UAF DEPARTMENT OF MATHEMATICS AND STATISTICS
MATH 161X PRECALCULUS FOR BUSINESS AND ECONOMICS
COMMON SYLLAUBS GUIDELINES
FALL 2014-FALL 2015

Syllabi must clearly satisfy university requirements, available at:
http://www.uaf.edu/uafgov/faculty-senate/curriculum/course-degree-procedures/-/uaf-syllabus-requirements/

Course Description: A study of polynomial, rational, exponential, and logarithmic functions. Solutions to systems of equations and linear inequalities. Applications to Business and Economics are emphasized. This course is appropriate for students who intend to major or minor in Business or students intending to take Math 262. Note: Credit may be earned for taking MATH F107X or MATH F161X, but not for both. Effective From Fall 2014 Until Fall 2015

Prerequisites: Placement into Math 161X or by receiving a B or better in DEVM 105 or DEVM 106. Enforcement of prerequisites is expected, though instructors have permission to override this requirement when appropriate.

Textbook: Precalculus 6th edition by Stewart, Redlin, and Watson. ISBN: 9780840068071 or students may purchase custom edition of text ISBN: 9781133066323. Students will also need access to the math of finance supplement for this course. This is a PDF file that you can download and post for your students. For the Math of Finance Supplement (click here)

Students should have the option of purchasing the e-book for this course through WebAssign.

Software: WebAssign (optional) For WebAssign Help (click here)

OR ALEKS (optional) For ALEKS Help (click here)

If you do not plan to use WebAssign but would like to have the resources available to your students who have access (click here for access information).

Drop Date: Please note that the University Drop Date Sept 19 2014 deadline will be strictly enforced.

Withdrawal Date: Please note that the University Withdrawal Date Oct 31, 2014 deadline will be strictly enforced.
Instructor Availability: All Instructors will have regular, posted office hours (or online meetings) during the week.

Grading Policy: The final grade in this course will be determined as follows:

<table>
<thead>
<tr>
<th>Written Assessed Work</th>
<th>At most 30%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Online Assessed Work</td>
<td>At most 15%</td>
</tr>
<tr>
<td>At least 2 Midterm Exams</td>
<td>At least 40% total</td>
</tr>
<tr>
<td>Comprehensive Final Exam</td>
<td>An instructor may choose to (A) Weight the final at least 25% OR (B) Weight the final less but require that a student must earn a minimum of 60% on the final in order to pass the class</td>
</tr>
</tbody>
</table>

Instructors should provide written feedback to students approximately weekly throughout the semester. This can be through humanly-graded assignments or email correspondence. Students must have a mechanism for estimating their current grade in the course.

To avoid confusion for the student, the syllabus should state: You need to earn a grade of C- or better in this course to receive core credit or to proceed to Math 262.

The syllabus must include a grading scale in some form. One example is below. Plus/minus grading is at the discretion of the instructor, but must be stated explicitly.

| A | 90-100 |
| B | 80-89 |
| C | 70-79 |
| D | 60-69 |
| F | 0-59 |

Exams: All exams should be paper-pencil exams, written and graded by a faculty member. Midterm and final exams from previous semesters should not be reused by an instructor. Limited reuse of edited problems is acceptable. An exam can have no more than 10% of points from multiple choice questions.

The final exam will be a comprehensive exam. Students will not be allowed to take the exam early or late unless there is written verifiable proof of the reason for missing the exam (e.g., a
doctor’s note, police report, court notice, etc., clearly stating the date AND time of the conflicting circumstances). In the event the final exam is not taken, under rare circumstances where the student has a legitimate reason for missing the exam, a makeup exam will be administered.

