ALGEBRA & TRIGONOMETRY FOR CALCULUS

MATH 1340

Course Description:

A combined algebra and trigonometry course for science and engineering students planning to enroll in Calculus I, MATH 1950. Topics include: systems of equations, polynomials and rational functions, exponential and logarithmic functions, trigonometric functions and their inverses, trigonometric identities and applications, conic sections, complex numbers, and sequences and series. Credit for both MATH 1320 and MATH 1340, or both MATH 1330 and MATH 1340 will not be given. **5 credits**

Prerequisites:

ACT Math at least 23, Math SAT at least 540, or Math SAT2016 at least 570 within last 2 years; or Accuplacer at least 5 or COMPASS at least 4 within last 2 years; or MATH 1310 with at least C- within last 2 years; or MATH 1340 within last 2 years

Major Topics:

1) Linear Functions

a. Linear Equations in One Variable

i. Definitions
ii. Solving Linear Equations on One Variable
iii. Solving Rational Equations with Variable in the Denominators
iv. Solve Formulas for a Specific Variable
v. Applications Using Linear Equations

b. Applications of Linear Equations

i. Procedure for Solving Applied Problems
ii. Use Linear Equations to Solve Applied Problems

c. Complex Numbers

i. Definition of Complex Numbers
ii. Addition, Subtraction, Multiplying
iii. Complex Conjugate and Division

d. Quadratic Equations

i. Solve a Quadratic Equation by Factoring
ii. Solve a Quadratic Equation by the Square Root Method
iii. Solve a Quadratic Equation by Completing the Square
iv. Solve a Quadratic Equation by using the Quadratic Formula
v. Solve Quadratic Equations with Complex Solutions
vi. Applications of Complex Numbers

e. Solving Other Types of Equations

i. Solving Equations by Factoring
ii. Solve Rational Equations
iii. Solve Equations Involving Radicals
iv. Solve Equations with Rational Exponents
v. Solve Equations That Are in Quadratic Form

f. Linear Inequalities

i. Inequality Terminology
ii. Solve and Graph Linear Inequalities
iii. Solve and Graph a Compound Inequality
iv. Solve and Graph an Inequality Involving the Reciprocal of a Linear Expression

g. Equations and Inequalities Involving Absolute Value

i. Solve Equations Involving Absolute Value

ii. Solve Inequalities Involving Absolute Value

2) Graphs and Functions

a. The Coordinate Plane

i. Plot points in the Cartesian Coordinate Plane

i. Distance Formula

ii. Midpoint Formula

b. Graphs of Equations

i. Sketch a Graph by Plotting Points

ii. Find the Intercepts

iii. Find the Symmetry

iv. Find the Equation of a Circle

c. Lines

i. Find the Slope

ii. The Point-Slope and Slope-Intercept Form of the Equation of a Line

iii. Equations of Horizontal and Vertical Lines

iv. General Form of the Equation of a Line

v. Parallel and Perpendicular Lines

vi. Modeling Data Using Linear Regression

d. Relations and Functions

i. Definition of Relations

ii. Definition of Functions

iii. Find the Domain of a Function

iv. Function Information from its Graph

v. Applications of Functions to Solving Applied Problems

e. Properties of Functions

i. Increasing and Decreasing Functions

ii. Locate Relative Maximum and Minimum Values

iii. Even-Odd Functions and Symmetry

iv. Average Rate of Change

f. A Library of Functions

v. Relate Linear Functions to Linear Equations

ii. Graph Square Root and Cube Root Functions

iii. Graph Other Basic Functions

iv. Evaluate and Graph Piecewise Functions

g. Transformations of Functions

i. Meaning of Transformations

ii. Vertical and Horizontal Shifts to Graph Functions

iii. Reflections to Graph Functions

iv. Stretching or Compressing to Graph Functions

h. Combining Functions: Composite Functions

i. Basic Operations on Functions

ii. Form Composite Functions

iii. Find the Domain of Composite Functions

iv. Decomposition of a Function

v. Apply Composition to Practical Problems

i. Inverse Functions

i. Definition

ii. Finding the Inverse Function

iii. Finding the Range of a One-to-One Function with an Inverse Function

iv. Applications of Inverse Functions to Real World Problems

3) Polynomial and Rational Functions

a. Quadratic Functions

i. Graph of a Quadratic Function in Standard Form
ii. Graph a Quadratic Function
iii. Solve Problems Modeled by Quadratic Functions

b. Polynomial Functions

i. Properties of the Graphs of Polynomial Functions
ii. Determine the End Behavior of Polynomial Functions
iii. Find the Zeros of a Polynomial Function by Factoring
iv. Relationships Between Degrees, Real Zeros, and Turning Points
v. Graph Polynomial Function

c. Dividing Polynomials

i. The Division Algorithm
ii. Synthetic Division
iii. The Remainder and Factor Theorems

d. Rational Functions

i. Definition of Rational Functions
ii. Vertical Asymptotes
iii. Horizontal Asymptotes
iv. Graph Rational Functions
v. Graph Rational Functions with Oblique Asymptotes

e. Polynomial and Rational Inequalities

i. Solve Quadratic Inequalities
ii. Solve Polynomial Inequalities
iii. Solve Rational Inequalities

f. Variation

i. Solve Direct Variation
ii. Solve Inverse Variation
iii. Solve Joint and Combined Variation

