Course Number: MATH 1113

Course Title: Precalculus

Hours Credit: 4 hours

Prerequisites: Four years of high school mathematics including algebra and trigonometry OR MATH 1111.

Courses Description: This course is designed to prepare students for calculus, physics and related technical subjects. Topics include an intensive study of algebraic and transcendental functions.


Learning Outcomes: Students should be able to demonstrate:
1. An understanding of functions and how to graph functions
2. An understanding of operations on functions including function composition
3. An understanding of polynomial and rational graphs, including intercepts and asymptotes
4. An understanding of how to find the zeros of a polynomial and how to factor polynomials
5. An understanding of inverse functions and how to find them graphically and algebraically
6. An understanding of the properties of exponential and logarithmic equations
7. An understanding of how to solve exponential and logarithmic equations
8. An understanding of how to find the values of the trigonometric functions from right triangles and circles
9. An understanding of how to graph the trigonometric functions
10. An understanding of how to prove trigonometric identities
11. An understanding of how to use the sum, difference, double-angle and half-angle formulas for sine and cosine
12. An understanding of how to solve triangle using the law of sines and law of cosines
13. An understanding of polar coordinates and graphs
14. An understanding of how to analyze and solve applied problems
SCHEDULE: The following sections of Blitzer’s book should be covered:

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* total = 51 hours, remaining 9 hours to be used for review/tests

** any student having difficulties during the review sections should be encouraged to switch to MATH 1111.
STANDARD TOPICS: (Must be covered)

1.7 Combinations of Functions/ Composite Functions
- Find the domain of a function (#1-30)
- Find the sum, difference, product and quotient of 2 functions and their domains (#31-48)
- Find the composition of 2 functions (#49-64, #65-72 with domain)
- Break a composition into its parts (#73-80)
- Applications (#95-100)

1.8 Inverse Functions
- Determining if 2 functions are inverses (#1-10)
- Find an equation for the inverse and verify (#11-28)
- Horizontal line test (#29-34)
- Graphing inverses (#35-38)
- Inverses with domain/range (#39-52)
- Applications (#65-69)

2.6 Rational Functions
- Find domain (#1-8)
- Limits from graph (#9-20)
- Vertical asymptotes (#21-28)
- Horizontal asymptotes (#29-36)
- STUDENTS SHOULD KNOW HOW TO USE A GRAPHING CALCULATOR TO OBTAIN THE GRAPHS GIVEN IN #37-70.

2.7 Polynomial and Rational Inequalities
- Solving polynomial inequalities (#1-34)
- Solving rational inequalities (#43-60)
- Applications (#75-80)

3.1 Exponential Functions
- Graphing exponential equation (#11-18)
- Identifying equation using vertical/horizontal shifts and reflections (#19-24)
- Graphing using horizontal/vertical shifts and reflections (#25-40)
- Compound Interest (#53-56)
- STUDENTS SHOULD BE ABLE TO USE A GRAPHING CALCULATOR TO GRAPH THE FUNCTIONS GIVEN IN # 11-18,25-52.
- Applications (#65-76)

3.2 Logarithmic Functions
- Switching between exponential and logarithmic form (#1-20)
- Evaluating logs using definition and inverse properties (#21-42)
- Identifying equations using vertical/horizontal shifts and reflections (#47-52)
- Log and ln notation (#81-100)
• STUDENTS SHOULD KNOW HOW TO USE A GRAPHING CALCULATOR TO OBTAIN THE GRAPHS GIVEN IN #43-46, 53-74.
• Applications (#113-119)

3.3 Properties of Logarithms
• Expand logarithmic expressions (#1-40)
• Condense logarithmic expressions (#41-70)
• Change of Basis formula (#71-78)
• Applications (#103,104)

3.4 Exponential and Logarithmic Equations
• Solve exponential equations (#1-42)
• Solve logarithmic equation involving single log (#49-64)
• Solve logarithmic equation involving multiple logs (#65-90)
• Applications (#101-118)

3.5 Modeling with Exponential and Logarithmic Functions
• Exponential growth and population models (#1-14)
• Exponential decay and half lives (#15-36)
• Logistic growth (#37-46)
• Newton’s Law of Cooling (#47-50)

4.1 Angles and Radian Measure
• Convert between radians and degrees (#13-40)
• Draw angles in standard position (#41-55)
• Finding coterminal angles (#57-70)
• Finding arclength (#71-74)
• Applications (#87-100)

4.2 Trigonometric Functions: The Unit Circle
• Find values of the 6 trig functions from a unit circle point (#1-4)
• Find common trig values given the unit circle points (#5-24, 53-60)
• Using basic identities to find trig values (#25-28)
• Using Pythagorean identity to find other trig values (#29-32)
• Using basic identities to evaluate expressions (#33-38)
• Using properties to evaluate a trig expression (#39-52)
• Applications (#81-84)

4.3 Right Triangle Trigonometry
• Finding values of 6 trig functions given 2 sides of a right triangle (#1-8)
• Properties of cofunctions (#21-28)
• Finding common trig values using right triangles (#9-20)
• Using trig to find the length of a side of a right triangle (#29-34)
• Applications (#53-60)

