



**PASSAIC COUNTY TECHNICAL INSTITUTE**  
45 Reinhardt Road  
Wayne, NJ

**Precalculus**  
**Course # 0067,0058**  
**5 Credits**  
**2017**

## I. Course Description

Precalculus is a course with college-level algebra and trigonometry is designed to prepare students for the study of calculus. This course involves covering algebraic topics that might not have been given attention in earlier algebra courses. In this course, the student will study functions, their common properties, individual attributes and their applications. Additional topics from calculus will be introduced that include limits of a function and their properties as well as finding the derivative of a function.

## II. PCTI Curriculum Unit Planner

### Semester 1

<b>Content Area:</b>	<b>Precalculus</b>	<b>Grade(s)</b>	<b>10,11,12</b>
<b>Unit Plan Title:</b>	<b>Semester 1 – Functions and Their Graphs; Polynomial, Rational, Exponential, And Logarithmic Functions</b> <i>In Semester 1, students study functions and their properties. Topics of study include parent functions, combinations of functions, inverses of functions, and transformations. Students will also extend their understanding of polynomial functions, rational functions, exponential functions, and logarithmic functions from Algebra 2.</i>		
	O. Summer Packet Review and Assessment (4 days, includes assessment day)		
	I. Functions and Their Graphs (23 days, includes assessment days)		
	1. Write linear equations given points on lines and their slope. (3 days)		
	2. Identify functions. (1 day)		
	3. Use functional notation and evaluate functions. (1 day)		
	4. Find domain and range of functions. (1 day)		
	5. Use functions to model and solve real-life problems. (1 day)		
	6. Find domain and range of functions and use the Vertical Line Test. (1 day)		
	7. Determine intervals on which functions are increasing, decreasing, or constant. (1 day)		
	8. Determine relative minimum and maximum values of functions. (1 day)		
	9. Identify and graph step functions and piecewise-defined functions. (1 day)		

10. Recognize graphs of common functions. (1 day)
11. Use vertical and horizontal shifts, reflections, and non-rigid transformations to graph functions. (2 days)
12. Add, subtract, multiply and divide functions. (2 days)
13. Find composition of functions. (1 day)
14. Find inverse functions. (2 days)
15. Construct scatter plots and interpret data from linear models. (1 day)

## II. Polynomial and Rational Functions (16 days, includes assessment days)

1. Write quadratic functions in standard and vertex form and use results to sketch graphs of functions. (2 days)
2. Find minimum and maximum values of functions in real-life applications. (1 day)
3. Use the Leading Coefficient Test to determine the end behavior and transformations to sketch the graphs of polynomial functions. (3 days)
  
4. Find all zeros of polynomials functions including complex zeros using the Fundamental Theorem of Algebra, factoring, and technology. (3 days)
5. Find horizontal and vertical asymptotes of rational functions. (1 day)
6. Analyze and sketch graphs of rational functions including those with slant asymptotes. (1 day)
7. Use rational functions to model and solve real-life problems. (1 day)
8. Use scatter plots and a graphing utility to find quadratic model for data. (1 day)
9. Use the Binomial Theorem to calculate binomial coefficients to write binomial expansions. (1 day)

## III. Exponential and Logarithmic Functions (17 days, includes assessment days)

1. Recognize and evaluate exponential functions with base  $a$  and  $e$ . (1 day)
2. Graph exponential functions. (1 day)
3. Use exponential functions to model and solve real-life problems. (1 day)
4. Recognize and evaluate logarithmic functions with base  $a$  and  $e$ . (1 day)
5. Graph logarithmic functions. (1 day)
6. Use logarithmic functions to model and solve real-life problems. (1 day)
7. Rewrite logarithms with different bases. (1 day)
8. Use properties of logarithms to evaluate or rewrite logarithmic expressions. (1 day)
9. Use properties of logarithms to expand or condense logarithmic expressions. (1 day)
10. Solve exponential and logarithmic equations. (2 days)
11. Use exponential and logarithmic functions to model and solve real-life problems. (1 day)
12. Recognize the five most common types of models involving exponential or logarithmic functions. (1 day)

