dimensional space, then model our development of calculus of several variables on concepts from one variable calculus. Prerequisite: one of 31, 31H, 31S (C or better) or satisfactory score on placement examination. Students can receive credit for only one of 32, 32H or 107. Fall 2006.

36. Mathematical and Computational Methods in the Life Sciences. Mr. Rambos. Mathematical models motivated by problems in biology will provide the motivation for studying a suite of mathematical concepts. We will cover topics in probability, discrete models, differential equations, linear algebra, and statistics. Some computational techniques will also be introduced to lend power to the theory. This course is not a substitute for full-semester courses in any of these topics, but is intended to provide essential analytical and computational tools to the life scientist. Prerequisite: one of 31, 31H, 31S (C or better), or satisfactory score on placement examination. Fall 2006.

57. Statistical Thinking. Mr. Kloke. The application of statistics to real-world problems goes beyond the application of a few formulae to a body of data. Statisticians become involved in research problems at the initial stages of formulating the hypotheses to be addressed and continue their involvement through the design and presentation of the results. This course, centered around a collection of projects, exposes the student to the complete spectrum of activities in which a statistician is involved. Not open to students who have taken 31, 31H, 31S, 32, 32H, 36 or AP statistics. Fall 2007.

58. Introduction to Statistics. Ms. Hardin. An introduction to the methodology and tools which are vital to the researcher in both the sciences and social sciences. Topics include introduction to probability; binomial, normal, Students' t and chi-square distributions; testing hypotheses; confidence intervals; analysis of variance; and regression and correlation analysis. Concepts will be applied to current data using statistical computer software. Prerequisite: 30 or equivalent. Not recommended for students who have taken AP statistics. Spring 2007.

58B. Introduction to Biostatistics. Mr. Kloke. An introduction to the methodology and tools which are vital to research in the biological and health sciences and medicine. Topics include probability; distributions of random variables; testing hypotheses; confidence intervals; analysis of variance; regression analysis; odds ratios; sensitivity and specificity; and nonparametric methods. Concepts will be applied to current data using statistical computer software. Prerequisite: 30 or equivalent. Not recommended for students who have taken AP statistics. Fall 2006.
109 Preparation for Calculus

This course is designed for students who plan to take courses for which calculus is a prerequisite, and need additional preparation before taking calculus. The course emphasizes functions, including polynomial, exponential, logarithmic, and trigonometric. Other topics include interpretation of graphs and charts, unit analysis, and problem solving methods. Students must have permission of the Director of Mathematics Placement to enroll. Offered Fall Semester only.

117 Gateways to Mathematics

Students learn principles of mathematical thinking by investigating one or more mathematical topics. Recent topics have included dynamic geometry, mathematics of games, and cryptology. Students investigate ideas through technical and non-technical reading and problem solving, introducing them to mathematical literature and exposition. The course is intended for all students. Offered both semesters.

118 Gateways: Geometric Patterns in Islamic Culture

In this mathematical exploration of the geometry underlying the patterns and images of Islamic art and architecture, students encounter the origins of patterns found in Islamic religious beliefs and the development over time of this expression of mathematics through culture. They study and analyze examples occurring in the architecture of buildings and monuments found in the Islamic world. Students apply the acquired geometry and Islamic culture by creating new original patterns and defending them as appropriate representations of Islamic decoration. Offered Spring Semester.

120 Calculus I

This course introduces differential and integral calculus of functions of a single real variable, including trigonometric, exponential, and logarithmic functions. Derivatives and integrals are explored graphically, symbolically, and numerically. Applications of the derivative are included. Prerequisite: Mathematics Placement Recommendation. Offered both semesters.

121 Calculus I with Laboratory

Similar to Mathematics 120, but includes a 1-hour weekly laboratory session.

126 Calculus II

This continuation of Mathematics 120 concentrates on methods and applications of integration and infinite sequences and series. May also include elementary differential equations and multiple integrals. Prerequisite: Mathematics 120, 121, or equivalent, or Mathematics Placement Recommendation. Credit may be earned for either Mathematics 126 or 128, but not both. Offered both semesters.

128 Honor Calculus II

This course covers the material in Mathematics 126 in greater depth and includes supplementary material. Prerequisite: Mathematics 120, 121, or Mathematics Placement Recommendation. Credit may be earned for either Mathematics 126 or 128, but not both. Offered both semesters.

210 Principles of Mathematics
This course is intended for non-majors. Students encounter selected mathematical topics demonstrating the scope of mathematical inquiry, its "unreasonable effectiveness," and its connections with other disciplines. Not open to first-year students. Offered Interim only.