4.4 Trigonometric Functions of Any Angle
• Finding 6 trig values given point on a circle (#1-8)
• Finding the quadrant given signs of trig functions (#17-22)
• Finding trig values given one value and quadrant (#23-33)
• Finding reference angles (#35-60)
• Finding exact values using reference angles (#61-86)

4.5 Graphs of Sine and Cosine
• Finding amplitude and period (#7-16, 35-42)
• Finding amplitude, period and phase shift (#17-30, 43-52)
• Applications (#75-88)
• STUDENTS SHOULD KNOW HOW TO USE A GRAPHING CALCULATOR TO OBTAIN THE GRAPHS GIVEN IN #7-30, 35-52.

4.6 Graphs of Other Trigonometric Functions
• STUDENTS SHOULD KNOW HOW TO USE A GRAPHING CALCULATOR TO OBTAIN THE GRAPHS GIVEN IN #5-12, 17-24, 29-44.
• Using graph of sine/cosine to obtain graph of sec/csc (#25-28)

4.7 Inverse Trigonometric Functions
• Finding exact values (#1-18)
• Using calculator to obtain values (#19-30)
• Inverse properties (#31-46)
• Making sketch to evaluate expressions involving trig and inverse trig functions (#47-62)
• Writing an expression involving trig and inverse trig function as an algebraic expression (#63-72)
• Applications (#93-96)

4.8 Applications of Trig Functions
• Solving triangles (#1-12)
• Harmonic motion (#17-28)
• Applications (#41-50, 59-62)

5.1 Verifying Identities
• Verify Identities (#1-40)

5.2 Sum and Difference Formulas
• Using sum/difference formulas (#1-8, 13-24)
• Rewriting an expression using sum/difference formulas (#25-32)
• Verifying Identities (#9-12, 33-50)

5.3 Double Angle, Power Reducing and Half-Angle Formulas
• Using Double Angle Formulas (#1-22)
5.5 Solving Trigonometric Equations
  • Determine if an x-value is a solution to a trig equation (#1-10)
  • Find all solutions to a trig equation (#11-24)
  • Find all solutions on a given interval (#25-62)

6.1 The Law of Sines
  • Solve a triangle (#1-16)
  • Determine of the given info produces 0, 1 or 2 triangles (#17-25)
  • Applications (#47-60)

6.2 The Law of Cosines
  • Solve a triangle (#1-18)
  • Heron’s area formula (#25-30)
  • Applications (#37-52)

6.3 Polar Coordinates
  • Plotting points in polar coordinates (#1-20)
  • Switch between polar and Cartesian coordinates of a point (#33-48)
  • Switch equations between polar and rectangular coordinates (#49-64)

6.4 Graphs of Polar Equations
  • STUDENTS SHOULD KNOW HOW TO USE A GRAPHING CALCULATOR TO OBTAIN THE GRAPHS GIVEN IN #13-34.

6.6 Vectors
  • Sketching vectors and magnitude (#5-12)
  • Finding vectors given initial/terminal points (#13-20)
  • Computations with vectors (#21-37)
  • Unit vectors (#39-45)
  • Finding components of a vector (#47-52)
  • Applications (#65-70, 79-82)

7.1 Systems of Linear Equations in Two Variables
  • Show a particular ordered pair is (not) a solution to a 2x2 system (#1-4)
  • Solve a 2x2 system by substitution (#5-18)
  • Solve a 2x2 system by addition method (#19-30)
  • Solve a 2x2 system by any method (#31-42)
  • Word problems (#43-46)
  • Applications (#55-92)

7.2 Systems of Linear Equations in Three Variables
  • Show an ordered triple is (not) a solution to a 3x3 system (#1-4)
- Solve a 3x3 system (#5-18)
- Word problems (#23,24)
- Find a quadratic passing thru 3 points (#19-22)
- Applications (#31-39)

7.3 Partial Fractions
- Form of partial fraction decomposition (#1-8)
- Partial fraction decomposition (#9-27)

7.4 Systems of Nonlinear Equations in Two Variables
- Solve a nonlinear system by substitution (#1-18)
- Solve a nonlinear system by addition method (#19-28)
- Solve a nonlinear system by any method (#29-42)
- Word problems (#43-46)
- Applications (#55-63)

8.1 Matrix Solutions to Linear Systems
- Augmented matrices (#1-12)
- Row operations (#13-18)
- Gaussian elimination (#21-38)

8.3 Matrix Operations
- Computations with matrices (#9-16)
- Matrix multiplication (#27-44)

8.4 Multiplicative Inverses of Matrices
- Determine if A and B are inverses (#1-10)
- Find inverse of a 2x2 matrix (#13-18)
- Finding an inverse by row operations (#19-27)

8.5 Determinants and Cramer’s Rule
- Find determinant of a 2x2 matrix (#1-10)
- Cramer’s rule to solve a system of 2 equations (#11-21)
- Determinants of a 3x3 matrix (#27-32)