



HHS Pre-Calculus Reference Book

Purpose: To create a reference book to review topics for your final exam and to prepare you for Calculus.

Instructions: Students are to compose a reference book containing information and examples of the graphs of common functions and concepts. The topics are listed below. Your book should contain detailed information and examples. Use color neatly for illustration purposes, if you desire. If you are unsure about the depth of any topic, please see your teacher for clarification.

General Layout: 2 point deduction for any structural errors.

- Your reference book should be presented in a 3 ring binder with page protectors to protect your work from spills and tears
- Include a title page at the front of the book
- Include a table of contents with topics and page numbers. (only needed on the Final check)
- All work is to be done on lineless paper using colored or black ink (NO PENCIL). Computer graphics CAN NOT BE USED.
- All work (except for headings) should be handwritten
- Every topic should include at least 1 worked-out example

Checkpoints:

- Thursday, February 27 – Chapters 1 and 2
- Tuesday, March 24 – Chapters 3 and 4
- Friday, May 29 – Entire Reference Book Due (Including Chapters 5, 6, 7, and 8)

Late Fees:

- Planned absences on due dates will require an early submission of the reference book.
- 10 points will be deducted per day if the reference book is turned in after the due dates.

Topics to be included in your reference book: (147 points total)

Chapter 1: Functions and Graphs (33 points)

A. 13 Basic Functions (include Domain, Range, Continuity, Symmetry, Increasing/Decreasing Intervals, Boundedness, Extrema, Asymptotes, End Behavior (Limits), and a graph for EACH function).

- | | | |
|-----------------|--------------------|-----------------------|
| i. Linear | vi. Absolute Value | x. Sine |
| ii. Quadratic | vii. Reciprocal | xi. Cosine |
| iii. Cubic | viii. Exponential | xii. Greatest Integer |
| iv. Square Root | ix. Logarithmic | xiii. Logistic |
| v. Cube Root | | |

B. Graphical Transformations (Explain and **graph** the transformations)

- Translations Up and Down: $f(x) = f(x) + c$ and $f(x) = f(x) - c$
- Translations Left and Right: $f(x) = f(x + c)$ and $f(x) = f(x - c)$
- Vertical Stretch and Shrink: $f(x) = c \cdot f(x)$ where $c > 1$ and $0 < c < 1$
- Horizontal Stretch and Shrink: $f(x) = f\left(\frac{x}{c}\right)$ where $c > 1$ and $0 < c < 1$
- Reflections: $f(x) = -f(x)$ and $f(x) = f(-x)$

C. Function Composition and Inverses: Create 2 functions, $f(x)$ and $g(x)$, then find the compositions and inverses below.

- $f(g(x))$
- $g(f(x))$
- $f^{-1}(x)$
- $g^{-1}(x)$

Chapter 2: Polynomial, Power, and Rational Functions (15 points)

A. Quadratic Functions

- Standard Form
- Vertex Form
- Converting from Standard Form to Vertex Form using Completing the Square

B. Power Functions

- Given an equation find the degree and constant of variation
- Direct Variation
- Indirect Variation

C. Polynomial Functions

- Multiplicity relative to an equation and a graph
- Given the zeros, find the function
- Given the function, find the zeros

D. Long Division and Synthetic Division

- Example of Long Division
- Example of Synthetic Division
- When to use one vs the other

E. Solving Inequalities with Sign Charts

- Example of solving inequalities with a sign chart

Chapter 3. Exponential, Logistic, and Logarithmic Functions (11 points)

A. Solving Exponential and Logarithmic Equations
i. Example of Solving an Exponential Equation
ii. Example of Solving a Logarithmic Equation
B. Modeling with Exponential and Logistic Equations (word problems)
i. Exponential Word Problem
ii. Logistic Word Problem
C. Properties of Logs
i. Write out the 3 properties
ii. Example of Expanding
iii. Example of Condensing