220 Elementary Linear Algebra

This course beautifully illustrates the nature of mathematics as a blend of technique, theory, abstraction, and applications. The important problem of solving systems of linear equations leads to the algebra of matrices, determinants, vector spaces, bases and dimension, linear transformations, and eigenvalues. Prerequisite: Mathematics 120 or 121. Offered both semesters.

224 Investigative Mathematics

Mathematicians make discoveries only after computing many examples, noticing patterns, and then inventing tools and language to describe what they see. Using computers, students conceptualize and prove theorems in a variety of mathematical areas. Closed to students who have taken courses beyond Mathematics 232. Prerequisite: Mathematics 126 or 128.

226 Multivariable Calculus

This course extends important ideas of single-variable calculus (derivatives, integrals, graphs, approximation, optimization, fundamental theorems, etc.) to higher-dimensional settings. These extensions make calculus tools far more powerful in modeling the (multi-dimensional) real world. Topics include partial derivatives, multiple integrals, transformations, Jacobians, line and surface integrals, and the fundamental theorems of Green, Stokes, and Gauss. Prerequisites: Mathematics 126 or 128, and 220. Offered both semesters.

230 Introduction to Differential Equations

This course introduces differential equations and analytical, numerical, and graphical techniques for their analysis. First and second order differential equations and linear systems are studied. Applications are selected from areas such as biology, chemistry, economics, ecology, and physics. Students use computers extensively to calculate and visualize results. Prerequisite: Mathematics 126 or 128 and 220. Offered both semesters.

232 Discrete Mathematics

Discrete (noncontinuous) mathematics has become increasingly important as more phenomena are investigated, represented and solved using computers (essentially, discrete machines). Students explore finite graphs, recurrence relations, and combinatorial optimization using problem solving techniques and algorithm design strategies. Prerequisite: Mathematics 120 or 121, or permission of the instructor. Offered alternate years.

234 The Structure of Higher Mathematics (abroad)

This course provides students with a transition from calculus and linear algebra to more advanced courses in theoretical mathematics. The unique feature of this course is that it is taught with a cultural context in Budapest, Hungary. This course not only supplies a bridge from beginning to advanced mathematics, but also allows participants to encounter an important worldwide center of mathematics.
Our catalog description aligns well with comparable institutions and national standards. The following table compares the number of courses required for Westmont’s major with mathematics majors at other institutions.

<table>
<thead>
<tr>
<th>Program</th>
<th>req'd MA courses</th>
<th>Notes</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Westmont (B.A.)</td>
<td>4</td>
<td>8.5 Two Problem Solving units account for the half course.</td>
<td>5</td>
</tr>
<tr>
<td>Westmont (B.S.)</td>
<td>4</td>
<td>7.5 Two Problem Solving units account for the half course.</td>
<td>5</td>
</tr>
<tr>
<td>St. Olaf</td>
<td>3</td>
<td>7 Requirements may vary based on individual programs. Some lower-division intermediate courses may be substituted for upper-division courses.</td>
<td>5</td>
</tr>
<tr>
<td>Gordon College</td>
<td>7</td>
<td>4 One of these lower-division could be regarded as upper-division.</td>
<td>5</td>
</tr>
<tr>
<td>Houghton College</td>
<td>4</td>
<td>3 Four lower-division courses are 4 units, one is 5 units, and all other courses are 3 units.</td>
<td>5</td>
</tr>
<tr>
<td>Azusa Pacific</td>
<td>6</td>
<td>5 One upper-division course (Vector Calculus) may be substituted for a lower-division course (Multivariable Calculus).</td>
<td>5</td>
</tr>
<tr>
<td>Pomona College</td>
<td>4</td>
<td>8 One upper-division course (Vector Calculus) may be substituted for a lower-division course (Multivariable Calculus).</td>
<td>5.5</td>
</tr>
</tbody>
</table>

Table 14: Curriculum comparison with comparable institutions.

The Mathematical Association of America’s Committee on the Undergraduate Program in Mathematics (CUPM) Curriculum Guide (2004)\(^1\) makes the following recommendations.

Every course should incorporate activities that will help all students progress in developing analytical, critical reasoning, problem-solving, and communication skills and acquiring mathematical habits of mind. More specifically, these activities should be designed to advance and measure students’ progress in learning to

- State problems carefully, modify problems when necessary to make them tractable, articulate assumptions, appreciate the value of precise definition, reason logically to conclusions, and interpret results intelligently;
- Approach problem solving with a willingness to try multiple approaches, persist in the face of difficulties, assess the correctness of solutions, explore examples, pose questions, and devise and test conjectures;
- Read mathematics with understanding and communicate mathematical ideas with clarity and coherence through writing and speaking.

These recommendations resonate in particular with the Communication and Creativity standards of our department.

\(^1\)See [http://www.maa.org/CUPM/curr_guide.html](http://www.maa.org/CUPM/curr_guide.html) (external link).