Rewritten: August, 2020

Calculus SYLLABUS - 2020-2021 Academic School Year

1st Marking Period

Test (Ch. P, Review Packet)

- P1-P2 - Graphs and Models
- P3 - Functions and Their Graphs
- P4 & P5 - Inverse, Exponential, and Logarithmic Functions
- Review – Trigonometry, Trig Functions, and their Inverses

Test (Ch. 1)

- 1.1 - A Preview of Calculus
- 1.2 - Finding Limits Graphically and Numerically
- 1.3 - Evaluating Limits Analytically
- 1.4 - Continuity and One-Sided Limits
- 1.5 - Infinite Limits
- 1.6 - Limits at Infinity
- 1.2, 1.3 - Precise Definition of Limits (time permitting)

Test (Ch. 2.1 - 2.2)

- 2.1 - The Derivative and the Tangent Line Problem
- 2.2 - Basic Rules of Differentiation and Rates of Change

2nd Marking Period

Test (Ch. 2.3-2.4)

- 2.3 - The Product and Quotient Rules and Higher Order Derivatives
- 2.4 - The Chain Rule

Test (Ch. 2.5-2.6)

- 2.5 - Implicit Differentiation
- 2.6 - Derivatives of Inverse Functions

Test (Ch. 2.7-2.8)

- 2.7 - Related Rates
- 2.8 - Newton's Method (if time permits)

Midterm (Ch. P, Ch. 1. Ch. 2)

3rd Marking Period

Test (3.1, 3.3, 3.4 and 3.5)

- 3.1-Extrema on an Interval
- 3.3-Increasing and Decreasing Functions and First Derivative Test
- 3.4-Concavity and Second Derivative Test
- 3.5-A Summary of Curve Sketching-Graphing Functions

Test (3.2 and 3.6)

- 3.2-Rolle's Theorem and Mean Value Theorem
- 3.6-Optimization Problems

Test (3.2 and 7.7)

- 3.7- Linear Approximation and Differentials
- 7.7-Indeterminate Forms and $L'Hôpital's$ Rule

4th Marking Period

Test (4.1-4.3)

- 4.1-Antiderivatives
- 4.2-Area-Approximting areas under the Curve
- 4.3 Riemann Sums and Definite Integrals

Test (4.4 and 4.6)

- 4.4-Fundamental Theorem of Calculus
  *Include Mean Value Theorem for Integrals and Average Value of a Function
- 4.6-Integration by Substitution

Test (4.7 and 6.1)

- 4.7-The Natural Logarithm of Functions: Integration
- 6.1- Area of Region Between Two Curves

Cumulative Final Exam (Ch. P – 4, 6.1)

Course Expectations and Skills

- Students are required to have proficiency in all prerequisite topics for Calculus. Those who do not demonstrate proficiency will be required to seek additional help after school to close their achievement gap in order to be successful in this course.
- Students are required to take notes and maintain those notes in a neat and organized notebook.
- Students are to bring their Chrome Book charged and ready to use for the lesson.
- Students are encouraged to have a graphing calculator.
- Students are required to participate in both small and large group discussions and activities, as directed

Resources

Text Book: Calculus for AP 2nd Edition, Ron Larson and Paul Battaglia
Additional Resources:

- https://sso.cengage.com/cb/
- WebAssign
- CalcChat.com
- CalcView.com
- Desmos and Desmos Teacher Activities

Assessment Information

Department of Mathematics – Calculus (2020-2021)

Marking Period 1	**Marking Period 2**	**Marking Period 3**	**Marking Period 4**
Major (MAJ): Summative 60%	Major (MAJ): Summative 50%	Major (MAJ): Summative 60%	Major (MAJ): Summative 50%
	Midterm (BMK): 20%		Final (EOC): 20%
Minor (MIN): Formative 30%	Minor (MIN): Formative 20%	Minor (MIN): Formative 30%	Minor (MIN): Formative 20%
Class Participation (CP): 5%	Class Participation (CP): 5%	Class Participation (CP): 5%	Class Participation (CP): 5%
Homework (HW): 5%	Homework (HW): 5%	Homework (HW): 5%	Homework (HW): 5%

Revised

Black Horse Pike Regional School District Curriculum Template

ENGAGING STUDENTS ■ FOSTERING ACHIEVEMENT ■ CULTIVATING 21ST CENTURY GLOBAL SKILLS

Course Name: Calculus

Course Number: 034100

UNIT P

PART I: UNIT RATIONALE

WHY ARE STUDENTS LEARNING THIS CONTENT AND THESE SKILLS?