The comprehensive final exam should contain problems including but not limited to (see assessment topics below):

Assessment Criteria 1. Students will show mastery of problem solving skills.
   Be able to model word problems using equations
   Be able to model word problems using systems
   Be able to model applications using functions
   Be able to model exponential growth/decay applications
   Be able to model business applications (profit, cost, revenue, supply, and demand
   Be able to model finance applications

Ex] Suppose consumers will demand 30 units of a product when the price is $12 per unit and 22 units when the price is $16 per unit. Find the demand equation assuming it is linear. Find the price when the demand is 40 units. Find the number of units when the price is $35.

Ex] Given the following equations: \( r = -q^2 + 7q \), and \( c = 3q - 12 \), find the following:
   a) The break even point(s):
   b) The maximum profit and the number of units for which this occurs
   c) On what interval(s) will there be a profit?
   d) On what intervals will there be a loss of profit?
   e) From a practical point of view, determine the domain and range.

Ex] Suppose the daily output of units q on the nth day of a production run is given by \( q = 600(1 - e^{-4n}) \). Determine to the nearest complete unit:
   a) the output on the first day
   b) the output on the tenth day
   c) After how many days will a production run of 500 units be reached?

Ex] $4000 is invested into an account. After 5 years the amount grows to $4884. Find the nominal rate of interest the money earns if interest is compounded monthly.

Assessment Criteria 2. Students will write mathematics properly
   Use proper notation
   Show work legibly in clear delineated steps
   Label graphs and diagrams correctly
   Show completely simplified exact solutions

Assessment Criteria 3. Students will show understanding of a broad spectrum of mathematical applications:
   a) Students will show an understanding of the nature of functions, for example
-state domain, range, and use function notation
-find the average rate of change of a function
-perform operations on functions: combining, composing, decomposing
-finding inverses and inverse functions
-properties of exponentials and logarithms

Ex] Given a graph, determine the following:
(a) \( f(-2) = \) _______  
(b) Domain: ____________________  
(c) Range: ____________________
(d) Value(s) of \( a \) such that \( f(a) = 2 \): ____________  
(e) Solutions to \( f(x) < 0 \): __________________

Ex] Find the domain of \( h(x) = \frac{\sqrt{10-x}}{\log(x-3)} \).

Ex] Let \( f(x) = x^2 + x + 2 \). Find and simplify \( \frac{f(1+h)-f(1)}{h} \).

Ex] Let \( f(x) = x^2 - 4 \) and \( g(x) = \sqrt{x-3} \). Find \( f \circ g \) and its domain.

Ex] Let \( f(x) = \frac{6x+1}{3x-5} \). Find \( f^{-1} \) and its range.

Ex] Find the slope-intercept form of the line that passes through the point \((7, -\frac{1}{2})\) and is perpendicular to \(2x - 5y = 0\)

Ex] Write \( s(t) = -4t^2 + 16t + 20 \) in standard form by completing the square. Then graph and determine the vertex and all intercepts.

**Assessment Criteria 3. Students will show understanding of a broad spectrum of mathematical applications:**

b) Students will be able to construct functions, for example
- linear supply and demand equations
- cost, revenue, profit
- present and future value
- arithmetic and geometric progressions
- exponential growth and decay

Ex] You finance a $70,000 mortgage for 20 years. If interest is 7% compounded monthly, determine:
a) the monthly payment  
b) the interest in the first payment
c) the total finance charge

Ex] A chair company produces 2 models of chairs: the Sequoia and the Saratoga. The Sequoia takes 3 hours to assemble and 2 hours to detail. The Saratoga takes 2 hours to assemble and 2 hours to detail. The maximum number of hours available to assemble is 24 and the maximum number of hours available for detailing is 18. If the company earns a profit of $45 per Sequoia and $35 per Saratoga, find the number of each model produced so that the profit would be maximized.

Ex] Find the equilibrium price if the supply equation is \(3q - 200p = -1800\) and the demand equation is \(3q + 100p = 1800\).

Ex] The Lucas Corporation produces household druids that have a unit selling price of $5000 and a unit cost of $3500. The fixed costs are $9,600,000. Write an equation for the total cost as a function of the number of units produced. Write an equation for the total revenue as a function of the number of units. What is the value of the break even quantity?

