Course Description: A study of algebraic, logarithmic and exponential functions; sequences and series, systems of equations and conic sections. A brief review of basic algebra prepares students for the rigor expected. The primary purpose of this course, in conjunction with MATH F108, is to prepare students for calculus. 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 107x determined by the UAF Math Placement Policy as stated in the UAF Catalog. Enforcement of prerequisites is expected, though instructors have permission to override this requirement when appropriate.


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

Software: WebAssign (optional) For WebAssign 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 200, Math 262, or Math 272.

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.

<table>
<thead>
<tr>
<th>A</th>
<th>90-100</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>80-89</td>
</tr>
<tr>
<td>C</td>
<td>70-79</td>
</tr>
<tr>
<td>D</td>
<td>60-69</td>
</tr>
<tr>
<td>F</td>
<td>0-59</td>
</tr>
</tbody>
</table>

Exams: All exams for this course are proctored, closed book, no notes and no calculators. 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 include problems from each of the Assessment Criteria listed below. Sample questions satisfying the various criteria are provided as guides. INSTRUCTORS SHOULD NOT USE THESE SPECIFIC QUESTIONS.

**Assessment Criteria 1: Students master problem solving skills.**

- **Modeling with Equations (word problems)**
- **Modeling with Functions; Applications**
- **Applications of Exponential Growth & Decay**

Ex1) The population of an isolated group of deer is given by 
\[ f(t) = \frac{400}{1 + 4e^{-t}} \]
where \( t \) is time in weeks. How long until the deer population reaches 200?

Ex 2) How wide a border of uniform width should be added to a rectangle that is 4 ft by 6 ft in order to double the area?

Ex 3) A man is walking away from a lamppost with a light source 6 m above the ground. The man is 2 m tall. How long is the man’s shadow when he is 10 m from the lamppost?

Ex 4) A group of mushers and their dogs are taking refuge in a large cabin during a late April snow storm. In the arctic entryway, there are a total of 136 boots (mushers) and booties (dogs). Inside, there are 37 mouths to feed (both dogs and mushers). Assuming that both dogs and mushers have all their legs, and all the dogs wear booties on all four paws, how many dogs and how many mushers are in the cabin?

Ex 5) Two positive numbers \( x \) and \( y \) are related by \( 2x + y = 60 \).

(a) Find a function that models the sum of the squares of \( x \) and \( y \).

(b) Find the values of \( x \) and \( y \) that minimize the function.

**Assessment Criteria 2: Students learn to write proper mathematics - Use proper notation; show work legibly using clear, delineated steps that are understandable to the reader.**

**Assessment Criteria 3: Students learn a broad spectrum of mathematical applications.**
a) Understanding the nature of functions
- Domain, range, function notation
- Symmetry, Equations of Lines, Slope as Rate of Change, Difference Quotient, Avg Rate of Change
- Even, Odd & Piecewise Defined Functions, Reading Graphs, Incr/Decr Intervals, Min/Max values
- Operations: Combining, composing, decomposing and finding inverses

Ex 1) 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 2) Find the domain of \( h(x) = \frac{\sqrt{10-x}}{\log(x-3)} \).

Ex 3) Let \( f(x) = x^2 + x + 2 \). Find and simplify \( \frac{f(1+h)-f(1)}{h} \).

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

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

Ex 6) Find the slope-intercept form of the line that passes through the point (7, -½) and is perpendicular to \( 2x - 5y = 0 \).

Ex 7) 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 learn a broad spectrum of mathematical applications.

b) Solving equations & Inequalities
- Equations: Absolute value, quadratic, rational, radical, exponential, logarithmic
- Polynomial equations
- the Division Algorithm and the Remainder Theorem
- Inequalities: Absolute value, polynomial, rational

Ex 1) 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) \[ \frac{x+1}{x-1} - \frac{2}{x^2-x} = \frac{4}{x} \]  
(e) \[ e^{2x} - 3e^x - 10 = 0 \]  
(f) \[ 9^{5x+1} = \frac{27}{3^x} \]

Ex 2) Solve the following inequalities over the set of real numbers

(a) \[ |x| - 3 > 9 \]  
(b) \[ y > |x| - 3 \]  
(c) \[ \frac{9}{x} \leq x \]

Assessment Criteria 3: Students learn a broad spectrum of mathematical applications.

c) Graphing basic functions (absolute value, radical, polynomial, rational, exponential, logarithmic) and conics

- Absolute value, quadratic, polynomial, rational, radical, exponential, logarithmic
- Translations of basic curves (shifting & reflecting), rational functions, asymptotes
- Parabolas, Ellipses, Hyperbolas

Ex 1) 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) \[ y = \frac{-2x^2+2}{x^2+6x+8} \]

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

Ex 3) Give a feasible equation for the functions shown in each graph.