4) Exponential and Logarithmic Functions

a. Exponential Functions

i. Definition of Exponential Functions
ii. Graph Exponential Functions
iii. Solve Exponential Equations
iv. Transformations on Exponential Functions

b. The Natural Exponential Function

i. Define Simple Interest
ii. Compound Interest Formula
iii. The Number *e*
iv. The Natural Exponential Function
v. Evaluate Exponential Functions

c. Logarithmic Functions

i. Define Logarithmic Functions
iv. Evaluate Logarithms
iii. Domain of Logarithmic Functions
iv. Graphs of Logarithmic Functions
v. Logarithms to Solve Exponential Equations

d. Rules of Logarithms

i. Rules of Logarithms
iv. Change of Base
iii. Growth and Decay

e. Exponential and Logarithmic Equations and Inequalities

i. Solving Exponential Equations
ii. Applications of Exponential Equations
iii. Solving Logarithmic Equations
iv. Logarithmic and Exponential Inequalities

5) Trigonometric Functions

a. Angles and Their Measure

i. Terminology Associated with Angles
ii. Use Degree and Radian Measure
iii. Convert Between Degree and Radian Measure
iv. Find Complements and Supplements
v. Find Length of an Arc of a Circle
vi. Compute Linear and Angular Speed
vii. Find the Area of a Sector

b. Right Angle Trigonometry

i. Define Trigonometric Functions of Acute Angles
ii. Evaluate Trigonometric Functions of Acute Angles
iii. Evaluate Trigonometric Functions for the Special Angles 30, 45, and 60
iv. Fundamental Identities
v. Right Triangle Trigonometry in Applications

c. Trigonometric Functions of Any Angle; The Unit Circle

i. Evaluate Trigonometric Functions of Any Angle
ii. Signs of the Trigonometric Functions in Each Quadrant
iii. The Reference Angle
iv. Reference Angles to Find Trigonometric Function Values
v. Define the Trigonometric Functions Using the Unit Circle

d. Graphs of the Sine and Cosine Functions

i. Define Periodic Functions
ii. Graphs of the Sine and Cosine Functions
iii. Amplitude and Period of Sinusoidal Functions
iv. Phase Shifts of Sinusoidal Functions

e. Graphs of the Other Trigonometric Functions

i. Graphs of the Tangent and Cotangent Functions
ii. Graphs of the Cosecant and Secant Functions

f. Inverse Trigonometric Functions

i. Graph and Apply the Inverse Sine Function
ii. Graph and Apply the Inverse Cosine Function
iii. Graph and Apply the Inverse Tangent Function
iv. Evaluate Inverse Trigonometric Functions
v. Exact Value of Composite Functions Involving the Inverse Trigonometric Function

6) Trigonometric Identities and Equations

a. Verifying Identities

i. Verify Even-Odd Identities
ii. Verify Trigonometric Identities

b. Sum and Difference Identities

i. Sum and Difference Identities for Cosine
ii. Cofunction Identities
iii. Sum and Difference Identities for Sine
iv. Sum and Difference Identities for Tangent

c. Double-Angle and Half-Angle Identities

i. Double-Angle Identities
iv. Power-Reducing Identities
iii. Half-Angle Identities

d. Trigonometric Equations I

i. Trigonometric Equations of the Form $a \sin(x-c)=k$, $a \cos(x-c)=k$, and $a \tan(x-c)=k$
ii. Trigonometric Equations and the Zero-Product Property
iii. Trigonometric Equations with More Than One Trigonometric Function
iv. Trigonometric Equations and Extraneous Solutions

e. Trigonometric Equations I

i. Trigonometric Equations Involving Multiple Angles
ii. Using Sum-to-Product Identities
iii. Equations Containing Inverse Trigonometric Functions

7) Applications of Trigonometric Functions

a. the Law of Sines

i. Solving Oblique Triangle
ii. Derive the Law of Sines
iii. Solving AAS and ASA Triangles Using the Law of Sines

b. The Law of Cosines

i. Derive the Law of Cosines
ii. Solving SAS Triangles Using the Law of Cosines
iii. Solving SSS Triangles Using the Law of Cosines

8) Systems of Equations and Inequalities

a. Systems of Linear Equations in Two Variables

i. Verify a Solution to a System of Equations
ii. Solve a System of Equations by the Graphical Method
iii. Solve a System of Equations by the Substitution Method
iv. Solve a System of Equations by the Elimination Method
v. Applications of Solving Systems of Equations

b. Systems of Nonlinear Equations

i. Solving Systems of Nonlinear Equations by Substitution
ii. Solving Systems of Nonlinear Equations by Elimination
iii. Applied Problems Using Nonlinear Systems

c. Systems of Inequalities

i. Graph of a Linear Inequality in Two Variables
ii. Graphs of Systems of Linear Inequalities in Two Variables
iii. Graphs of Nonlinear Inequality in Two Variables
iv. Graphs of Systems of Nonlinear Inequalities in Two Variables

9) Conic Sections

a. Conic Sections: Overview

b. The Parabola

i. Geometric Definition of a Parabola
ii. Equation of a Parabola
iii. Translations of Parabolas
iv. Reflecting Properties of Parabolas

c. The Ellipse

i. Definition of an Ellipse
ii. Equation of an Ellipse
iii. Translations of Ellipses
iv. Applications of Ellipses

d. The Hyperbola

i. Definition of Hyperbola
ii. The Asymptotes of a Hyperbola
iii. Graphing a Hyperbola with Center (0,0)
iv. Translations of Hyperbolas
v. Applications of Hyperbolas

Textbook:

Ratti, J. S., and Marcus S. McWaters. *Precalculus: A Right Triangle Approach Plus NEW MyMathLab with Pearson eText -- Access Card Package (3rd Edition) (Ratti/McWaters Series)*.

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