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

AP CALCULUS — BC

CHARDON
LOCAL SCHOOLS
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COS — MATH — ***Revised November 2021***

AP Calculus BC

Strand: Limits and Continuity

Learning Standard:	**How Taught?**
CHA 1.1 Introducing Calculus: Can Change Occur at an Instant? **LIM 1.2** Defining Limits and Using Limit Notation **LIM 1.3** Estimating Limit Values from Graphs **LIM 1.4** Estimating Limit Values from Tables **LIM 1.5** Determining Limits Using Algebraic Properties of Limits **LIM 1.6** Determining Limits Using Algebraic Manipulation **LIM 1.7** Selecting Procedures for Determining Limits **LIM 1.8** Determining Limits Using the Squeeze Theorem **LIM 1.9** Connecting Multiple Representations of Limits **LIM 1.10** Exploring Types of Discontinuities **LIM 1.11** Defining Continuity at a Point **LIM 1.12** Confirming Continuity over an Interval **LIM 1.13** Removing Discontinuities **LIM 1.14** Connecting Infinite Limits and Vertical Asymptotes **LIM 1.15** Connecting Limits at Infinity and Horizontal Asymptotes **LIM 1.16** Working with the Intermediate Value Theorem (IVT)	**Teaching activities may include, but are not limited to:** ● Direct Instruction ● Cooperative Groups ● Stations ● Data Driven Instruction ● Scaffolding
Materials: ● Texas Instrument Graphing Calculator ● Chromebook ● AP Classroom	**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)
	How Re-Taught? **Re-teaching activities may include, but are not limited to:** ● breaking down concept into smaller components ● presenting the information again in a different way ● Universal Design for Learning principles offering students opportunities to experience and engage material in new and different way ● practice activities such as computer tutorials, games, hands-on activities ● review sessions

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AP Calculus BC

Strand: Differentiation: Definition and Fundamental Properties

Learning Standard:	**How Taught?**
2.1 Defining Average and Instantaneous Rates of Change at a Point **2.2** Defining the Derivative of a Function and Using Derivative Notation **2.3** Estimating Derivatives of a Function at a Point **2.4** Connecting Differentiability and Continuity: Determining When Derivatives Do and Do Not Exist **2.5** Applying the Power Rule **2.6** Derivative Rules: Constant, Sum, Difference, and Constant Multiple **2.7** Derivatives of cos x, sin x, ex, and ln x **2.8** The Product Rule **2.9** The Quotient Rule **2.10** Finding the Derivatives of Tangent, Cotangent, Secant, and/or Cosecant Functions	**Teaching activities may include, but are not limited to:** ● Direct Instruction ● Cooperative Groups ● Stations ● Data Driven Instruction ● Scaffolding
Materials: ● Texas Instrument Graphing Calculator ● Chromebook	**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)
	How Re-Taught? **Re-teaching activities may include, but are not limited to:** ● breaking down concept into smaller components ● presenting the information again in a different way ● Universal Design for Learning principles offering students opportunities to experience and engage material in new and different way ● practice activities such as computer tutorials, games, hands-on activities ● review sessions

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Strand: Differentiation: Composite, Implicit, and Inverse Functions

Learning Standard:

3.1 The Chain Rule
3.2 Implicit Differentiation
3.3 Differentiating Inverse Functions
3.4 Differentiating Inverse Trigonometric Functions
3.5 Selecting Procedures for Calculating Derivatives
3.6 Calculating Higher-Order Derivatives

How Taught?

Teaching activities may include, but are not limited to:

- Direct Instruction
- Cooperative Groups
- Stations
- Data Driven Instruction
- Scaffolding

Materials:

- Texas Instrument Graphing Calculator
- Chromebook

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)

How Re-Taught?

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

- breaking down concept into smaller components

	• presenting the information again in a different way • Universal Design for Learning principles offering students opportunities to experience and engage material in new and different way • practice activities such as computer tutorials, games, hands-on activities • review sessions

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Strand: Contextual Applications of Differentiation

Learning Standard:

4.1 Interpreting the Meaning of the Derivative in Context
4.2 Straight-Line Motion: Connecting Position, Velocity, and Acceleration
4.3 Rates of Change in Applied Contexts Other Than Motion
4.4 Introduction to Related Rates
4.5 Solving Related Rates Problems
4.6 Approximating Values of a Function Using Local Linearity and Linearization
4.7 Using L'Hospital's Rule for Determining Limits of Indeterminate Forms

How Taught?