- 13. Use exponential growth and decay functions to model and solve real-life problems. (1 day)
- 14. Use logarithmic functions to model and solve real-life problems. (1 day)
- 15. Construct scatter plots and interpret data from exponential and logistic models. (1 day)

### NJSLS Standard(s) Addressed in this unit

- F-IF.A.2 Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.
- F-IF.B.4 For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing the features. Give a verbal description of the relationship.  
*Key features include: intercepts, intervals where the function is increasing, decreasing, positive or negative; relative maximum and minimums; symmetries; end behavior; and periodicity.*
- F-IF.C.7 Graph function expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.
  - F-IF.C.7.a Graph linear and quadratic functions and show intercepts, maxima and minima.
  - F-IF.C.7.d Graph rational function, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.
  - F-IF.C.7.e Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.
- F-IF.C.8.a Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, symmetry of the graph, and interpret these in terms of a context.
- F-IF.C.8.b Use the properties of exponents to interpret expressions for exponential functions.
- F-LE.A.1 Distinguish between situations that can be modeled with linear functions and with exponential functions.
- F-LE.A.1.c Recognize situations in which a quantity grows or decays by a constant percent rate per unit interval relative to another.
- F-LE.A.4 Understand the inverse relationship between exponents and logarithm, for exponential models, express as a logarithm the solutions to  $ab^{ct} = d$  where  $a$ ,  $c$ , and  $d$  are numbers and the  $b^{ct} = d$  where  $a$ ,  $c$ , and  $d$  are numbers and the base  $b$  is 2, 10, or  $e$ ; evaluate the logarithm using technology.
- N-CN.C.7 Solve quadratic equations with real coefficients that have complex solutions.
- N-CN.C.9 Know the Fundamental Theorem of Algebra; show that it is true for quadratic polynomials.
- S-ID.B.6.a Fit a function to the data; use function fitted to data to solve problems in the context of the data. Use given function or choose a function suggested by the context. *Emphasize linear, quadratic, and exponential models.*

### Essential Questions (3-5)

1. What is the relationship between even and odd functions and symmetry?
2. How do vertical and horizontal line tests relate to inverse functions?

3. Why is synthetic division used instead of polynomial long division?
4. How are exponential and logarithmic functions related?
5. How do you apply the compound interest formulas and when?

### Anchor Text

### Precalculus with Limits: A Graphing Approach Sixth Edition

Authors : Ron Larson with the assistance of David C. Falvo  
Brooks/Cole Cengage Learning  
Copyright Date: 2012  
ISBN: 978-1-111-42764-1

