

# Shormann Precalculus with Trigonometry

## Scope & Sequence

### Number

Defining Mathematics

History of Number

Permutations and Combinations

Operations with whole number exponents

Operations with fractional exponents

Operations with scientific notation

Logarithm means exponent

Subsets of Real Numbers

Union and intersection of sets

Complex numbers

Operations with complex numbers

Subsets, disjoint sets, equivalent sets

Sets and Venn (Euler) diagrams

Sets and Cartesian product

Absolute value and order

Counting problems, including permutations and combinations

Special number types, including binary

### Ratio (including proportional relationships)

Rational and irrational numbers

Rational and radical equations

Logarithms as "ratio numbers"

Direct and inverse variation

Product rule for logarithms

Quotient rule for logarithms

Power rule for logarithms

Proportion and the Christian adventure

Ratio word problems

Simplifying complex fractions

## **Algebra (including algebra of functions)**

History of Algebra

Algebra fundamentals review

Special Polynomials

Combined operations with algebraic expressions

Combined operations with logarithms

Completing the square

Quadratic formula

Modeling functions numerically

Modeling functions symbolically

Modeling functions verbally

Finding domain and range from functions

Operations with functions

Evaluating functions, including nonstandard forms

Composite functions

Symbolic and verbal (tabular) representation of functions

Symbolic and verbal (tabular) transformation of functions

Operations with polynomials

Operations with exponents

Operations with logarithms

Linear equations

Quadratic equations

Absolute Value equations

Polynomial equations

Polynomial division

Synthetic division and the remainder theorem

Synthetic division and the factor theorem

Rational equations

Radical equations

Exponential equations

Logarithmic equations

Linear inequalities

Quadratic inequalities

Absolute value inequalities

Linear systems of equations

Non-linear systems of equations

Word problems and systems of equations(value, uniform motion, etc.)

Partial fractions

## **Geometry (Including Logic)**

History of Geometry

Geometry Fundamentals Review

Coordinate geometry

Distance, midpoint

Properties of parallelograms and trapezoids

3-dimensional geometry

Geometry in art and creation

Geometry in 3D design

Euclid, axioms and postulates

Euclid, theorems, proofs

Triangle similarity

Triangle congruency

Triangle proofs

Circle relationships

Circle proofs

Construction

Non-Euclidean Geometry

Pythagorean theorem

Logic fundamentals

Syllogisms

Truth tables

Conjunctions, disjunctions, implications, and negations

Conditional statements

Necessary and sufficient conditions

Converse, inverse, and contrapositive

Hypotheses, conclusions, and counterexamples

## **Analytical Geometry (including graphical forms of functions)**

History of Analytical Geometry

Analytical geometry fundamentals review

Rectangular Coordinate System

Linear equations

Linear inequalities

Nonlinear inequalities

Creating exp. and log. equations from word problems

Functions and relations

Modeling functions graphically

Finding domain and range from graphs

Finding x-intercepts (roots) of polynomial functions (equations), with and without a graphing calculator

Finding extrema from graphs (with and without graphing calculator)

Finding poles (asymptotes) and zeros

Finding inverse functions

Graphing functions

Complex roots

Applications from algebra and geometry

Conics, including parabolas, circles, ellipses and hyperbolas

Even and odd functions

Inverse functions

Graphical representation of functions, including linear, nonlinear, and piecewise defined

Graphical transformation of functions, including linear, nonlinear, and piecewise defined

Linear functions as models

Nonlinear functions as models

Linear system word problems (graphical forms)

Nonlinear system word problems, with and without graphing calculator

Nonlinear systems of inequalities (graphical forms)

## Measurement

History of measurement

Why standards matter

Rate conversions

Length conversions

Area conversions

Volume conversions

Currency (money) conversions

Special conversions, like finding cost per part

Perimeter, area, surface area and volume

Chemical mixture problems

Gas law problems

Interest rate, savings, and debt, and what the Bible has to say about it

## Trigonometry

Trigonometry and right triangle basics

Trigonometry and Unit Circle Basics

Inverse trig functions

Reciprocal trig functions

Composite trig functions

Products of complex numbers

DeMoivre's theorem, Euler's formula, and complex roots

Parallelogram law

Polar coordinates and conversion to rectangular, and vice-versa

Vectors

Resultant vectors

Resultant vectors, force applications

Trigonometric equations

Graphing Trig functions

Transformations of Trig functions

Basic Trig. Identities

Law of Sines

Law of Cosines

Sum and Difference Trig. Identities

Half and double angle trig identities

Periodicity

Periodic and other Trig functions with a calculator

Periodic and other Trig functions without a calculator

Non-periodic functions

Trig functions as models(finding height of an object, damping functions, etc.)

Using Trig to find area of inscribed regular polygons and connection to finding integrals

Pythagorean theorem applications

## Calculus

History of Calculus

To understand calculus, just believe

Limits of simple continuous and discontinuous functions

Limits of rational polynomial functions

Infinity as a limit

Special limits

Limit definitions of fundamental derivatives

Limit definition of an integral

Calculus is about rates of change

Derivative means slope

Derivatives of polynomials, especially  $x^2$

Using derivatives to find equations of tangent lines

Derivative applications, including finding extrema

2nd derivative

Derivatives of sums and differences

Product and quotient rules for derivatives

Chain Rule for derivatives

Related rates

Integrals I (integrals as area under a curve)

Integrals II (summing area under curve using upper rectangles;  $f(x)$  times  $\Delta x$ )

Integrals III (definite integrals;  $f(x)$  times  $dx$ )

Integrals IV (antiderivatives)

Fundamental theorem of calculus

## **Statistics**

Counting problems, including permutations and combinations

Computation of probabilities of simple and compound events

Simple conditional probability

One-variable data and the normal distribution, histograms

Mean, median, mode and range

Standard deviation and variance

Data interpretation and representation: tables; bar, line, circle graphs; pie charts, scatterplots, histograms

linear regression, including the least squares algorithm

nonlinear regression

Student's t-test

## **Computer Mathematics (see also Logic in Geometry section)**

Pixels, bits, and the binary numeral system

Sequences

Series

Infinite Series

Resolving fractions into infinite series

Deriving formulas for infinite series

Sums

Factorials

Pascal's triangle

Binomial Theorem

Matrices, finding determinants and operations

Cramer's rule

Boolean algebra
Recurrence problems