The mission of the Chardon Local Schools is high achievement for all students where learning is our most important work.

Course of Study — MATH
Revised November 2021
PRECALCULUS

Course of Study — MATH — *Revised November 2021*
PreCalculus

Strand: Functions

Learning Standard:

- I can **define a function.**

- I can **identify the domain and range of a function,** given a graph. My goal is to work at becoming fluent in the use of interval notation.

- I can **transform functions.** When given a transformed equation I can sketch the graph and describe the change. When given a graph I can write an equation to represent the transformation. I can do these things from both parent functions as well as non-parent functions.

- I can use **function notation**, perform operations with functions and compute function compositions.

- I can solve to **find the inverse of a function**.

- I can **simplify problems involving exponents** (including negative and fractional exponents) and solve equations involving exponents.

- I can **solve triangles using right triangle trig, Law of Sines, and Law of Cosines**.

- I can **write the equation of a line in point-slope form**.

- I **understand radians** and can measure angles in radians & convert

How Taught?
Teaching activities may include, but are not limited to:
- Direct Instruction
- Cooperative Groups
- Stations
- Data Driven Instruction
- Scaffolding

from radians to degrees. ● I can **convert from linear speed to angular speed.** ● I can **factor a binomial**.	
Materials: ● Texas Instrument Graphing Calculator ● Geogebra 3D Calculator ● Chromebook ● Quizlet ● Kahoot ● Quizizz	**How Assessed?** **Assessments may include, but are not limited to:** ● Pre-Assessments (pre-tests, observation, anticipation guide, questioning, diagnostics) ● Formative Assessments (entry/exit slips, group work, reflections, discussions, writer's workshops, homework/classwork, self and peer evaluations, observations, conferences, rubrics) ● Summative Assessments (formal essays, using rubrics; tests/exams, projects, creative assignments, presentations)
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Course of Study — MATH — *Revised November 2021*
PreCalculus

Strand: Area under the Curve

Learning Standard:

- I can graph and write equations of piecewise defined functions.

- I have an intuitive understanding of continuity.

- I can transform a piecewise defined function.

- I can work with piecewise functions as in problems.

- I can use sigma notation to represent and calculate the sum of a sequence.

- I can estimate the area under a curve using left-endpoint rectangles, right-endpoint rectangles, trapezoids, and midpoint rectangles.

- I can shift the area as in problems.

- I can write the area as a function as in problems.

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Course of Study — MATH — *Revised November 2021*
PreCalculus

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PreCalculus

Strand: Exponential and Logarithms

Learning Standard:	How Taught?
● I can **graph functions with horizontal and vertical stretches**. This includes the following... ○ Explore the effect of multiplying the *input* by a number ($f(kx)$) on the graph of $y = f(x)$. ● I can use **exponential functions to solve applications.** This includes the following... a. Find an exponential function of the form $y = k \cdot a^x$ whose graph passes through two given points. b. Use exponential functions to solve real-world problems. ● I can **stretch exponential functions.** This includes the following... a. Understand a vertical stretch of $y = x^2$ is equivalent to a horizontal stretch by a different factor. b. Understand a vertical stretch of $y = km^x$ is equivalent to a horizontal shift. ● I can **work with inverse functions.** This includes the following... a. Review inverse functions by using the concept of undoing the original operations. b. Generate the graph of the inverse by reflecting the original function across the line $y = x$.	**Teaching activities may include, but are not limited to:** ● Direct Instruction ● Cooperative Groups ● Stations ● Data Driven Instruction ● Scaffolding

c. Recall that the inverse is also a function only if its graph passes the vertical line test.
d. Learn that domains and ranges switch when functions are inverses of each other.
e. Use "switch and solve" to find the inverse of rational functions algebraically.

- I can **understand logs as the inverse of exponentials.** This includes the following...
  a. Redevelop the log function by reversing a table for an exponential function.
  b. Practice converting between exponential and log equations.
  c. Formally define the log function.

- I can **graph logarithmic functions** and can stretch/shift this function like other parent graphs.

- I can **work within the law.** This includes the following...
  a. Use a table of common logs from 1 through 10 to generate the three laws of logarithms.
  b. Understand that logs can have many different bases (two commonly used bases are 10 and e).

- I can **solve exponential equations** (and find logs with bases other than 10).

Course of Study — MATH — *Revised November 2021*
PreCalculus

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Strand: Circular Functions

Learning Standard:

- I can find angles and coordinates in the Unit Circle.

- I can evaluate trig expressions on the Unit Circle.

- I can use right triangles/fundamental Pythagorean Identity to find trigonometric ratios.

- I can write equations of Sine & Cosine functions from a graph.

- I can graph sine and cosine functions using the five point method.

- I can simplify complex fractions.

- I can simplify trigonometric expressions and verify trigonometric identities.