Course/Unit Title: Calculus **Grade Level(s):** 12	**Unit Summary**: All of the skills and concepts in this chapter are prerequisite for a successful experience in Calculus 1. You can assign this as summer work but should certainly touch upon the topics for at least a week or two before jumping into the Limits Unit as these topics are essential to any good Calculus student's understanding of the subject of Calculus. (Ch. P.1, P.2, P.3, P.4, P.5)
Essential Question(s): • How do you identify intercepts and points of intersection, and test for symmetry? • How do you find the slope of a line and use the slope to write an equation of the line? • How do you determine the domain and range of a function, and classify functions? • How do you find the inverse of a function? • How are the functions $f(x) = e^x$ and $g(x) = \ln x$ related, and what properties can you use to simplify exponential and logarithmic expressions?	**Enduring Understanding(s):** Students will be able to: • Test a graph for symmetry with respect to an axis and the origin. • Find the points of intersection of two graphs. • Fit a mathematical model to a real-life data set. • Find the slope of a line passing through two points. • Write the equation of a line with a given point and slope • Interpret slope as a ratio or as a rate in a real-life application. • Sketch the graph of a linear equation in slope-intercept form. • Write equations of lines that are parallel or perpendicular to a given line. • Find the domain and range of a function. • Identify different types of transformations of functions. • Classify functions and recognize combinations of functions. • Verify that one function is the inverse function of another function. • Determine whether a function has an inverse function. • Develop properties of the six inverse trigonometric functions. • Develop and use properties of exponential functions. • Understand the definition of the number e. • Understand the definition of the natural logarithm function and develop and use properties of the natural logarithm function.

PART II: INSTRUCTIONAL STRATEGIES AND RESOURCES

DESCRIBE THE LEARNING TARGETS.

Application of Mathematical Practices for Calculus

Learning Target

MPAC 1 – Implementing Mathematical Processes

The properties of logarithms are extremely important when you study concepts such as integration by partial fraction decomposition (Calc 2) and the logistic equation ("flatten the curve" terminology from the coronavirus pandemic came from the logistic equation that models the dissipation of a virus on a population quarantined). Be sure the students become familiar with the basic properties and how to implement them.

MPAC 2 – Connecting Representations

The expression $\frac{f(x+\Delta x)-f(x)}{\Delta x}$ is called the *difference quotient* and has very special significance in Calculus as it is used in the formulation of the derivative.
Polynomial functions of the form $f(x) = x^n$ are sometimes referred to as *power functions*.

MPAC 3 – Justification

When using the formula for slope, note that

$$\frac{y_2 - y_1}{x_2 - x_1} = \frac{-(y_1 - y_2)}{-(x_1 - x_2)} = \frac{y_1 - y_2}{x_1 - x_2}$$

So it doesn't matter in which order you subtract as long as you are consistent and both "subtracted coordinates" come from the same point.
When testing whether a function is one-to-one, producing examples and counterexamples can be helpful when investigating whether a statement is true or false.
Note that when studying exponential functions $f(x) = a^x$, the base of $a = 1$ is excluded because it yields the function $f(x) = 1^x = 1$. This is a constant function, not an exponential function.

MPAC 4 – Communication and Notation

In mathematics, the phrase "if and only if" is a way of stating two implications in one statement. For example, the statement "Two distinct nonvertical lines are parallel if and only if their slopes are equal" can be written as the following two implications:

1. If two distinct nonvertical lines are parallel, then their slopes are equal.
2. If two distinct nonvertical lines have the same slopes, then they are parallel.

Inter-Disciplinary Connections:

There are a great amount of word problems in each section in such fields as business, sports, physics, data mining, engineering, biology, etc.

Students will engage with the following text:

Textbook:

Calculus for AP 2nd Edition: Larson and Battaglia

Online Resources incorporated throughout the year, included but not limited to:

- LarsonCalculusforAP.com; videos explaining concepts, proofs, view three-dimensional graphs
- WebAssign
- CalcChat – website provides free solutions to all odd number problems in each section and review exercises; also students can chat with a tutor during hours posted on the site.
- CalcView – video solutions of selected problems.
- Desmos – online graphing calculator tool

Calculator:

TI - 84

The Following 21st Century Skills and the 8 mathematical practices are embedded throughout the course and are evident in daily lessons, assignments, activities, assessments and projects:

21st Century skills:

- Critical thinking
- Creativity
- Collaboration
- Communication
- Information literacy
- Technology literacy
- Media literacy
- Flexibility
- Leadership
- Initiative
- Productivity
- Social Skills

Mathematical Practices:

- Make sense of problems and persevere in solving
- them
- Reason abstractly and quantitatively
- Construct viable arguments and critique the
- reasoning of others
- Model with mathematics
- Use appropriate tools strategically
- Attend to precision
- Look for and make use of structure
- Look for and express regularity in repeated
- reasoning

Students will write:

Writing and Open-Ended Problems
Error analysis problems and written description on how to fix them.
***** All "Exploring Concepts" highlighted questions at the conclusion of each section's HW problems.
*' All review, concept, and test problems at the conclusion of each chapter.

PART III: TRANSFER OF KNOWLEDGE AND SKILLS

DESCRIBE THE LEARNING EXPERIENCE.

How will students uncover content and build skills.