### Informational Texts (3-5)

None

### Short Texts (1-3)

None

### Formative & Summative Assessments

#### Formative Assessment

- Homework
- Quiz
- Chapter test
- Classwork

#### Summative Assessment

- Semester PreTest
- Semester PostTest
- Project
- Final Exam

### Resources (websites, Canvas, LMS, Google Classroom, documents, etc.)

TI Nspire Graphing Calculator  
Excel  
Canvas  
Google Classroom

<https://www.khanacademy.org/math/prec calculus>

<https://www.desmos.com/calculator>

<http://www.state.nj.us/education/cccs/2016/math/standards.pdf>

<http://www.state.nj.us/education/cccs/2014/tech/>

<http://www.cengage.com/>

**Suggested Time Frame:** 60 Days

## Semester 2

<b>Content Area:</b>	<b>Precalculus</b>	<b>Grade(s)</b>	<b>10,11, &amp; 12</b>
<b>Unit Plan Title:</b>	<p><b>Semester 2 – Trigonometric Functions and Analytic Trigonometry</b></p> <p><i>In Semester 2, trigonometric functions are applied to real world situations. Trigonometric ratios are connected to the unit circle. Students simplify trigonometric expressions, prove identities using trigonometric functions, and solve trigonometric equations.</i></p> <p>IV. Trigonometric Functions (33 days, includes assessment days)</p> <ol style="list-style-type: none"><li>1. Describe angles and convert between radian and degree measures. (3 days)</li><li>2. Identify a unit circle and use to evaluate trigonometric functions. (2 days)</li><li>3. Use domain and range to evaluate sine and cosine functions. (2 days)</li><li>4. Evaluate trigonometric functions. (1 day)</li><li>5. Use the fundamental trigonometric identities. (2 days)</li><li>6. Use trigonometric functions to model and solve real-life problems. (1 day)</li><li>7. Find and use reference angles to evaluate trigonometric functions. (3 days)</li><li>8. Sketch the graphs of sine and cosine functions using amplitude, period, and translations. (3 days)</li><li>9. Use the sine and cosine functions to model real-life functions. (2 days)</li><li>10. Sketch the graphs of tangent, cotangent, secant and cosecant functions. (6 days)</li><li>11. Evaluate inverse trigonometric functions. (1 days)</li><li>12. Evaluate composite trigonometric functions. (1 day)</li><li>13. Solve real-life problems involving right triangles, directional bearings, and harmonic motion. (3 days)</li></ol> <p>V. Analytic Trigonometry (27 days, includes assessment days)</p> <ol style="list-style-type: none"><li>1. Use the fundamental trigonometric identities to evaluate, simplify and rewrite trigonometric expressions.</li><li>2. Verify trigonometric identities.</li><li>3. Use standard algebraic techniques to solve trigonometric equations.</li><li>4. Solve trigonometric equations of quadratic type.</li><li>5. Solve trigonometric equations involving multiple angles.</li></ol>		

6. Use inverse trigonometric functions to solve trigonometric equations.
7. Use the sum and difference formulas to evaluate trigonometric functions, verify identities, and solve trigonometric equations.
8. Use multiple-angle formulas to rewrite and evaluate trigonometric functions.
9. Use power-reducing formulas to rewrite and evaluate trigonometric functions.
10. Use half-angle formulas to rewrite and evaluate trigonometric functions.
11. Use product-to-sum and sum-to-product formulas to rewrite and evaluate trigonometric functions.

### NJSLS Standard(s) Addressed in this unit

- F-TF.A.1 Understand radian measure of an angle as the length of the arc on the unit circle subtended by the angle.
- F-TF.A.2 Explain how the unit circle in the coordinate plane enables the extension of trigonometric functions to all real numbers, interpreted as radian measures of angles traversed counterclockwise around the unit circle.
- F-TF.A.3 Use special triangles to determine geometrically the values of sine, cosine, tangent for  $\pi/3$ ,  $\pi/4$ , and  $\pi/6$ , and to use the unit circle to express the values of sine, cosine, and tangent for  $\pi - x$ ,  $\pi + x$ , and  $2\pi - x$  in terms of their values for  $x$ , where  $x$  is any real number.
- F-TF.B.5 Choose trigonometric functions to model periodic phenomena with specified amplitude, frequency, and midline.
- F-TF.B.7 Use inverse functions to solve trigonometric equations that arise in modeling contexts; evaluate the solutions using technology, and interpret them in terms of the context.
- F-TF.C.8 Prove the Pythagorean identity  $\sin^2 \theta + \cos^2 \theta = 1$  and use it to find  $\sin(\theta)$ ,  $\cos(\theta)$ ,  $\tan(\theta)$ , given  $\sin(\theta)$ ,  $\cos(\theta)$ ,  $\tan(\theta)$ , and the quadrant of the angle.
- F-TF.C.9 Prove the addition and subtraction formulas for sine, cosine, and tangent and use them to solve problems.
- G-SRT.D.9 Derive the formulas  $A = \frac{1}{2} ab \sin(C)$  for the area of a triangle by drawing an auxiliary line from a vertex perpendicular to the opposite side.