Assessment Criteria 3. Students will show understanding of a broad spectrum of mathematical applications:
   c) Students will be able to solve equations and inequalities, for example
      - absolute value, quadratic, rational, radical, exponential and logarithmic
      - use factoring or division to solve polynomial equations
      - use elimination, substitution or row-reduction to solve systems

Ex] Solve for \(x\) over the set of real and complex numbers. Use logarithms in your answer only if unavoidable; if so, use base 10 or base \(e\).

(a) \(3x(x - 2) = 1\) \hspace{1cm} (b) \(\log(x + 6) = 2 \log x - \log(x - 1)\) \hspace{1cm} (c) \(\sqrt{4x + 1} + x = 5\)

(d) \(\frac{x + 1}{x - 1} - \frac{2}{x^2 - x} = \frac{4}{x}\) \hspace{1cm} (e) \(e^{2x} - 3e^x - 10 = 0\) \hspace{1cm} (f) \(9^{5x+1} = 27^{3x}\)

Ex] Solve the following inequalities over the set of real numbers

(a) \(|x| - 3 > 9\) \hspace{1cm} (b) \(y > |x| - 3\) \hspace{1cm} (c) \(\frac{9}{x} \leq x\)

Ex] Solve the system using matrix reduction:

\[
\begin{aligned}
4x - 6y &= -10 \\
-3x + 9y &= 9
\end{aligned}
\]

Assessment Criteria 3. Students will show understanding of a broad spectrum of mathematical applications:
d) Students will be able to graph functions, for example
- intercepts and asymptotes
- basic functions (absolute value, radical, rational, polynomial, exponential, logarithmic)
- transformations of basic functions

Ex] For each, find the domain and all intercepts and asymptotes that exist. Then graph.

(a) \( y = 2e^{1-x} - 4 \)  
(b) \( y = 2 - \log_2(x + 8) \)  
(c) \( y = \frac{-2x^2 + 2}{x^2 + 6x + 8} \)

Graph (a) \( y = x^4 - 3x^3 - 4x^2 \)

Ex] Give a feasible equation for the functions shown in each graph.

Ex] Graph the system \( \begin{cases} x^2 + 2y = 2 \\ xy = 4 \end{cases} \) and find the points of intersection.

Assessment Criteria 3. Students will show understanding of a broad spectrum of mathematical applications:

e) Students will have a working knowledge of the mathematics of finance, for example
- find principal, periodic payment amount, interest rates, finance charges
- present and future value
- arithmetic and geometric progressions

Ex] What is the present value of an ordinary annuity, which will provide $2000 per quarter for four years at the rate of 7% compounded quarterly?

Ex] Find the compound amount for an investment of $4000 for 7 years at 4% compounded quarterly.

Ex] Write in summation notation: \(-11 - 6 - 1 + 4 + 9 + 14 + 19 + 24 + 29 + 34\)

Ex] Evaluate \( \sum_{k=1}^{\infty} \frac{(-1)^{k+1} 2}{3^k} \)

Sample Course Schedule: (Link)

Week 1: Introduction and begin Chapter 1 (this is always a short week Thursday and Friday)

Week 2: Chapter 1/2
Course Content and Approximate Timing: (Link)

Chapter 1: Fundamental Concepts of Algebra—4 hours
*Chapter 1 should be a brief review- instructors should spend some time on factoring, exponents and radicals, inequalities and absolute value*
Real Numbers
Exponents and Radicals
Algebraic Expressions
Rational Expressions
Equations
Modeling with Equations
Inequalities
Coordinate Geometry
Lines

Chapter 2: Functions—8 hours
*Applications to business and economics should be emphasized*
Basics of Functions
Graphs of Functions