Section P.1: Graphs and Models	
Focus and Motivate Starting Options (Lesson Warm Up)	Suggestions include but not limited to Have students work with the difference quotient on opening problems to refresh. Refer to Lesson Motivator in textbook
Teaching Objectives	• Sketch the graph of an equation. • Find the intercepts of a graph. • Test a graph for symmetry with respect to an axis and the origin. • Find the points of intersection of two graphs. • Fit a mathematical model to a real-life data set.
Checking for Understanding	Suggestions include but not limited to: Exit Tickets (teacher made supplement) Inquiry Formative Assessment Lesson Closer in textbook
Practice and Apply Assigning Homework	Section P.1 p. 10-13 #2-26 even, 27-37 odd, 57, 59, 64

Section P.2: Linear Models and Rates of Change	
Focus and Motivate Starting Options (Lesson Warm Up)	Suggestions include but not limited to: Algebraic justification of the order of coordinates used in the linear slope formula Also refer to Lesson Motivator in textbook

Teaching Objectives	• Find the slope of a line passing through two points. • Write the equation of a line with a given point and slope. • Interpret slope as a ratio or as a rate in real-life applications. • Sketch the graph of a linear equation in slope-intercept form. • Write equations of lines that are parallel or perpendicular to a given line.
Checking for Understanding	Suggestions include but not limited to: Exit Tickets (teacher made supplement) Inquiry Formative Assessment Lesson Closer in textbook
Practice and Apply Assigning Homework	Section P.2 p. 20-22 #2-62 odd, 65, 67, 73,

Section P.3: Functions and their Graphs	
Focus and Motivate Starting Options (Lesson Warm Up)	Suggestions include but not limited to: Algebra review, pages A34 Also refer to Lesson Motivator in textbook
Teaching Objectives	• Use function notation to represent and evaluate a function. • Find the domain and range of a function. • Sketch the graph of a function. • Identify different types of transformations of functions. • Classify functions and recognize combinations of functions.
Checking for Understanding	Suggestions include but not limited to: Exit Tickets (teacher made supplement) Inquiry Formative Assessment Lesson Closer in textbook
Practice and Apply Assigning Homework	Section P.3 p. 31-34, #2-34 odd, 47-52 all, 55, 57, 59, 62, 65, 73-76 all, 81, 83, 84

Section P.4: Inverse Functions	
Focus and Motivate Starting Options (Lesson Warm Up)	Suggestions include but not limited to: Complete the exploration on P. 35 “Finding inverse functions”. Also refer to Lesson Motivator in textbook
Teaching Objectives	• Verify that one function is the inverse of another function. • Determine whether a function has an inverse. • Develop properties of the six inverse trigonometric functions.
Checking for Understanding	Suggestions include but not limited to: Exit Tickets (teacher made supplement) Inquiry Formative Assessment Lesson Closer in textbook
Practice and Apply Assigning Homework	Section P.4 p. 42-45, #1-12 all, 14, 15, 18, 19, 22, 23, 25, 28, 30, 31-45 odd, 48, 67, 71, 73, 75, 78, 79, 81, 83, 86,

Section P.5: Exponential And Logarithmic Functions	
Focus and Motivate Starting Options (Lesson Warm Up)	Suggestions include but not limited to: Recall the rules of exponentials. Also refer to Lesson Motivator in textbook
Teaching Objectives	• Develop and use properties of exponential functions. • Understand the definition of the number e. • Understand the definition of the natural logarithm function, and develop and use properties of the natural logarithmic function.
Checking for Understanding	Suggestions include but not limited to: Exit Tickets (teacher made supplement) Inquiry Formative Assessment Lesson Closer in textbook
Practice and Apply Assigning Homework	Section P.5 p. 51-53 # 2-32 even, 39, 40, 51, 57, 60, 69, 71, 86-102 even, 103, 119, 120

PART IV: EVIDENCE OF LEARNING

IDENTIFY THE METHODS BY WHICH STUDENTS WILL DEMONSTRATE THEIR UNDERSTANDING OF CONTENT AND THEIR ABILITY TO APPLY SKILLS. IDENTIFY BLOOM'S LEVELS.

Formative Assessments:

The effectiveness of the instructional program will be base on teacher observations, students doing quality of work together, questioning strategies, self and peer assessment, student record-keeping, quizzes, performance tasks, diagnostic tests, and homework.

Accommodations/Modifications:

As per individual student's IEP or 504 plans.

Summative Assessments:

Section test, Benchmark test (including midterm), end of course test.

Accommodations/Modifications:

As per individual student's IEP or 504 plans.

Performance Assessments:

The following assessments require students to utilize various strand of mathematics:

- Projects
- Homework
- Classwork

Accommodations/Modifications:

As per individual student's IEP or 504 plans.

Revised

Black Horse Pike Regional School District Curriculum Template

ENGAGING STUDENTS ■ FOSTERING ACHIEVEMENT ■ CULTIVATING 21ST CENTURY GLOBAL SKILLS

Course Name: Calculus

Course Number: 034100

UNIT 1

PART I: UNIT RATIONALE

WHY ARE STUDENTS LEARNING THIS CONTENT AND THESE SKILLS?

