

Development of Major Content Strands in Pre-Calculus with Trigonometry

Chp	Modeling	Functions and Inverses	Graphical forms and Transformations	Trigonometric Functions	Trigonometric Applications
1	Students create and use a linear model of what they can see through a tube at a given distance.	Students review function notation, composition of functions, and basic inverses.	Students review parent graphs and extend this knowledge to arbitrary graphs. Point-slope form of a line is developed and used throughout the course.	Radians are introduced and the unit circle is created using radian measures.	Review of basic right triangle trigonometry. Solving triangles using the Law of Sines and the Law of Cosines. Finding the area of a triangle using two sides and an included angle.
2	Equations and data as rates are used in applications to generate meaning for area under a curve. Students model the altitude of a rocket based on its velocity.	This thread is spiraled through homework.	Piecewise functions are introduced and used in transformations.	Radian measures are practiced in homework as well as special triangles. Periodic functions are introduced.	Law of Sines and Cosines spiraled in homework.
3	Students apply exponentials to half-life and other applications.	More complex inverse are found. Logarithms are used as the inverse to exponentials.	Students look at transformations of the form $f(a(x))$. Students transform exponential functions.	Radian measures and special triangles are spiraled in homework.	Law of Sines and Cosines are spiraled in homework.
4	Periodic functions are modeled in applications.	All six trig functions are introduced.	Graphs and transformations of sine and cosine are introduced and practiced.	Coordinates in a unit circle are found. Exact values for all six trig functions are found in the unit circle.	Periodic functions are used in applications.
5	Students use view tubes to find inverse variation. Direct and inverse variation is explored.	This thread is spiraled in homework.	Rational functions are explored. Graphs of $\frac{1}{f(x)}$ are found including graphs of secant and cosecant.	This thread is spiraled in homework.	This thread is spiraled in homework.
6	Students use trig functions to model sinusoidal motion. An optional section includes combining a periodic function with exponential decay to model the motion of a spring.	Inverse trig functions are introduced.	Transformation of trig functions reinforced and extended.	Students solve trig equations with both restricted and unrestricted domain.	Ambiguous case of Law of Sines is covered. Students apply periodic functions in multiple applications. Angle of inclination is used.

Shaded areas indicate key components of chapter.

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7	Students setup and solve optimization problems used in calculus. These problems are solved graphically.	Even and odd functions are introduced.	This thread is spiraled in homework.	This thread is spiraled in homework.	This thread is spiraled in homework.
8	Applications involving e^x are used.	Natural log and e^x are defined and used in multiple problems.	Graphs and transformations of $y = e^x$ and $y = \ln x$.	This thread is spiraled in homework.	This thread is spiraled in homework.
9	Optimization is used in multiple parts of the chapter. Distinctions are made between velocity and speed.	Students use function notation and limits to develop and use the definition of a derivative.	Students compare position vs. time graphs and velocity vs. time graphs.	This thread is spiraled in homework.	This thread is spiraled in homework.
10	Motion is described using parametric equations and vectors.	Parametric equations are used to find inverses.	Parametric equations are graphed and compared.	Component form of vectors are used to simplify problems.	Law of Sines and Cosines are used to solve vector problems. Additional trig applications in homework.
11		Functions in polar form are explored.	Polar graphs and transformations are investigated and used.	This thread is spiraled in homework and as part of polar investigations.	This thread is spiraled in homework.
12		Topics learned earlier are spiraled in the extra problems section of the book.	Linear transformations using matrices is a major focus of this chapter.	Topics learned earlier are spiraled in the extra problems section of the book.	Topics learned earlier are spiraled in the extra problems section of the book.
13		Topics learned earlier are spiraled in the extra problems section of the book.	Conic sections shown in traditional textbook format to prepare students for college mathematics.	Topics learned earlier are spiraled in the extra problems section of the book.	Topics learned earlier are spiraled in the extra problems section of the book.

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Chp	Trigonometric Identities	Concepts of Calculus	Algebraic Techniques	Use of Technology	Vectors and Parametric and Polar Equations
1		Distance as area under a velocity graph is introduced.	Rules of exponents are reviewed, particularly radicals and fractional exponents.	Students transform graphs using a graphing calculator. First programming steps are introduced including programming the Quadratic Formula.	
2		Sigma notation is introduced and used to find area under a curve. Area under a curve is a major focus of the chapter.	Work with rational expressions is reviewed.	Piecewise functions are graphed using a graphing calculator. Students program sum and area programs.	
3		Area under a curve is spiraled in homework.	Students simplify exponential functions. Students simplify complex fractions. Properties of logs are used.	Students use graphing calculators to transform graphs of the form $f(a(x))$ and to graph inverses.	
4	The Pythagorean Identities and reciprocal trig functions are found. Students simplify and verify identities.	Area under a curve is spiraled in homework.	Techniques explored earlier are spiraled in homework.	Students use the zoom features of the calculator to set an appropriate window for trig functions. Students use programs created earlier.	
5	Identities are spiraled in homework.	Limits and limit notation are introduced. Formal definition of continuity is given and used.	More complex simplifications of rational functions are practiced.	Students use tables and graphs to explore limits.	
6	Students continue work on earlier identities and expand these ideas to include the angle sum and difference formulas, double angle, and half angle formulas.	This thread is spiraled in homework.	Substitution is used to help solve trig equations.	Students graph inverse trig relations and functions. Students use statistical plots for data on the spring problem.	

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Chp	Trigonometric Identities	Concepts of Calculus	Algebraic Techniques	Use of Technology	Vectors and Parametric and Polar Equations
7	Students practice these problems in homework.	Increasing, decreasing, and concavity are introduced. Arithmetic and geometric series are used. Setup for optimization is extensive in chapter.	Use of substitution to simplify problems. Polynomial division is taught. Binomial expansion is taught.	Use of combinations for binomial expansions is demonstrated. Finding the max or min of a function using a calculator is practiced.	
8	This thread is spiraled in homework.	Limits are developed extensively in this chapter. Infinite geometric series and harmonic series are investigated.	Sequence notation is introduced and used.		
9	Angle sum and difference formulas are used to find the derivatives of sine and cosine.	Rates of change and the definition of the derivative are extensively investigated in this chapter. The relationship between area under a curve and rates of change is also investigated.	Manipulations to solve derivative problems are extensively used.	Students investigate slopes of secant lines (average rates of change) to develop the slope of a tangent line (instantaneous rate of change).	
10	Topics learned earlier are spiraled in homework.	Topics learned earlier are spiraled in homework.	Topics learned earlier are applied in problems and spiraled in homework.	Parametric equations are graphed on a calculator.	Vectors and parametric equations introduced including dot product for vectors.
11	Topics learned earlier are spiraled in homework.	Topics learned earlier are spiraled in homework.	Conversions between polar and rectangular systems are made. Operations using complex numbers are studied in both standard and polar form. DeMoivre's Theorem is used to find powers and roots of complex numbers.	Polar equations are graphed and studied on a calculator.	Polar equations are introduced, graphed, and used to evaluate powers and roots of complex numbers.
12	Topics learned earlier are spiraled in the extra problems section of the book.	Topics learned earlier are spiraled in the extra problems section of the book.	Matrix operations including inverse and matrix equations are investigated.	Matrix operations are performed on a graphing calculator.	
13	Topics learned earlier are spiraled in the extra problems section of the book.	Topics learned earlier are spiraled in the extra problems section of the book.	Operations to change from standard to graphing forms of conics are shown and practiced.		

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