Week 3: Chapter 2
Week 4: Chapter 2
Week 5: Midterm, Chapter 3
Week 6: Chapter 3
Week 7: Chapter 3
Week 8: Chapter 3/4
Week 9: Chapter4
Week 10: Chapter 4
Week 11: Midterm, Chapter 10
Week 12: Chapter 10
Week 13: Chapter 10
Week 14: Supplement (finance)
Week 15: Supplement (finance)
Week 16: Final Exam
Getting information from the Graph of a Function
Average Rate of Change of a Function
Transformations of Functions
Combining Functions
One-to-one Functions and Their Inverses
Modeling with Functions

Chapter 3: Polynomial and rational functions—11 hours
Quadratic Functions and Models
Polynomial Functions and Their Graphs
Dividing Polynomials (focus should be on long division)
Complex Numbers and Complex Zeros (no more than ½ hour spent on this topic)
The Fundamental Theorem of Algebra
Rational Functions (no more than 1 hour should be spent on graphing techniques of rational functions)

Chapter 4: Exponential and logarithmic functions—8 hours
*Applications to business and economics should be emphasized*
Exponential Functions
The Natural Exponential Function
Logarithmic Functions
Laws of Logarithms
Exponential and Logarithmic Equations
Modeling with Exponential and Logarithmic Functions (Compound Interest and Continuous compounding should be included)

Chapter 10: Systems—8 hours
Linear systems
Non-linear systems
Basic operations on matrices
Solving systems using matrices
Systems of linear inequalities
Applications involving systems
Linear Programming (no more than 1 hour spent on this topic)

Mathematics of Finance Supplement—6 hours
Present and Future Value
Geometric sequences and summation Notation
Annuities
Amortizations of loans

Topics for Assessment: (Link)
Algebra: Exponents and Radicals, Polynomials, Factoring, Rational Expressions
Solving Equations: Absolute Value, quadratic, rational, radical, exponential, logarithmic
Solving Inequalities: Absolute Value, Quadratic, Polynomial, Rational
Functions: Absolute Value, Quadratic, Polynomial, Radical, Rational, Exponential, Logarithmic
- Domain, range, function notation
- Revenue, Cost and Profit equations
- Modeling supply and demand
- Marginal revenue, marginal cost, and marginal profit
- Reading Graphs, Increasing/Decreasing Intervals, Max/Min Values
- Operations: Combining, Composing, Decomposing, Finding Inverses
- Graphing: Translations of Basic Curves, Rational Functions, Asymptotes
- Exponential Growth/Decay Applications
Systems of Equations and Inequalities:
- Solving systems
- Expressing systems using matrices
- Operations on Matrices
- Linear Programming
Finance
- Compound Interest and continuous compound interest
- Total Value, Present Value, Future Value
- Amortizations
Sequences and Series
- Summation Notation
- Arithmetic and geometric progressions
- Sums of series

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   - Be able to model word problems using equations
   - Be able to model word problems using systems
   - Be able to model applications using functions
   - Be able to model exponential growth/decay applications
   - Be able to model business applications (profit, cost, revenue, supply, and demand
   - Be able to model finance applications
2. Students will write mathematics properly
   - Use proper notation
   - Show work legibly in clear delineated steps
   - Label graphs and diagrams correctly
   - Show completely simplified exact solutions
3. Students will show understanding of a broad spectrum of mathematical applications
   demonstrating their knowledge in the following five categories:
   a) Students will show an understanding of the nature of functions, for example
      - state domain, range, and use function notation
      - find the average rate of change of a function
      - perform operations on functions: combining, composing, decomposing
      - finding inverses and inverse functions
- properties of exponentials and logarithms

b) Students will be able to construct functions, for example
   - linear supply and demand equations
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   - exponential growth and decay

c) Students will be able to solve equations and inequalities, for example
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   - use factoring or division to solve polynomial equations
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d) Students will be able to graph functions, for example
   - intercepts and asymptotes
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e) Students will have a working knowledge of the mathematics of finance, for example
   - find principal, periodic payment amount, interest rates, finance charges
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