Course/Unit Title: Calculus **Grade Level(s):** **12**	**Unit Summary**: Students will begin to learn about limits, the most important aspect of the Calculus course. They will begin to understand the basic operations and algebraic rules of limits, discover the algebra of limits and their properties, and dive into what it means for a function to be continuous. (Ch. 1.1, 1.2, 1.3, 1.4, 1.5, 1.6)
Essential Question(s): • What is Calculus? • What is a limit and how can you determine the limit of a function as x approaches c? • What algebraic techniques can you use to evaluate a limit? • What is continuity and how does it apply to the Intermediate Value Theorem? • What is an infinite limit? • What is a limit at infinity?	**Enduring Understanding(s):** Students will be able to: • Understand what Calculus is and how it compares to Pre-calculus. • Understand that the tangent line problem is basic to Calculus. • Understand that the area problem is also basic to Calculus. • Estimate a limit using a numerical or graphical approach. • Learn different ways that a limit can fail to exist. • Study and use a formal definition of a limit. • Evaluate a limit using properties of limits. • Develop and use a strategy for finding limits. • Evaluate a limit using the dividing out technique. • Evaluate a limit using the rationalizing technique. • Evaluate a limit using the Squeeze Theorem. • Determine continuity at a point and continuity on an open interval. • Determine one-sided limits and continuity on a closed interval. • Use properties of continuity. • Understand and use the Intermediate Value Theorem. • Determine infinite limits from the left and from the right. • Find and sketch the vertical asymptotes of the graph of a function. • Determine (finite) limits at infinity. • Determine the horizontal asymptotes, if any, of the graph of a function. • Determine infinite limits at infinity.

PART II: INSTRUCTIONAL STRATEGIES AND RESOURCES

DESCRIBE THE LEARNING TARGETS.

Application of Mathematical Practices for Calculus

Learning Target

MPAC 1 – Implementing Mathematical Processes:
Students quickly notice that finding limits graphically or numerically give accurate answers but solving them algebraically gives proof that the exact value is correct. They become adept in the techniques of factoring, rationalizing the numerator or denominator, or using the Squeeze (Sandwich) Theorem.

MPAC 2 – Connecting Representations:
There exist a plethora of examples on homework,in class, and online where solving limit problems can be achieved quickly by using a specific approach. In the case of limits, we are talking about the graphical, numerical, and the analytic.

MPAC 3 – Justification:
Students are introduced to a myriad of new types of functions in this chapter for the analysis of limits. These functions are "step" or piecewise defined functions, including the Greatest Integer Function and the Sign (or "Signum") Function, and using limit definitions and properties, will have to reason limits involving these functions.

MPAC 4 – Communicating and Notation
In some featured real-world applications, students should be able to convey in words the limit notation of their solution and what their solution means in the context of the problem. Also, Understanding the notation of limits is the cornerstone of the course, as the definitions of derivatives and integrals are all given in the language of limits.

Inter-Disciplinary Connections:

There are a great amount of word problems in each section in such fields as business, sports, physics, data mining, engineering, biology, etc.

As an example, an exercise asks students to determine the oxygen level in a pond where organic waste is dumped and oxidizes**.** The student must determine the levels after 1, 2 and 10 weeks, and the level as t $t \to \infty$ **.**

Students will engage with the following text:

Textbook:

Calculus for AP 2nd Edition: Larson and Battaglia

Online Resources incorporated throughout the year, included but not limited to:

- LarsonCalculusforAP.com; videos explaining concepts, proofs, view three-dimensional graphs
- WebAssign
- CalcChat – website provides free solutions to all odd number problems in each section and review exercises; also students can chat with a tutor during hours posted on the site.
- CalcView – video solutions of selected problems.
- Desmos – online graphing calculator tool

Calculator:

TI - 84

The following 21st Century Skills and the 8 mathematical practices are embedded throughout the course and are evident in daily lessons, assignments, activities, assessments, and projects.

21'st Century Skills:	**Mathematical Practices:**
- Critical Thinking - Creativity - Collaboration - Communication - Information Literacy - Technological Literacy - Media Literacy - Flexibility - Leadership - Initiative - Productivity - Social Skills	- Make sense of problems and persevere in solving them. - Reason abstractly and quantitatively - Construct viable arguments and critique the reasoning of others. - Model with Mathematics - Use appropriate tools strategically - Attend to precision - Look for and make use of structure - Look for and express regularity in repeated reasoning.

Students will write:

Writing and Open-Ended Problems:

- Write a brief description of the graphical meaning of the notation $\lim_{x \to 8} f(x) = 25$.
- Describe three types of behavior associated with the nonexistence of a limit. Illustrate each type with a graph of a function.

- If the functions f and g are continuous for all real x, is $f + g$ always continuous for all real x? Is f/g always continuous for all real x? If either is not continuous, provide the example for justification.
- Describe the difference between a removable and a nonremovable discontinuity.
- Discuss the continuity of the function $f(x) = x[\![x]\!]$.
- In your own words, describe the meaning of an infinite limit. Is ∞ a real number?
- Does the graph of every rational function have a vertical asymptote?
- In your own words, describe what is meant by the statements: (a) $\lim_{x\to\infty} f(x) = 4$ and (b) $\lim_{x\to-\infty} f(x) = 2$

PART III: TRANSFER OF KNOWLEDGE AND SKILLS

DESCRIBE THE LEARNING EXPERIENCE.

How will students uncover content and build skills.

