G-E-T High School Curriculum
Align, Explore, Empower
Scope and Sequence
Pre-Calculus

Unit 1 - (Understanding and Analyzing Graphs and Tables)	(About 7 Weeks)

Students will learn properties of functions whether they are displayed through graphs or tables. Features of graph defined, described, created, and used for deductive reasoning. Several dozens of graphical features are examined but fall into a few broad categories; limits, continuity, height, slope, and area. Features include domain, range, x-int, y-int, increasing, decreasing, absolute extrema, relative extrema, 3 types of discontinuity, 5 types of non-differentiability, average rate of change, instantaneous rate of change. These features are all examined without functions and without the use of Calculus.

Standards for Pre-Calculus

CCSS.MATH.CONTENT.HSF.IF.B.6

Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.*

CCSS.MATH.CONTENT.HSF.IF.B.4

For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity*.*

CCSS.MATH.CONTENT.HSF.IF.C.7

Graph functions expressed symbolically and show key features of the graph, by hand in simple cases and using technology for more complicated cases.*

Unit 2 - (Linear functions including absolute value and piecewise)	(About 4 weeks)

In this unit, students will …
Students will graph linear, absolute value, and piecewise functions given different forms, restrictions, and transfermations. Students will be asked to state the graphical features discussed in unit #1 of 3 the functions just given the function itself. Students will be asked to create functions that meet the graphical features from unit # 1. These features will be discussed without a graph and without the use of Calculus. Linear functions also come with very basic word problems. We discuss these graphical features in the context of a real life scenario. We compare how for example the domain of the function and the domain of the function in context arent necessarily the same.

Standards for Pre-Calculus

CCSS.MATH.CONTENT.HSF.IF.A.1

Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If *f* is a function and *x* is an element of its domain, then *f*(*x*) denotes the output of *f* corresponding to the input *x*. The graph of *f* is the graph of the equation *y* = *f*(*x*).

CCSS.MATH.CONTENT.HSF.IF.A.2

Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.

CCSS.MATH.CONTENT.HSF.IF.B.4

For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity*.*

CCSS.MATH.CONTENT.HSF.IF.B.5

Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. *For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.**

CCSS.MATH.CONTENT.HSF.IF.C.7.A

Graph linear and quadratic functions and show intercepts, maxima, and minima.

CCSS.MATH.CONTENT.HSF.IF.C.7.B

Graph square root, cube root, and piecewise-defined functions, including step functions and

absolute value functions.

CCSS.MATH.CONTENT.HSF.BF.A.1

Write a function that describes a relationship between two quantities.

CCSS.MATH.CONTENT.HSF.LE.A.2

Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).

Unit 3 - (Quadratic functions and Projectile Motion)	(About 5 weeks)

Students will graph quadratic functions in 3 different formats. Each format requires a different method. With each format students will state the graphical features discussed in unit # 1. Students will be asked to create functions that meet the graphical features from unit # 1. This is the first time we see a nonlinear function and the first time some calculus is introduced. Quadratic functions model projectile motion. We examine the same features of that motion as we did with a function without context. Roots of a quadratic are the time the ball strikes the ground. Axis of symmetry is the time of the highest point. The y value of the vertex is the max height of the projectile. The slope of the function at any given moment would be the velocity of the ball. Because we now have calculus we can get the velocity of the ball at any instant, and understand what acceleration is. We compare how for example the slope of the function and the velocity of the ball are only the same inside the domain of the ball.

Standards for Pre-Calculus

CCSS.MATH.CONTENT.HSF.IF.A.1

Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If *f* is a function and *x* is an element of its domain, then *f*(*x*) denotes the output of *f* corresponding to the input *x*. The graph of *f* is the graph of the equation *y* = *f*(*x*).

CCSS.MATH.CONTENT.HSF.IF.A.2

Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.

CCSS.MATH.CONTENT.HSF.IF.B.4

For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. *Key features include: intercepts; intervals where the*

function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.*

CCSS.MATH.CONTENT.HSF.IF.B.5

Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. *For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.**

CCSS.MATH.CONTENT.HSF.IF.C.7.A

Graph linear and quadratic functions and show intercepts, maxima, and minima.

CCSS.MATH.CONTENT.HSF.IF.C.8.A

Use the process of factoring and completing the square in a quadratic function to show zeros, extreme values, and symmetry of the graph, and interpret these in terms of a context.

CCSS.MATH.CONTENT.HSF.BF.A.1

Write a function that describes a relationship between two quantities.

Unit 4 - (Polynomial Functions)	About 5 weeks)

Students examine polynomial functions and continue to state the graphical features discussed in unit # 1. Most of the graphical features can be analyzed without calculus. But now that we have such a nice tool we can use it to decide when the graph is increasing/decreasing (whether the slope is positive/negative). End behavior, domain, range, y-int, x-int and many other features are still examined without the use of calculus. Students are asked to create and/or name the specific polynomial that would satisfy the given graphical feature. We use polynomial functions to model rectilinear motion, which is motion in 1 dimension. Now that we have polynomial functions with degree larger than 2 we will see changes in acceleration which correspond to inflection points on the basic graph. Solving polynomial equations and performing operations with polynomials.

Standards for Pre-Calculus

CCSS.MATH.CONTENT.HSA.APR.A.1

Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.