### Essential Questions (3-5)

1. What is the meaning of trigonometry?
2. How does the study of trigonometry relate to real-world periodic phenomena?
3. How does right triangle trigonometry relate to trigonometry in a unit circle?
4. How does a change in amplitude affect a function's graph?
5. Where can the graphs of trigonometric functions be found in our everyday lives?

### Anchor Text

### Precalculus with Limits: A Graphing Approach Sixth Edition

Authors : Ron Larson with the assistance of David C. Falvo  
Brooks/Cole Cengage Learning  
Copyright Date: 2012  
ISBN: 978-1-111-42764-1

### Informational Texts (3-5)

None

### Short Texts (1-3)

None

### Formative & Summative Assessments

#### Formative Assessment

- Homework
- Quiz
- Chapter test
- Classwork

#### Summative Assessment

- Semester PreTest
- Semester PostTest
- Project
- Final Exam

### Resources (websites, Canvas, LMS, Google Classroom, documents, etc.)

TI Nspire Graphing Calculator

Excel

Canvas

Google Classroom

<https://www.khanacademy.org/math/precalculus>

<https://www.desmos.com/calculator>

<http://www.state.nj.us/education/cccs/2016/math/standards.pdf>

<http://www.state.nj.us/education/cccs/2014/tech/>

<http://www.cengage.com/>

<https://mathbits.com/MathBits/TeacherResources/PreCalculus/PreCalculusT.html>

**Suggested Time Frame:**

60 Days

## Semester 3

<b>Content Area:</b>	<b>Precalculus</b>	<b>Grade(s)</b>	<b>10,11, &amp;12</b>
<b>Unit Plan Title:</b>	<p>Semester 3 – Limits and Differentiation</p> <p>In Semester 3, the concept of a limit of function and methods for evaluating a limit will be covered. Students will also be introduced to the process of differentiation and the methods and rules for finding the derivatives of functions.</p> <p>VI. Limits and an Introduction to Calculus (25 days, includes assessment days)</p> <ol style="list-style-type: none"> <li>1. Use the definition of limits to estimate limits. (2 days)</li> <li>2. Approximate limits of functions graphically and numerically. (2 days)</li> <li>3. Determine whether limits of a function exist. (2 days)</li> <li>4. Study and use the formal definition of limits. (2 days)</li> <li>5. Use properties of limits and direct substitution to evaluate limits. (2 days)</li> <li>6. Evaluating limits analytically using the dividing out and rationalizing techniques. (5 days)</li> <li>7. Determine continuity at a point and on an open interval. (3 days)</li> <li>8. Evaluate one-sided limits of functions. (3 days)</li> </ol> <p>VII. Differentiation (35 days, includes assessment days)</p> <ol style="list-style-type: none"> <li>1. Understand the tangent line problem. (2 days)</li> <li>2. Find the slope of the tangent line to a curve at a given point. (2 days)</li> <li>3. Use the limit definition of slope to find exact slopes of graphs. (2 days)</li> <li>4. Find derivatives of functions and use derivatives to find slopes of graphs. (2 days)</li> <li>5. Find the derivative of a function using the Constant Rule. (1 day)</li> <li>6. Find the derivative of a function using the Power Rule. (1 day)</li> <li>7. Find the derivative of a function using the Constant Multiple Rule. (2 days)</li> <li>8. Find the derivative of a function using the Sum and Difference Rules. (2 days)</li> <li>9. Find the derivatives of the sine and cosine functions. (2 days)</li> <li>10. Use derivatives to find rates of change. (2 days)</li> <li>11. Find the derivative of a function using the Product Rule. (2 days)</li> <li>12. Find the derivative of a function using the Quotient Rule. (2 days)</li> <li>13. Find the derivative of a trigonometric function. (2 days)</li> <li>14. Find a higher-order derivative of a function. (2 days)</li> <li>15. Find the derivative of a composite function using the Chain Rule. (5 days)</li> </ol>		
<b>NJSLS Standard(s) Addressed in this unit</b>			