Section 1.1: A Preview of Calculus	
Focus and Motivate Starting Options (Lesson Warm Up)	Suggestions include but not limited to Find slope between two points and the equation of a line connecting them Refer to Lesson Motivator in textbook
Teaching Objectives	• Understand what Calculus is and how it compares to precalculus. • Understand that the tangent line problem is basic to Calculus • Understand that area problem is also basic to Calculus
Checking for Understanding	Suggestions include but not limited to: Exit Tickets (teacher made supplement) Inquiry Formative Assessment Lesson Closer in textbook
Practice and Apply Assigning Homework	Section 1.1 p.63-64 # 5-14, 17, 18

Section 1.2 – Finding Limits Graphically and Numerically	
Focus and Motivate Starting Options (Lesson Warm Up)	Suggestions include but not limited to: Create a list of numbers that get closer and closer to a number without reaching it. Also refer to Lesson Motivator in textbook
Teaching Objectives	• Estimate a limit using a numerical or graphical approach. • Learn different ways that a limit can fail to exist. • Study and use a formal definition of limits.
Checking for Understanding	Suggestions include but not limited to: Exit Tickets (teacher made supplement) Inquiry Formative Assessment Lesson Closer in textbook
Practice and Apply Assigning Homework	Section 1.2 p. 72-75 #1-6 all, 8-16 even, 17-25 odd, 26, 28, 31, 39, 42, 55, 57, 61, 62, 69, 70

Section 1.3: Evaluating Limits Analytically	
Focus and Motivate Starting Options (Lesson Warm Up)	Suggestions include but not limited to: Have students calculate the limit of a polynomial $f(x)$ numerically around $x = 0$ and compare to $f(0)$. Also refer to Lesson Motivator in textbook
Teaching Objectives	• Evaluate a limit using properties of limits. • Develop and use a strategy for finding limits. • Evaluate a limit using the dividing out technique. • Evaluate a limit using the rationalization technique. • Evaluate a limit using the Squeeze (Sandwich) Theorem.
Checking for Understanding	Suggestions include but not limited to: Exit Tickets (teacher made supplement) Inquiry Formative Assessment Lesson Closer in textbook
Practice and Apply Assigning Homework	Section 1.3 P. 84-86 # 1-46 (any), 53-68 (any), 73, 76, 77, 79, 82, 97-100 (any), 101, 102,

Section 1.4: Continuity and One-Sided Limits	
Focus and Motivate Starting Options (Lesson Warm Up)	Suggestions include but not limited to: Exploration on pg. 87. Also refer to Lesson Motivator in textbook
Teaching Objectives	• Determine continuity at a point and continuity on an open interval. • Determine one-sided limits and continuity on a closed interval. • Use properties of continuity. • Understand and use the Intermediate Value Theorem.
Checking for Understanding	Suggestions include but not limited to: Exit Tickets (teacher made supplement) Inquiry Formative Assessment Lesson Closer in textbook
Practice and Apply Assigning Homework	Section 1.4 p. 96-99 # 1-15 all, 17, 18, 19, 21, 23, 25, 30, 32, 34, 35, 39-53 odd, 63- 66 all, 69, 71, 89, 91, 93, 97, 117,

Section 1.5: Infinite Limits	
Focus and Motivate Starting Options (Lesson Warm Up)	Suggestions include but not limited to: Small Socratic Seminar about the nature of infinity Also refer to Lesson Motivator in textbook
Teaching Objectives	• Determine infinite limits from the left and right. • Find and sketch the vertical asymptotes of the graph of a function.
Checking for Understanding	Suggestions include but not limited to: Exit Tickets (teacher made supplement) Inquiry Formative Assessment Lesson Closer in textbook
Practice and Apply Assigning Homework	Section 1.5 p. 105-107 # 1,3, 5-8 all, 10, 11, 13, 15, 16, 18, 21, 22, 24, 25, 28, 31, 40-48 even, 49-61 odd, 67-68, 70

Section 1.6: Limits at Infinity	
Focus and Motivate Starting Options (Lesson Warm Up)	Suggestions include but not limited to: Review methods of discovering end behavior for polynomials and rational function from precalculus Also refer to Lesson Motivator in textbook
Teaching Objectives	• Determine (finite) limits at infinity. • Determine the horizontal asymptotes, if any, of the graph of a function. • Determine infinite limits at infinity.
Checking for Understanding	Suggestions include but not limited to: Exit Tickets (teacher made supplement) Inquiry Formative Assessment Lesson Closer in textbook
Practice and Apply Assigning Homework	Section 1.6 p. 115-117, # 8-16 even, 19, 22, 24, 26, 27, 28, 31, 37, 39, 40, 41, 47, 56

PART IV: EVIDENCE OF LEARNING

IDENTIFY THE METHODS BY WHICH STUDENTS WILL DEMONSTRATE THEIR UNDERSTANDING OF CONTENT AND THEIR ABILITY TO APPLY SKILLS. IDENTIFY BLOOM'S LEVELS.

Formative Assessments:

The effectiveness of the instructional program will be based upon teacher observations, students doing quality of work together, questioning strategies, self and peer assessment, student record-keeping, quizzes, performance tasks, diagnostic tests, and homework.

Accommodations/Modifications:

As per individual student's IEP or 504 plan.

Summative Assessments:

Section Tests, Midterm & final assessments

Accommodations/Modifications:

As per individual student's IEP or 504 plan.

