

Effective Fall 2015

Required sections for MATH 173 for *Functions Modeling Change: A Preparation for Calculus*, 5th edition; Connally, Hughes-Hallett, Gleason, et. al.

The prerequisite course is MATH 116, Intermediate Algebra. The course objectives for MATH 116 are listed below. Italicized notes in brackets are specific competencies taken from the Content Outline and Competencies for MATH 116 that students coming into Precalculus are often weak in.

1. Factor algebraic expressions.
2. Simplify arithmetic and algebraic expressions including those containing rational expressions, rational exponents, radicals, or complex numbers. [*Students should be able to apply the laws of exponents to simplify expressions containing rational exponents. They should also be able to simplify complex fractions.*]
3. Evaluate functions.
4. Solve equations in one variable including quadratic, quadratic in form, and those containing rational expressions, radicals, or absolute value. [*Students should be able to solve quadratic equations by completing the square and by using the quadratic formula.*]
5. Solve equations in more than one variable including systems of linear equations and literal equations.
6. Solve equations developed from applications.
7. Solve inequalities in one variable including linear and quadratic inequalities. [*Students should be able to show solutions on a number line and in interval notation.*]
8. Graph linear inequalities on a coordinate plane.
9. Construct equations of lines and circles.
10. Identify characteristics of functions and non-functions. [*Students should be able to identify the domain and range of a function given its graph.*]

Objective VI. F requires that students be able to analyze graphs of non-linear systems to determine the number of solutions. This topic is not addressed specifically by the text as a general topic, though it is discussed for particular systems, such as finding the number of solutions for a trigonometric function intersecting with a linear function representing an output value. One way to incorporate this objective might be to pose a few problems each time a new type of function is introduced. This could include extending some of the problems in the text.

At the end of each chapter are questions titled Strengthen Your Understanding. These are good questions for students to try to make sure they understand the finer details of definitions and procedures.

Ch. 1: Linear Functions and Change

The Skills Refresher for Chapter One at the end of Chapter One may help students get up to speed. The

Skill Refresher problems at the beginning of each section are helpful, too.

1.1 Functions and Function Notation (Although the material in this section is review material, this is a good place to introduce students to vocabulary that will be used in the book and to the challenge of working problems without “worked out” examples provided. This is a good place to refer to the preface, To Students: How to Learn from this Book, on page ix.)

1.2 Rate of Change

1.3 Linear Functions (This is also review material, but at a higher level. Note that this book prefers $y = b + mx$ rather than $y = mx + b$.)

1.4 Formulas for Linear Functions

1.5 Modeling with Linear Functions

Ch. 2: Functions

2.1 Input and Output

2.2 Domain and Range

2.3 Piecewise-defined Functions

2.4 Preview of Transformations: Shifts

2.5 Preview of Composite and Inverse Functions

2.6 Concavity

Optional: Ch. 3: Quadratic Functions

Students should have covered this material in Intermediate Algebra. You may want to include some of this material in Chapter 11 with polynomials. There is a Skills Refresher for Chapter 3. It includes practice for factoring and completing the square.

3.1 Introduction to the Family of Quadratic Functions

3.2 The Vertex of a Parabola (Note that the vertex is found by completing the square in this text.)

Ch. 4: Exponential Functions

There is a Skills Refresher for Chapter 4. It includes a review of exponents.

4.1 Introduction to the Family of Exponential Functions

4.2 Comparing Exponential and Linear Functions

4.3 Graphs of Exponential Functions

4.4 Applications to Compound Interest

4.5 The Number e

Ch. 5: Logarithmic Functions

There is a Skills Refresher for Chapter 5. However, since students are not expected to have covered logarithms before, this is not so much review as it is a nice collection of examples for students to practice the properties of logarithms.

5.1 Logarithms and Their Properties

5.2 Logarithms and Exponential Models

5.3 The Logarithmic Function and Its Applications

Ch. 6: Transformations of Functions and Their Graphs

- 6.1 Shifts, Reflections, and Symmetry
- 6.2 Vertical Stretches and Compressions
- 6.3 Horizontal Stretches and Combinations of Transformations

Ch. 7: Trigonometry and Periodic Functions

There is a Skills Refresher for Chapter 7 that covers special angles on the unit circle. Of course, since students are not required to have trig before taking this course, this may not be a refresher as much as it is a good collection of basic problems using special angles. Objective IV. E. explicitly requires memorization of basic trigonometric values for problem solving. Trig special angle mastery tests are available in the MRC if desired.

- 7.1 Introduction to Periodic Functions
- 7.2 The Sine and Cosine Functions
- 7.3 Radians and Arc Length
- 7.4 Graphs of the Sine and Cosine
- 7.5 Sinusoidal Functions (phase shift is optional)
- 7.6 The Tangent Function
- 7.7 Trigonometric Relationships and Identities
- 7.8 Inverse Trigonometric Functions

Ch. 8: Triangle Trigonometry and Polar Coordinates

- 8.1 Trig Functions and Right Triangles
- 8.2 Non-right Triangles
- 8.3 Polar Coordinates

Ch. 9: Trigonometric Identities, Models, and Complex Numbers

- 9.1 Trigonometric Equations
- 9.2 Identities, Expressions, and Equations
- 9.3 Sum and difference Formulas for Sine and Cosine
- 9.6 Complex Numbers and De Moivre's Theorem

Ch. 10: Compositions, Inverses, and Combinations of Functions

- 10.1 Composition of Functions (The difference quotient is introduced in exercises 33-36 and is required on the course outline for precalculus)
- 10.2 Invertibility and Properties of Inverse Functions
- 10.3 Combinations of Functions

Ch. 11: Polynomial and Rational Functions

There is a Skills Refresher for Chapter 11 that contains a good review of working with fractions.

- 11.1 Power Functions (proportionality is optional)
- 11.2 Polynomial Functions
- 11.3 The Short-run Behavior of Polynomials (note that the Fundamental Theorem of Algebra is not included in the book, and complex zeros are not discussed. Objective VI.C. in the Course Content Outline)

for Precalculus requires that this be discussed.)

11.4 Rational Functions

11.5 The Short-run Behavior of Rational Functions

11.6 Comparing Power, Exponential, and Log Functions

Ch. 12: Vectors and Matrices

12.1 Vectors

12.2 Components of a Vector

12.3 Applications of Vectors (optional but interesting if there is time)

12.4 The Dot Product

Ch. 13: Sequences and Series

13.1 Sequences

13.2 Defining Functions Using Sums: Arithmetic series

13.3 Finite Geometric Series

The Binomial Theorem is required but not covered in the Connally textbook. You can prepare notes from one of our College Algebra textbooks or the alternate book for Precalculus, *Precalculus: Mathematics for Calculus*, 7th ed. by Stewart, Redlin, and Watson. You could also check out open educational resources such as OpenStax-CNX:

<http://cnx.org/contents/13ac107a-f15f-49d2-97e8-60ab2e3b519c@5.158:92/Algebra-and-Trigonometry>

Formulas allowed on the final exam will be attached. There is a copy in Infoshare.