Teaching activities may include, but are not limited to:

- Direct Instruction
- Cooperative Groups
- Stations
- Data Driven Instruction
- Scaffolding

Materials:

- Texas Instrument Graphing Calculator
- Chromebook

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)

How Re-Taught?

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

	• breaking down concept into smaller components • presenting the information again in a different way • Universal Design for Learning principles offering students opportunities to experience and engage material in new and different way • practice activities such as computer tutorials, games, hands-on activities • review sessions

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Strand: Analytical Applications of Differentiation

Learning Standard:	**How Taught?**
5.1 Using the Mean Value Theorem **5.2** Extreme Value Theorem, Global Versus Local Extrema, and Critical Points **5.3** Determining Intervals on Which a Function Is Increasing or Decreasing **5.4** Using the First Derivative Test to Determine Relative (Local) Extrema **5.5** Using the Candidates Test to Determine Absolute (Global) Extrema **5.6** Determining Concavity of Functions over Their Domains **5.7** Using the Second Derivative Test to Determine Extrema **5.8** Sketching Graphs of Functions and Their Derivatives **5.9** Connecting a Function, Its First Derivative, and Its Second Derivative **5.10** Introduction to Optimization Problems **5.11** Solving Optimization Problems **5.12** Exploring Behaviors of Implicit Relations	**Teaching activities may include, but are not limited to:** ● Direct Instruction ● Cooperative Groups ● Stations ● Data Driven Instruction ● Scaffolding
Materials: ● Texas Instrument Graphing Calculator ● Chromebook	**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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	How Re-Taught? **Re-teaching activities may include, but are not limited to:** ● breaking down concept into smaller components ● presenting the information again in a different way ● Universal Design for Learning principles offering students opportunities to experience and engage material in new and different way ● practice activities such as computer tutorials, games, hands-on activities ● review sessions

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Strand: Integration and Accumulation of Change

Learning Standard:	**How Taught?**
6.1 Exploring Accumulations of Change **6.2** Approximating Areas with Riemann Sums **6.3** Riemann Sums, Summation Notation, and Definite Integral Notation **6.4** The Fundamental Theorem of Calculus and Accumulation Functions **6.5** Interpreting the Behavior of Accumulation Functions Involving Area **6.6** Applying Properties of Definite Integrals **6.7** The Fundamental Theorem of Calculus and Definite Integrals **6.8** Finding Antiderivatives and Indefinite Integrals: Basic Rules and Notation **6.9** Integrating Using Substitution **6.10** Integrating Functions Using Long Division and Completing the Square **6.11** Integrating Using Integration by Parts **6.12** Using Linear Partial Fractions bc only **6.13** Evaluating Improper Integrals bc only **6.14** Selecting Techniques for Antidifferentiation	**Teaching activities may include, but are not limited to:** ● Direct Instruction ● Cooperative Groups ● Stations ● Data Driven Instruction ● Scaffolding
Materials: ● Texas Instrument Graphing Calculator ● Chromebook	**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)
	How Re-Taught? **Re-teaching activities may include, but are not limited to:** ● breaking down concept into smaller components ● presenting the information again in a different way ● Universal Design for Learning principles offering students opportunities to experience and engage material in new and different way ● practice activities such as computer tutorials, games, hands-on activities ● review sessions

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Strand: Differential Equations

Learning Standard:	**How Taught?**
7.1 Modeling Situations with Differential Equations **7.2** Verifying Solutions for Differential Equations **7.3** Sketching Slope Fields **7.4** Reasoning Using Slope Fields **7.5** Approximating Solutions Using Euler's Method bc only **7.6** Finding General Solutions Using Separation of Variables **7.7** Finding Particular Solutions Using Initial Conditions and Separation of Variables **7.8** Exponential Models with Differential Equations **7.9** Logistic Models with Differential Equations	**Teaching activities may include, but are not limited to:** ● Direct Instruction ● Cooperative Groups ● Stations ● Data Driven Instruction ● Scaffolding
Materials: ● Texas Instrument Graphing Calculator ● Chromebook	**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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	How Re-Taught? **Re-teaching activities may include, but are not limited to:** ● breaking down concept into smaller components ● presenting the information again in a different way ● Universal Design for Learning principles offering students opportunities to experience and engage material in new and different way ● practice activities such as computer tutorials, games, hands-on activities ● review sessions