Performance Assessments:

Projects (optional), Homework, Classwork

Accommodations/Modifications:

As per individual student's IEP or 504 plan.

Black Horse Pike Regional School District Curriculum Template

ENGAGING STUDENTS ■ FOSTERING ACHIEVEMENT ■ CULTIVATING 21ST CENTURY GLOBAL SKILLS

Course Name: Calculus

Course Number: 034100

UNIT 2

PART I: UNIT RATIONALE

WHY ARE STUDENTS LEARNING THIS CONTENT AND THESE SKILLS?

Course/Unit Title: Calculus **Grade Level(s):** **12**	**Unit Summary**: In Chapter 2, students will really get into the heart of calculus. Derivatives are a major concern of the course, so you will spend a significant amount of time on this unit. As you progress through the chapter, you will want to spend some time on the relationship between position, velocity, and acceleration, as well as related rates. This will most likely be the first time students will be asked to think deeply on a conceptual level, so they may struggle at first. To implement many of the methods introduced in the chapter, students will be required to use some calculus at first, then they will complete the methods using mostly algebra. (Ch. 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8 (optional))
Essential Question(s): • What is a derivative and what is its relationship to continuity? • How do you find the derivatives of basic algebraic functions, trigonometric functions, and exponential functions? • How do you find the derivatives of functions involving products and quotients? • How do you find the derivatives of composite functions, natural logarithmic functions, and exponential functions with bases other than e? • How do you find the derivative of implicitly defined functions?	**Enduring Understanding(s):** Students will be able to: • Find the slope of the tangent line to a curve at a point. • Use the limit definition to find the derivative of a function. • Understand the relationship between differentiability and continuity. • Find the derivative of a function using a table or a graph. • Find the derivative of a function using the Constant Rule. • Find the derivative of a function using the Power Rule. • Find the derivative of a function using the Constant Multiple Rule. • Find the derivative of a function using the Sum and Difference Rules. • Find the derivative of the sine and cosine functions. • Find the derivative of exponential functions. • Use derivatives to find rates of change. • Find the derivative of a function using the Product Rule. • Find the derivative of a function using the Quotient Rule. • Find the derivative of any trigonometric functions. • Find a higher-order derivative of a function. • Find the derivative of a composite function using the Chain Rule. • Find the derivative of a function using the General Power Rule. • Simplify the derivative of a function using algebra. • Find the derivative of a transcendental function using the Chain Rule. • Find the derivative of a function involving the natural logarithm function. • Define and differentiate exponential functions that have bases other than e.

• How do you find the derivatives of inverse functions, including inverse trigonometric functions? • What is a related rate and how do you find it? • (optional) How can you use derivatives to approximate the zero of a function?	• Distinguish between functions written in implicit form and explicit form. • Use implicit differentiation to find the derivative of a function. • Find derivatives of functions using logarithmic differentiation. • Find the derivative of an inverse function. • Differentiate an inverse trigonometric function. • Find a related rate. • Use related rates to solve real-life applications. • (optional) Approximate a zero of a function using Newton's Method.

PART II: INSTRUCTIONAL STRATEGIES AND RESOURCES

DESCRIBE THE LEARNING TARGETS.

Application of Mathematical Practices for Calculus

Learning Target

MPAC 1 – Implementing Mathematical Processes

When using the definition to find a derivative of a function, the key is to rewrite the difference quotient so that Δx is no longer a factor of the denominator. Students should be able to rewrite rational expressions as a sum of terms. As an example, if $f(x) = \frac{3x^2-x+1}{x}$ can be rewritten as $f(x) = 3x - 1 + \frac{1}{x}$ and thus use the power rule as opposed to the quotient rule, which wouldn't have been introduced by then. When using the Product rule, if should be when both factors of a product contain a variable and the Constant Multiple rule when one factor is constant. When confronted with composite functions, if you are taking the derivative, you may be able to expand and use previous rules instead of the chain rule on the original function. Students should be made aware that there is benefit to applying logarithmic properties before differentiation, as this may simplify the work. Logarithmic differentiation could also be implemented in implicit differentiation techniques and students should consider both while learning and see where there are advantages and disadvantages between both. When using Larson's guidelines for solving related rates problems, it's important to implicitly differentiate before substitution of known variable values as this will produce inappropriate derivatives.

MPAC 2 – Connecting Representations

Remember that the derivative of a function f is itself a function, which can be used to find the slope of the tangent line at the point $(x, f(x))$ on the graph of f. The change in position Δx is also called the *displacement* of an object over the time interval from t to $t + \Delta t$. Because of trigonometric identities, the derivative of a trigonometric function can take many forms. This presents a challenge when you are trying to match your answers to those given in the back of the textbook (or during a multiple-choice portion of an assessment).

MPAC 3 – Justification

Students, when proving the derivative of the exponential function $f(x) = e\hat{}x$ using the limit definition of the derivative, need to be able to argue that $e \approx (1 + \Delta x)^{1/\Delta x}$ which implies that $e^{\Delta x} \approx 1 + \Delta x$. Students can prove the product rule for products involving more than two factors by assuming that the product of two such factors is a single function and applying the product rule for two factors.