- F-IF.A.2 Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.
- A-APR.B.3 Understand the relationship between zeros and factors of polynomials. Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of a function defined by the polynomial.
- F-BF.B.3 Identify the effect on the graph of replacing  $f(x)$  by  $f(x) + k$ ,  $k f(x)$ ,  $f(kx)$ , and  $f(x + k)$  for specific values of  $k$  (both positive and negative); find the value of  $k$  given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them.
- F-IF.B.5 Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. For example, *if the function  $h(n)$  gives the number of person-hours it takes to assemble  $n$  engines in a factory, then the positive integers would be an appropriate domain for the function.*\*
- F.LE.A.1 Distinguish between situations that can be modeled with linear functions and with exponential functions
- F-IF.B.6 Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.
- F-IF.C.7 Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.
- F-IF.C.8 Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.
  - Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.
  - Use the properties of exponents to interpret expressions for exponential functions. *For example, identify percent rate of change in functions such as  $y = (1.02)^t$ ,  $y = (0.97)^t$ ,  $y = (1.01)^{12t}$ ,  $y = (1.2)^{t/10}$ , and classify them as representing exponential growth or decay.*
- F-IF.C.9 Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.*
- G-MG.A.3 Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios).

### Essential Questions (3-5)

- What is a limit?
- What are the different types of function discontinuity?
- What is a derivative?
- What role do derivatives and limits play as a foundation for the calculus and in practical applications?

5. How is the derivative related to velocity and acceleration?

### Anchor Text

#### **Precalculus with Limits: A Graphing Approach Sixth Edition**

Authors : Ron Larson with the assistance of David C. Falvo  
Brooks/Cole Cengage Learning  
Copyright Date: 2012  
ISBN: 978-1-111-42764-1

### Informational Texts (3-5)

None

### Short Texts (1-3)

None

### Formative & Summative Assessments

#### Formative Assessment

- Homework
- Quiz
- Chapter test
- Classwork

#### Summative Assessment

- Semester PreTest
- Semester PostTest
- Project
- Final Exam

### Resources (websites, Canvas, LMS, Google Classroom, documents, etc.)

TI Nspire Graphing Calculator

Excel

Canvas

Google Classroom

<https://www.khanacademy.org/math/precalculus>

<https://www.desmos.com/calculator>

<http://www.state.nj.us/education/cccs/2016/math/standards.pdf>

<http://www.state.nj.us/education/cccs/2014/tech/>

<http://www.cengage.com/>

<https://mathbits.com/MathBits/TeacherResources/PreCalculus/PreCalculusT.html><http://www.state.nj.us/education/cccs/2014/tech/>

<b>Suggested Time Frame:</b>	60 Days

### III. Instructional Strategies :

- Lecture
- Graphs and other visuals
- Student investigative activities
- Engaging in discussions
- Reading silently and aloud
- Brainstorming
- Listening
- Participating in small and large groups
- Collaborative projects
- Answering questions (oral and written)
- Summarizing
- Debating
- Analyzing data, discussions, etc.
- Peer teaching
- Playing games
- Note taking
- Writing

### Differentiated Instruction

- Students will work individually, engage in cooperative learning, and utilize discovery learning on certain activities. Through the use of lectures, the internet, and interactive whiteboards, students will be exposed to various teaching methods including: visual, auditory, and kinesthetic. Copies of data sets and other important notes will be given to students.

#### **IV. Methods of Student Evaluation**

Assessments are divided into two general categories: summative or formal (graded) and formative or informal/classroom-based (both graded and ungraded). The key to effectively assessing a student's mastery of skills is to match the assessment method to the learning objective.