Chapter 4. Trigonometric Functions and Graphs (26 points)

A. DMS
i. DMS to Degrees
ii. Degrees to DMS
B. Radians
i. Radians to Degrees
ii. Degrees to Radians
C. Unit Circle
D. Graphs of Trigonometric Functions
i. Graph of Sine
ii. Graph of Cosine
iii. Graph of Tangent
E. Graphs of Reciprocal Trigonometric Functions
i. Graph of Cosecant
ii. Graph of Secant
iii. Graph of Cotangent
F. Graphs of Inverse Trigonometric Functions
i. Graph of Inverse Sine
ii. Graph of Inverse Cosine
iii. Graph of Inverse Tangent
G. Evaluating Trig expressions using Unit Circle
i. $\sin \theta$, $\cos \theta$, and $\tan \theta$ examples (examples must be using negative angles for θ)
ii. $\csc \theta$, $\sec \theta$, and $\cot \theta$ examples (examples must be using radians for θ)
iii. $\sin^{-1} \theta$, $\cos^{-1} \theta$, $\tan^{-1} \theta$ examples (answers must be given in degrees)
H. Sinusoidal Functions (Graph 1 function with each transformation below)
i. Amplitude
ii. Period
iii. Phase Shift
iv. Midline
v. Reflection (over the x axis)

Chapter 5. Analytic Trigonometry (14 points)

A. Identities
i. Reciprocal Identities
ii. Quotient Identities
iii. Pythagorean Identities
iv. Co-Function Identities
v. Even-Odd Identities
vi. Double Angle Identities
vii. Half Angle Identities
viii. Power-Reducing Identities
B. Simplifying Trig Functions
C. Solving Trig Equations
D. Proving Trig Identities
E. Law of Sines
i. One regular example
ii. One example of the ambiguous case
F. Law of Cosines
G. Area of a Triangle
i. SAS Example
ii. SSS Example (Heron's Formula)

Chapter 6. Applications of Trigonometry (18 points)

A. Vectors
i. Component Form
ii. Standard Form (using i and j)
iii. Finding the Magnitude of a Vector
iv. Finding the Direction Angle of a Vector
v. Dot Product
vi. Finding the Angle Between 2 Vectors
B. Parametric Equations
i. Eliminating the Parameter (one trig example and one non-trig example)
ii. Projectile Motion
C. Polar Coordinates
i. Plotting Polar Coordinates
ii. Converting Points from Polar to Rectangular
iii. Converting Points from Rectangular to Polar
iv. Converting Equations from Polar to Rectangular
v. Converting Equations from Rectangular to Polar
D. Graphs and Equations of Polar Graphs
i. Lemniscate
ii. Limacon
iii. Spiral of Archimedes
iv. Rose Curve

Chapter 7: Conics (20 points)

A. Parabola
i. Standard Equations
ii. Example of finding the Vertex
iii. Example of finding the Directrix
iv. Example of finding the focal length and focal width
v. Example of finding which way the parabola opens
B. Ellipse
i. Standard Equations
ii. Example of finding the Center
iii. Example of finding the Vertices
iv. Example of finding the Foci
v. Example of Determining if the Ellipse is Wide or Tall
C. Hyperbola
i. Standard Equations
ii. Example of finding the Center
iii. Example of finding the Vertices
iv. Example of finding the Foci
v. Example of finding the Asymptotes
v. Example of Determining if the Hyperbola opens Left/Right or Up/Down

Chapter 8. Limits, Sequences, and Series (10 points)

A. Limits
i. Finding Limits Graphically
ii. One-Sided Limits
iii. Finding Limits Algebraically
iv. Finding Limits Numerically
B. Sequences
i. Recursive and Explicit Formulas for Arithmetic Sequences
ii. Recursive and Explicit Formulas for Geometric Sequences
C. Series
i. Sigma Notation
ii. Sum of a Finite Series
iii. Sum of an Infinite Series (Converging vs Diverging)