MPAC 4 – Communication and Notation

The notation $f'(x)$ is read as "f prime of x". The notations y'' and y''' are read as "y double prime" and "y triple prime", respectively. Note that the prime notation is only used for the first, second, and third derivatives. Be sure students understand the mathematical conventions regarding parentheses for trigonometric functions. For instance, $\sin 2x = \sin(2x)$, not $\sin^2 x$. Students should understand that in vertical motion problems and other physical examples that negative quantities are decreasing in magnitude.

Inter-Disciplinary Connections:

There are a great amount of word problems in each section in such fields as business, sports, physics, data mining, engineering, biology, etc.

Students will engage with the following text:

Textbook:

Calculus for AP 2nd Edition: Larson and Battaglia

Online Resources incorporated throughout the year, included but not limited to:

- LarsonCalculusforAP.com; videos explaining concepts, proofs, view three-dimensional graphs
- WebAssign
- CalcChat – website provides free solutions to all odd number problems in each section and review exercises; also students can chat with a tutor during hours posted on the site.
- CalcView – video solutions of selected problems.
- Desmos – online graphing calculator tool

Calculator:

TI - 84

The Following 21st Century Skills and the 8 mathematical practices are embedded throughout the course and are evident in daily lessons, assignments, activities, assessments and projects:

21st Century skills: • Critical thinking • Creativity • Collaboration • Communication • Information literacy • Technology literacy • Media literacy • Flexibility • Leadership • Initiative • Productivity • Social Skills	**Mathematical Practices:** • Make sense of problems and persevere in solving • them • Reason abstractly and quantitatively • Construct viable arguments and critique the • reasoning of others • Model with mathematics • Use appropriate tools strategically • Attend to precision • Look for and make use of structure • Look for and express regularity in repeated • reasoning

Students will write:

Writing and Open-Ended Problems

Error analysis problems and written description on how to fix them.
Let f be a differentiable function with period p. Is the function f' also periodic. Explain.
Consider the function $g(x) = f(2x)$. Is the function g' periodic? Verify your answer.
***** All "Exploring Concepts" highlighted questions at the conclusion of each section's HW problems.
*' All review, concept, and test problems at the conclusion of each chapter.

PART III: TRANSFER OF KNOWLEDGE AND SKILLS

DESCRIBE THE LEARNING EXPERIENCE.

How will students uncover content and build skills.

Section 2.1: The Derivative and the Tangent Line Problem	
Focus and Motivate Starting Options (Lesson Warm Up)	Suggestions include but not limited to Have students work with the difference quotient on opening problems to refresh. Refer to Lesson Motivator in textbook
Teaching Objectives	• Find the slope of the tangent line to a curve at a point. • Use the limit definition to find the derivative of a function. • Understand the relationship between differentiability and continuity. • Find the derivative of a function given by a table or a graph.
Checking for Understanding	Suggestions include but not limited to: Exit Tickets (teacher made supplement) Inquiry Formative Assessment Lesson Closer in textbook
Practice and Apply Assigning Homework	Section 2.1 p. 132-134 # 1,2,6-28 even, 29, 31, 37, 39, 43, 53, 61-65 odd, 69

Section 2.2: Basic Differentiation Rules and Rates of Change	
Focus and Motivate Starting Options (Lesson Warm Up)	Suggestions include but not limited to: Complete Exploration-"Writing a Conjecture", pg. 135 Also refer to Lesson Motivator in textbook
Teaching Objectives	• Find the derivative of a function using the following rules - Constant, Power, Constant Multiple, Sum, and Difference • Find the derivatives of the sine and cosine functions and exponential functions • Use derivatives to find rates of change.

Checking for Understanding	Suggestions include but not limited to: Exit Tickets (teacher made supplement) Inquiry Formative Assessment Lesson Closer in textbook
Practice and Apply Assigning Homework	Section 2.2 p. 144-147 #1, 2, 4-26 even, 27, 29, 30, 32, 34, 37, 40, 41-53 odd, 56, 57-63 odd, 67, 71, 73, 79, 80, 99, 101, 110

Section 2.3: Product and Quotient Rules and Higher-Order Derivatives	
Focus and Motivate Starting Options (Lesson Warm Up)	Suggestions include but not limited to: Algebra review, pages A38 and A39 Also refer to Lesson Motivator in textbook
Teaching Objectives	• Find the derivative of a function using the Product and Quotient Rules. • Find the derivative of a trigonometric function. • Find a higher-order derivative of a function.
Checking for Understanding	Suggestions include but not limited to: Exit Tickets (teacher made supplement) Inquiry Formative Assessment Lesson Closer in textbook
Practice and Apply Assigning Homework	Section 2.3 p. 155-158, #2-20 even, 21, 23, 26, 28, 32, 35, 38, 39, 41, 51, 53-65 odd, 77-83 odd, 89, 95, 97, 100-108 even, 109, 111, 125(b),

Section 2.4: The Chain Rule	
Focus and Motivate Starting Options (Lesson Warm Up)	Suggestions include but not limited to: Review composite function algebra Also refer to Lesson Motivator in textbook
Teaching Objectives	• Find the derivatives of composite functions and transcendental functions using the General Power Rule and Chain Rule. • Simplify the derivative of a function using algebra. • Find the derivative of a function involving the natural logarithmic function. • Define and differentiate exponential functions that have bases other than e.