Ex 4) Graph

(a) \[ x^2 + (y - 2)^2 = 4 \]  
(b) \[ 4x^2 - (y + 1)^2 = 16 \]  
(c) \[ \frac{(x+2)^2}{9} + \frac{(y-1)^2}{4} = 1 \]

Ex 5) Graph the system \[ \begin{cases} x^2 + 4y^2 = 20 \\ xy = 4 \end{cases} \] and find the points of intersection.

Assessment Criteria 3: Students learn a broad spectrum of mathematical applications.

d) Understanding the properties of exponential and logarithmic functions

Ex 1) Simplify \( 64^{2/3} + 2 \ln \sqrt{e} + (\log 100)^3 \)
Ex 2) Use properties of logarithms to expand the expression \( \log \left( \frac{10^x(x-10)}{x^3} \right) \). Arguments should be simplified.

**Assessment Criteria 4: Students have mastered the prerequisite material for the course.**

- **Algebra: Exponents & Radicals, Polynomials, Factoring, Rational Expressions**

Ex 1) Simplify each to a single reduced expression without negative exponents.

\[
\begin{align*}
(a) & \quad \frac{8x - 2x^3}{8x(x + 2)} \\
(b) & \quad \frac{2(8x)^{\frac{1}{3}} y^{-3}}{3x^{-1} y^{\frac{1}{3}}} \\
(c) & \quad \frac{4-8x^{-1}}{1-4x^{-2}} \\
(d) & \quad \frac{2}{x + 1} - 2
\end{align*}
\]

Ex 2) Simplify each algebraic expression

\[
\begin{align*}
(a) & \quad \frac{1}{x+1} - \frac{2}{x^2 + 2x + 1} + \frac{3}{x^2 - 1} \\
(b) & \quad \frac{3(x-1)^{-1/2} + (x-1)^{-3/2}}{x - 1}
\end{align*}
\]

Ex 3) Multiply \((\sqrt{h^2 + 4} + 2)(\sqrt{h^2 + 4} - 2)\)

Ex 4) Rationalize the denominator of \(\frac{x - 16}{\sqrt{x - 4}}\).

Sample Course Schedule: (Link)  
Week 1: Introduction and begin Chapter 1 (this is always a short week Thursday and Friday)  
Week 2: Chapter 1  
Week 3: Chapter 2  
Week 4: Chapter 2  
Week 5: Midterm  
Week 6: Chapter 3  
Week 7: Chapter 3  
Week 8: Chapter 3  
Week 9: Chapter 4  
Week 10: Chapter 4  
Week 11: Chapter 4  
Week 12: Midterm  
Week 13: Chapter 10  
Week 14: Chapter 11/12  
Week 15: Midterm and Review  
Week 16: Final Exam

Course Content and Approximate Timing: (Link)
Chapter 1: Fundamental Concepts of Algebra—8 hours
Real Numbers
Exponents and Radicals
Algebraic Expressions
Rational Expressions
Equations
Modeling with Equations
Inequalities
Coordinate Geometry
Lines
OPTIONAL: Making Models Using Variation

Chapter 2: Functions—10 hours
Basics of Functions
Graphs of Functions
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—9 hours
Quadratic Functions and Models
Polynomial Functions and Their Graphs
Dividing Polynomials (Optional: synthetic division)
OPTIONAL: Real Zeros of Polynomials
Complex Numbers and Complex Zeros (no more than ½ hour spent on this topic)
The Fundamental Theorem of Algebra
Rational Functions

Chapter 4: Exponential and logarithmic functions—9 hours
Exponential Functions
The Natural Exponential Function
Logarithmic Functions
Laws of Logarithms
Exponential and Logarithmic Equations
Modeling with Exponential and Logarithmic Functions

Chapter 10: Systems—4 hours
Systems of Linear Equations
OPTIONAL: Partial Fractions
Systems of Non-linear Equations
Systems of Inequalities
Chapter 11: Conic sections—4 hours
(For this Chapter general information should be emphasized. Students should be able to recognize types of conics from the equations and be able to graph the conic from the equation)
Parabolas
Ellipses
Hyperbolas
Shifted Conics

Chapter 12: Arithmetic and Geometric Sequences and Series—4 hours
Sequences and summation notation
Arithmetic Sequences
Geometric Sequences