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Strand: Applications of Integration

Learning Standard:	**How Taught?**
8.1 Finding the Average Value of a Function on an Interval **8.2** Connecting Position, Velocity, and Acceleration of Functions Using Integrals **8.3** Using Accumulation Functions and Definite Integrals in Applied Contexts **8.4** Finding the Area Between Curves Expressed as Functions of x **8.5** Finding the Area Between Curves Expressed as Functions of y **8.6** Finding the Area Between Curves That Intersect at More Than Two Points **8.7** Volumes with Cross Sections: Squares and Rectangles **8.8** Volumes with Cross Sections: Triangles and Semicircles **8.9** Volume with Disc Method: Revolving Around the x- or y-Axis **8.10** Volume with Disc Method: Revolving Around Other Axes **8.11** Volume with Washer Method: Revolving Around the x- or y-Axis **8.12** Volume with Washer Method: Revolving Around Other Axes **8.13** The Arc Length of a Smooth, Planar Curve and Distance Traveled	**Teaching activities may include, but are not limited to:** ● Direct Instruction ● Cooperative Groups ● Stations ● Data Driven Instruction ● Scaffolding
Materials: ● Texas Instrument Graphing Calculator ● Chromebook	**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)
	How Re-Taught? **Re-teaching activities may include, but are not limited to:** ● breaking down concept into smaller components ● presenting the information again in a different way ● Universal Design for Learning principles offering students opportunities to experience and engage material in new and different way ● practice activities such as computer tutorials, games, hands-on activities ● review sessions

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Strand: Parametric Equations, Polar Coordinates, and Vector-Valued Functions

Learning Standard:

9.1 Defining and Differentiating Parametric Equations

9.2 Second Derivatives of Parametric Equations

9.3 Finding Arc Lengths of Curves Given by Parametric Equations

9.4 Defining and Differentiating Vector Valued Functions

9.5 Integrating Vector-Valued Functions

9.6 Solving Motion Problems Using Parametric and Vector-Valued Functions

9.7 Defining Polar Coordinates and Differentiating in Polar Form

9.8 Find the Area of a Polar Region or the Area Bounded by a Single Polar Curve

9.9 Finding the Area of the Region Bounded by Two Polar Curve

How Taught?

Teaching activities may include, but are not limited to:

- Direct Instruction
- Cooperative Groups
- Stations
- Data Driven Instruction
- Scaffolding

Materials:

- Texas Instrument Graphing Calculator
- Chromebook

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)

How Re-Taught?

	Re-teaching activities may include, but are not limited to: ● breaking down concept into smaller components ● presenting the information again in a different way ● Universal Design for Learning principles offering students opportunities to experience and engage material in new and different way ● practice activities such as computer tutorials, games, hands-on activities ● review sessions

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Strand: Infinite Sequences and Series

Learning Standard:	**How Taught?**
10.1 Defining Convergent and Divergent Infinite Series **10.2** Working with Geometric Series **10.3** The nth Term Test for Divergence **10.4** Integral Test for Convergence **10.5** Harmonic Series and p-Series **10.6** Comparison Tests for Convergence **10.7** Alternating Series Test for Convergence **10.8** Ratio Test for Convergence **10.9** Determining Absolute or Conditional Convergence **10.10** Alternating Series Error Bound **10.11** Finding Taylor Polynomial Approximations of Functions **10.12** Lagrange Error Bound **10.13** Radius and Interval of Convergence of Power Series **10.14** Finding Taylor or Maclaurin Series for a Function **10.15** Representing Functions as Power Series	**Teaching activities may include, but are not limited to:** ● Direct Instruction ● Cooperative Groups ● Stations ● Data Driven Instruction ● Scaffolding
Materials: ● Texas Instrument Graphing Calculator ● Chromebook	**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)
	How Re-Taught? **Re-teaching activities may include, but are not limited to:** ● breaking down concept into smaller components ● presenting the information again in a different way ● Universal Design for Learning principles offering students opportunities to experience and engage material in new and different way ● practice activities such as computer tutorials, games, hands-on activities ● review sessions