- I can model applications with periodic functions.

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Course of Study — MATH — *Revised November 2021*
PreCalculus

Strand: Limits

Learning Standard:

- I can work with direct and inverse variation.

- I can transform rational functions.

- I can simplify algebraic fractions.

- I can graph reciprocal functions ($\frac{1}{f(x)}$).

- I can define and evaluate a limit at a given point from a table, an equation, or a graph.

- I can define and evaluate limits at infinity.

- I can work with limits including one sided limits and limits of piecewise defined functions.

- I can formally define continuity and test a function to determine if it is continuous at a point.

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Course of Study — MATH — *Revised November 2021*
PreCalculus

Strand: Extending Periodic Functions

Learning Standard:

- I can solve trigonometric equations.

- I can evaluate inverse trigonometric functions on their restricted range.

- I can understand the ambiguous case of the law of sines.

- I can graph transformations of trigonometric functions.

- I can model real life situations with periodic functions.

- I can find exact values and solve equations using angle sum/difference formulas.

- I can find exact values and solve equations using double and half angle formulas.

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- Summative Assessments (formal essays, using rubrics; tests/exams, projects, creative assignments, presentations)

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Re-teaching activities may include, but are not limited to:

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Course of Study — MATH — *Revised November 2021*
PreCalculus

Strand: Polynomial Arithmetic and Analysis

Learning Standard:	How Taught?
- I can describe properties of functions including increasing and decreasing intervals, concavity, and even/odd functions. - I can set up word problems in terms of a specific variable. - I can simplify algebraic expressions using substitution. - I can complete the square. - I can divide polynomials. - I can add arithmetic and geometric series. - I can use Pascal's triangle for binomial expansion and binomial probabilities.	**Teaching activities may include, but are not limited to:** - Direct Instruction - Cooperative Groups - Stations - Data Driven Instruction - Scaffolding
Materials: - Texas Instrument Graphing Calculator - Geogebra 3D Calculator - Chromebook - Quizlet - Kahoot - Quizizz	**How Assessed?** **Assessments may include, but are not limited to:** - Pre-Assessments (pre-tests, observation, anticipation guide, questioning, diagnostics) - Formative Assessments (entry/exit slips, group work, reflections, discussions, writer's workshops, homework/classwork, self and peer evaluations, observations, conferences, rubrics)

Course of Study — MATH — *Revised November 2021*
PreCalculus

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Strand: More Limits

Learning Standard:

- I can evaluate limits at infinity based on an understanding of dominant terms.

- I can find limits of rational functions.

- I can understand and work with recursively defined sequences.

- I can define *e* and I can use the number *e* to solve equations or applications.

- I can find the sums for infinite geometric series.

- I can work with the harmonic series and fibonacci series to explore powerful mathematical patterns.

- I can write proofs using mathematical induction.

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Course of Study — MATH — *Revised November 2021*
PreCalculus

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PreCalculus

Strand: Rates of Change

Learning Standard:

- I can calculate slope and interpret average rate of change (AROC) for a variety of situations.

- I can use limits to find the instantaneous rate of change (IROC).

- I can find the equation of secant lines and tangent lines.

- I can sketch velocity and position graphs. This includes understanding and interpreting the relationship between velocity and position graphs.

- I can formally define the derivative of a function and calculate the slope of a function at a point.

- I can express the area under the curve as a function.

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Course of Study — MATH — *Revised November 2021*

PreCalculus

discussions, writer's workshops, homework/classwork, self and peer evaluations, observations, conferences, rubrics)
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Strand: Vectors and Parametric Equations

Course of Study — MATH — *Revised November 2021*
PreCalculus

Learning Standard:	How Taught?
- I can find the magnitude and direction (standard angle) of a vector given component form and vice versa. This includes working with unit vectors. - I can use geometry to perform operations using vectors (vector addition). - I can use vectors to solve common applications to physics and calculus. - I can calculate the dot product and use this concept to find the angle between two vectors. - I can define the motion of an object using parametric equations and use parametric equations to solve application problems. - I can graph parametric equations and eliminate the parameter to write a parametric equation in rectangular form. - I can write the vector equation for a line given two points.	**Teaching activities may include, but are not limited to:** - Direct Instruction - Cooperative Groups - Stations - Data Driven Instruction - Scaffolding
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Course of Study — MATH — *Revised November 2021*
PreCalculus

Strand: Polar Equations and Complex Numbers

Learning Standard:
- I can graph polar coordinates
- I can convert between polar and rectangular coordinates and equations.
- I can graph basic polar curves without calculators.
- I can graph polar curves with a calculator.
- I can classify families of polar curves with key properties.
- I can change a complex number into a polar form.
- I can find products and quotients of complex numbers.
- I can use DeMoivre's Theorem.
- I can find roots of complex numbers

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