##### Formal Assessments

- Homework and classwork assignments
- Reports and presentations
- Technological applications
- Multiple choice assessment
- Quizzes
- Projects
- Short answer and problem solving assessment
- Tests
- Investigative task

##### Informal Assessments

- Instructor's observations of note-taking, and organization of notebooks and assignments
- Class Participation
- Cooperative learning activities
- Observing citizenship and appropriate social responses
- Instructor's observations of time management skills

## V. Scope and Sequence

Key: I – Introduced, D-developed in Depth, R-Reinforced

<b>Skills/Concepts to be Learned</b>	<b>10</b>	<b>11</b>	<b>12</b>
Explore domain and range, symmetry, intercepts, asymptotes and continuity of functions. Work with inverses of functions and function composition.	DR	DR	DR
Analyze the graphs of polynomial functions.	DR	DR	DR
Add, subtract, multiply, and divide complex numbers.	DR	DR	DR
Find zeros of polynomial functions.	DR	DR	DR
Divide polynomials, and explore the connections between polynomials and rational expressions.	DR	DR	DR
Investigate rational functions and three different types of asymptotes.	DR	DR	DR
Use properties of exponents and logarithms, and apply exponential, logarithmic, and logistic functions to real world situations.	IDR	IDR	IDR
Solve exponential and logarithmic equations. Calculate simple, compound, and continuous interest.	IDR	IDR	IDR
Find missing sides and angles of right triangles using trigonometric ratios. Extend the concept of trigonometric ratios to trigonometric functions.	DR	DR	DR
Use radian measure of an angle.	DR	DR	DR
Evaluate trigonometric functions using the unit circle.	DR	DR	DR
Investigate amplitude, frequency, period, and phase shift of trigonometric functions.	IDR	IDR	IDR

Evaluate inverse trigonometric functions.	IDR	IDR	IDR
Use and prove trigonometric identities, sum and difference identities, Pythagorean identities, and double and half angle identities.	IDR	IDR	IDR
Solve trigonometric equations.	IDR	IDR	IDR
Find limits of functions using graphs, tables, substitution, and rationalization.	ID	ID	ID
Find instantaneous rate of change, and the relationship between continuity and differentiability. Apply the Chain Rule and introduce implicit differentiation.	ID	ID	ID

## VI. Textbooks, Instructional Resources and Software

**Precalculus with Limits: A Graphing Approach;** Authors: Ron Larson with the assistance of David C. Falvo

<b>Resources for Students</b>	<b>Resources for Teachers</b>
<p><b>Digital</b></p> <p>Companion website: <a href="http://www.cengage.com/">http://www.cengage.com/</a></p> <ul style="list-style-type: none"> <li>• Practice and Resources</li> <li>• Student Solutions Manuel</li> <li>• Note-Taking Guide</li> <li>• Enhanced Web Assign</li> <li>• Text-Specific DVD</li> <li>• Lecture Videos</li> <li>• Animated Precalculus</li> <li>• Practice Quizzes and Tests</li> </ul> <p>Internet Resources</p> <ul style="list-style-type: none"> <li>• Online Student Edition</li> </ul> <p><b>Print</b></p>	<p><b>Digital</b></p> <p>Companion website: <a href="http://www.cengage.com/">http://www.cengage.com/</a></p> <p>Resources</p> <ul style="list-style-type: none"> <li>• Lesson Plans</li> <li>• Complete Solutions Manuel</li> <li>• Student Solutions Manuel</li> <li>• Instructor Note-Taking</li> <li>• Student Note-Taking Guide (with Answer Key)</li> <li>• Course Support</li> <li>• PowerPoint Lecture Tools</li> <li>• TI-Nspire Graphing Calculator Guide</li> <li>• TI-84 Graphing Calculator Keystroke Guide</li> <li>• Smart Notebook Guide</li> <li>• Exam View Files/Test Banks</li> <li>• Chapter Project: Answers and Teacher’s Notes</li> </ul> <p>Assessment Resources</p>