CCSS.MATH.CONTENT.HSF.IF.A.1

Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If *f* is a function and *x* is an element of its domain, then *f*(*x*) denotes the output of *f* corresponding to the

input x. The graph of f is the graph of the equation $y = f(x)$.

CCSS.MATH.CONTENT.HSF.IF.A.2

Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.

CCSS.MATH.CONTENT.HSF.IF.B.4

For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity*.*

CCSS.MATH.CONTENT.HSF.IF.B.5

Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. *For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.**

CCSS.MATH.CONTENT.HSF.IF.C.7.C

Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.

Unit 5 - (Rational Functions)	(About 4 weeks)

Students will examine rational functions and many features on the graph that they haven't seen since unit 1. Holes and Vertical Asymptotes and limits at a point are all topics they haven't seen since unit #1. Students are asked to create or state functional features with very little calculus. The only thing calculus helps us with in this section is getting the slope at a point and deciding what a positive or a negative slope means. In addition to looking at the function itself we also solve rational equations. There is no context work in this section.

Standards for Pre-Calculus

CCSS.MATH.CONTENT.HSF.IF.A.1

Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If f is a function and x is an element of its domain, then $f(x)$ denotes the output of f corresponding to the input x. The graph of f is the graph of the equation $y = f(x)$.

CCSS.MATH.CONTENT.HSF.IF.A.2

Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.

CCSS.MATH.CONTENT.HSF.IF.B.4

For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity*.*

CCSS.MATH.CONTENT.HSF.IF.C.7.D

(+) Graph rational functions, identifying zeros and asymptotes when suitable factorizations are available, and showing end behavior.

Unit 6 - (Trigonometry)	(About 4 Weeks)

Students start with trig functions needed to find missing measures of triangles; right triangle trig, Law or Sine, Law of Cosine. We then transition into unit circle trig. The basic 3 identities, the 3 reciprocal identities, and all 6 inverse identities. We use unit circles to evaluate complex trig expressions. We will use inverse trig to solve equations involving trig. Students will use all identities to prove/verify given properties. Finally we will take a look into the graphical features of trig functions without any use of calculus.

Standards for Pre-Calculus

CCSS.MATH.CONTENT.HSF.IF.A.1

Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If f is a function and x is an element of its domain, then $f(x)$ denotes the output of f corresponding to the input x. The graph of f is the graph of the equation $y = f(x)$.

CCSS.MATH.CONTENT.HSF.IF.A.2

Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.

CCSS.MATH.CONTENT.HSF.TF.A.1

Understand radian measure of an angle as the length of the arc on the unit circle subtended by

the angle.

CCSS.MATH.CONTENT.HSF.TF.A.2

Explain how the unit circle in the coordinate plane enables the extension of trigonometric functions to all real numbers, interpreted as radian measures of angles traversed counterclockwise around the unit circle.

CCSS.MATH.CONTENT.HSF.TF.A.3

(+) Use special triangles to determine geometrically the values of sine, cosine, tangent for π/3, π/4 and π/6, and use the unit circle to express the values of sine, cosine, and tangent for *x*, π + *x*, and 2π - *x* in terms of their values for *x*, where *x* is any real number.

Unit 7 - (Exponents and Radical Functions)	(About 3 weeks)

Students will start with properties of exponents. Properties include fractional exponents, negative exponents, operations with exponents, and exponents identities. Students will solve radical and exponential equations using those properties. Finally we will take a look into the graphical features of radical functions without any use of calculus.

Standards for Pre-Calculus

CCSS.MATH.CONTENT.HSF.IF.A.1

Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If *f* is a function and *x* is an element of its domain, then *f*(*x*) denotes the output of *f* corresponding to the input *x*. The graph of *f* is the graph of the equation *y* = *f*(*x*).

CCSS.MATH.CONTENT.HSF.IF.A.2

Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.

Unit 8- (Log and Exponential Functions)	(About 4 weeks)

Students evaluate log expressions and use properties of log. Students will solve log and exponential equations. Students will use log and exponential functions to model growth and decay. Finally we will take a look into the graphical features of these functions without any use of calculus.

Standards for Pre-Calculus

CCSS.MATH.CONTENT.HSF.IF.A.1

Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If *f* is a function and *x* is an element of its domain, then *f*(*x*) denotes the output of *f* corresponding to the input *x*. The graph of *f* is the graph of the equation *y* = *f*(*x*).

CCSS.MATH.CONTENT.HSF.IF.A.2

Use function notation, evaluate functions for inputs in their domains, and interpret statements that use function notation in terms of a context.

CCSS.MATH.CONTENT.HSF.IF.B.4

For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. *Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity*.*

CCSS.MATH.CONTENT.HSF.IF.B.5

Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. *For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.**

CCSS.MATH.CONTENT.HSF.IF.C.7.E

Graph exponential and logarithmic functions, showing intercepts and end behavior, and trigonometric functions, showing period, midline, and amplitude.

CCSS.MATH.CONTENT.HSF.BF.A.1

Write a function that describes a relationship between two quantities.

CCSS.MATH.CONTENT.HSF.LE.A.1

Distinguish between situations that can be modeled with linear functions and with exponential functions.

CCSS.MATH.CONTENT.HSF.LE.A.2

Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).