

The Notebook Project – Precalculus

This project is designed to improve study skills and organizational skills for a successful career in mathematics. You are to turn a composition notebook into a “Go To” textbook for easy reference and review.

*Table of Contents MUST BE located on the first 6 pages (Quarter 1 & 2 will require the 1st 4 pages for content.

Topics covered:

1) Functions

- a. Definition of Function, Domain, Range, & Vertical Line Test
- b. Examples of “Relations vs. Function”
 - i. List of points
 - ii. Mapping Diagram
 - iii. Graph
 - iv. Equations (i.e. $f(x) = 3x^2$, $f(x) = 3x$, $x^2 + y^2 = 1$)
- c. Interval Notation
- d. Symmetry
- e. Finding Domain of a function
 - i. Most functions (w/ example)
 - ii. Rational Functions (w/ steps & examples)
 - iii. Radical Functions (w/ steps & examples)
- f. Function Transformations [diagram & examples]
- g. Operation of Functions (w/ examples of each operation)
- h. Inverse Functions
 - i. Define one-to-one function
 - ii. Horizontal Line Test
 - iii. Steps to finding the inverse of a function
 1. Example 1: $y = 5x - 7$
 2. Example 2: $y = \sqrt{x - 3}$
 3. Example 3: $f(x) = \frac{1}{x-4}$

2) Polynomial Functions

- a. Define: polynomial function, degree, root, & zero
- b. Naming polynomials [Degree & Term] (w/ examples)
- c. Multiplicity
- d. Extrema (maximum/minimum)

- i. Theorem – “A polynomial function with degree n has at most $n-1$ extrema”
 - e. Fundamental Theorem of Algebra
 - f. Polynomial Long Division
 - i. Example: $\frac{x^4-2x^3+8x-16}{x^2-2}$
 - g. Synthetic Division
 - i. Example: $\frac{x^4-2x^3+8x-16}{x+2}$
 - h. Remainder Theorem
 - i. Example: $P(2)$ for $P(x) = x^4 - 2x^3 + 8x - 16$
 - i. Factor Theorem
 - i. Is $(x + 2)$ a factor for $P(x) = x^4 - 2x^3 + 8x - 16$
 - j. Rational Roots Theorem/Rational Zeros Theorem
 - k. Finding the zeros of a polynomial function steps
 - i. Without Calculator
 - 1. Example
 - ii. With Graphing Calculator
 - 1. Example
- 3) Rational Functions
 - a. Standard Form Rational Functions
 - i. Finding Vertical Asymptotes
 - ii. Determining Horizontal Asymptotes
 - iii. Finding Holes
- 4) Unit Circle & Right Triangle
 - a. Unit Circle
 - b. Angles
 - c. Radian & Degree Conversions
 - d. Trigonometric Ratios
 - i. On a triangle
 - ii. A point on a graph
 - e. Solving Right Triangles
- 5) Graphs of Trigonometric Functions
 - a. Graph of Sine (w/ properties)
 - b. Graph of Cosine (w/ properties)
 - c. Applications with Sine & Cosine
 - i. High Tide problem
 - ii. Temperature problem

- d. Graph of Secant (w/ properties)
 - e. Graph of Cosecant (w/ properties)
 - f. Graph of Tangent (w/ properties)
 - g. Graph of Cotangent (w/ properties)
- 6) Law of Sines & Cosines
- a. Law of Sines
 - b. Ambiguous Case of the Law of Sines
 - c. Law of Cosines
- 7) Analytic Trigonometry
- a. Reciprocal Identities
 - b. Quotient Identities
 - c. Pythagorean Identities
 - d. Sum & Difference Formulas
 - e. Double & Half Angle Formulas
 - f. Trigonometric Equations
 - i. Guidelines to solve
 - ii. Example 1: $\tan\left(\frac{\pi}{2} - 2\theta\right) = 1$
 - iii. Example 2: $2 \cos^2 \theta + \cos \theta - 1 = 0$
- 8) Vectors
- a. Modeling vectors on a graph
 - b. Magnitude
 - c. Direction Angle
 - d. Vector Components (how to compute x & y)
 - e. Vector Addition
 - f. Scalar Multiplication
 - g. Dot Product
 - h. Angle between 2 vectors
 - i. Applications of Vectors (give 2 examples, i.e. airplane problem)
 - i. Converting from Bearing formula
- 9) Parametric Equations
- a. Plotting points with parametric equations
 - b. Eliminating a parameter
- 10) Polar Equations
- a. Polar Coordinates
 - i. How to plot a polar coordinate
 - ii. Converting polar coordinates to rectangular coordinates

- iii. Converting rectangular coordinates to polar coordinates
 - b. Polar Equations
 - i. Converting from Polar to Rectangular
 - ii. Converting from Rectangular to Polar
 - c. Polar Graphs
 - i. Cardioid (equation & graph)
 - ii. Limacon
 - 1. With Inner Loop (equation & graph)
 - 2. With Outer Loop (equation & graph)
 - iii. Rose (equation & graph)
 - iv. Lemniscate (equation & graph)
- 11) Conic Sections
 - a. Parabola
 - b. Ellipse
 - c. Circle
 - d. Hyperbola
- 12) Limits
 - a. Definition of limit (with notation explanation)
 - b. Finding a limit via a table (example)
 - c. Finding a limit graphically (example)
 - d. One sided limit \rightarrow (notation explanation)
 - i. $\lim_{x \rightarrow c} f(x)$ exist if $\lim_{x \rightarrow c^-} f(x) = \lim_{x \rightarrow c^+} f(x)$
 - ii. Example
 - When limits do not exist [3 cases]
 - Properties of limits
 - Finding limits
 - Direct substitution (example)
 - e. Indeterminant form
 - i. Factoring
 - ii. Rationalizing
 - iii. Embedded denominator
 - iv. Trigonometric identity
 - f. Limit involving infinity
 - Horizontal asymptote rules (with example)
 - End behavior model for rational function
 - Vertical asymptotes