Student Edition ISBN: 978-1-111-42764-1

- Exam View Files
- Test Banks

Internet Resources

- Online Teacher Edition

**Print**

Annotated Instructor's Edition ISBN: 978-0-547-64708-1

## VII. Precalculus Curriculum Correlation Chart with Textbook

<b>PreCalculus Topic</b>	<b>Corresponding Text Sections</b>
<b>A. Functions and Their Graphs</b>	
1. Explore domain and range, symmetry, intercepts, asymptotes and continuity of functions.	1.1, 1.2,
2. Work with inverses of functions and function composition.	1.5, 1.6
3. Analyze the graphs of polynomial functions.	1.3, 1.4
<b>B. Polynomial and Rational Functions</b>	
1. Add, subtract, multiply, and divide complex numbers.	2.4
2. Find zeros of polynomial functions.	2.1, 2.2, 2.3,
3. Divide polynomials, and explore the connections between polynomials and rational expressions.	2.6
4. Investigate rational functions and three different types of asymptotes.	2.6, 2.7
<b>C. Exponential and Logarithmic Functions</b>	
1. Use properties of exponents and logarithms, and apply exponential, logarithmic, and logistic functions to real world situations.	3.2, 3.5
2. Solve exponential and logarithmic equations.	3.4
3. Calculate simple, compound, and continuous interest.	3.1,3.2

**D. Trigonometric Functions**

1. Find missing sides and angles of right triangles using trigonometric ratios.	4.3
2. Extend the concept of trigonometric ratios to trigonometric functions.	4.4
3. Use radian measure of an angle.	4.1
4. Evaluate trigonometric functions using the unit circle.	4.2
5. Investigate amplitude, frequency, period, and phase shift of trigonometric functions.	4.5, 4.6
6. Evaluate inverse trigonometric functions.	4.7

**E. Analytic Trigonometry**

1. Use and prove trigonometric identities, sum and difference identities, Pythagorean identities, and double and half angle identities.	5.1, 5.2, 5.4, 5.5
2. Solve trigonometric equations.	5.3

**F. Limits and an Introduction to Calculus**

1. Find limits of functions using graphs, tables, substitution, and rationalization.	11.1, 11.2
--------------------------------------------------------------------------------------	------------

**G. Differentiation**

1. Find instantaneous rate of change, and the relationship between continuity and differentiability.	not in text
2. Apply the Chain Rule and introduce implicit differentiation.	not in text

## VIII. Student Handout

### Precalculus Course Overview

Precalculus is a course with college-level algebra and trigonometry that is designed to prepare students for the study of calculus. This course involves covering algebraic topics that might not have been given attention in earlier algebra courses. In this course the student will study functions, their common properties, individual attributes and their applications. Additional topics from calculus will be introduced that include limits of a function and their properties as well as finding the derivative of a function.

### Proficiencies

#### A. Functions and Their Graphs

- Explore domain and range, symmetry, intercepts, asymptotes and continuity of functions.
- Work with inverses of functions and function composition.
- Analyze the graphs of polynomial functions.

#### B. Polynomial and Rational Functions

- Add, subtract, multiply, and divide complex numbers.
- Find zeros of polynomial functions.
- Divide polynomials, and explore the connections between polynomials and
- Rational expressions.
- Investigate rational functions and three different types of asymptotes.

#### C. Exponential and Logarithmic Functions

- Use properties of exponents and logarithms, and apply exponential, logarithmic, and logistic functions to real world situations.
- Solve exponential and logarithmic equations.
- Calculate simple, compound, and continuous interest.

#### D. Trigonometric Functions

- Find missing sides and angles of right triangles using trigonometric ratios.
- Extend the concept of trigonometric ratios to trigonometric functions.
- Use radian measure of an angle.
- Evaluate trigonometric functions using the unit circle.
- Investigate amplitude, frequency, period, and phase shift of trigonometric functions.
- Evaluate inverse trigonometric functions.

## **E. Limits and an Introduction to Calculus**

- Find limits of functions using graphs, tables, substitution, and rationalization.

## **F. Differentiation**

- Find instantaneous rate of change, and the relationship between continuity and differentiability.
- Apply the Chain Rule and introduce implicit differentiation.