Checking for Understanding	Suggestions include but not limited to: Exit Tickets (teacher made supplement) Inquiry Formative Assessment Lesson Closer in textbook
Practice and Apply Assigning Homework	Section 2.4 p. 169-173, #1-5 odd, 8-30 even, 41, 44, 45, 48, 49, 50, 53, 57, 61, 65, 68, 69, 71, 75, 82, 83, 88, 91, 99, 109, 111, 117, 119, 127, 129, 141, 142, 143, 149, 165, 167, 171, 172

Section 2.5: Implicit Differentiation	
Focus and Motivate Starting Options (Lesson Warm Up)	Suggestions include but not limited to: Discussion on how to write the equation of a conic section as a combination of functions. Also refer to Lesson Motivator in textbook
Teaching Objectives	• Distinguish between functions written in implicit form and explicit form. • Use implicit differentiation to find the derivative of a function. • Find derivatives of functions using logarithmic differentiation.
Checking for Understanding	Suggestions include but not limited to: Exit Tickets (teacher made supplement) Inquiry Formative Assessment Lesson Closer in textbook
Practice and Apply Assigning Homework	Section 2.5 p. 180-182 # 2-20 even, 21, 27-39 odd, 49, 51, 55, 56, 61, 63, 78

Section 2.6: Derivatives of Inverse Functions	
Focus and Motivate Starting Options (Lesson Warm Up)	Suggestions include but not limited to: Finding inverse functions, symmetry of inverse functions Inverse Trig function review Also refer to Lesson Motivator in textbook
Teaching Objectives	• Find the derivative of an inverse function. • Differentiate an inverse trigonometric function.
Checking for Understanding	Suggestions include but not limited to: Exit Tickets (teacher made supplement)

	Inquiry Formative Assessment Lesson Closer in textbook
Practice and Apply Assigning Homework	Section 2.6 p. 187-189 # 2-10 even, 16-26 even, 27, 29, 31, 35, 43, 53, 71

Section 2.7: Related Rates	
Focus and Motivate Starting Options (Lesson Warm Up)	Suggestions include but not limited to: Have students complete the exploration on p. 190. Also refer to Lesson Motivator in textbook
Teaching Objectives	• Find a related rate. • Use related rates to solve real life problems.
Checking for Understanding	Suggestions include but not limited to: Exit Tickets (teacher made supplement) Inquiry Formative Assessment Lesson Closer in textbook
Practice and Apply Assigning Homework	Section 2.7 p. 195-198 #2-8 even, 9, 10, 13, 14, 16, 20, 21, 23, 24, 27, 28, 31, 35, 38, 43

Section 2.8: Newton's Method (Optional; if time permits)	
Focus and Motivate Starting Options (Lesson Warm Up)	Suggestions include but not limited to: Find x-intercept of a tangent line to a function. Also refer to Lesson Motivator in textbook
Teaching Objectives	• Approximate a zero of a function using Newton's Method
Checking for Understanding	Suggestions include but not limited to: Exit Tickets (teacher made supplement) Inquiry Formative Assessment Lesson Closer in textbook
Practice and Apply Assigning Homework	Section 2.8 p. 202-203 # 2-10 even, 17-23 odd, 35, 36, 40

PART IV: EVIDENCE OF LEARNING

IDENTIFY THE METHODS BY WHICH STUDENTS WILL DEMONSTRATE THEIR UNDERSTANDING OF CONTENT AND THEIR ABILITY TO APPLY SKILLS. IDENTIFY BLOOM'S LEVELS.

Formative Assessments:

The effectiveness of the instructional program will be base on teacher observations, students doing quality of work together, questioning strategies, self and peer assessment, student record-keeping, quizzes, performance tasks, diagnostic tests, and homework.

Accommodations/Modifications:

As per individual student's IEP or 504 plans.

Summative Assessments:

Section test, Benchmark test (including midterm), end of course test.

Accommodations/Modifications:

As per individual student's IEP or 504 plans.

Performance Assessments:

The following assessments require students to utilize various strand of mathematics:

- Projects
- Homework
- Classwork

Accommodations/Modifications:

As per individual student's IEP or 504 plans.

Revised

Black Horse Pike Regional School District Curriculum Template

ENGAGING STUDENTS • FOSTERING ACHIEVEMENT • CULTIVATING 21ST CENTURY GLOBAL SKILLS

Course Name: Calculus

Course Number:

UNIT 3

PART I: UNIT RATIONALE

WHY ARE STUDENTS LEARNING THIS CONTENT AND THESE SKILLS?

Course/Unit Title: Calculus **Grade Level(s):** 12	**Unit Summary**: **Students will locate extrema on an interval, use Rolle's Theorem and the Mean Value Theorem. They will use the First and Second Derivative Test to find intervals of increase, decrease and concavity, inflection points, critical points and extreme values. Students will explore limits at infinity and analyze various types of functions. They will solve optimization problems and find differentials. Students will use L'Hôpital's Rule to solve problems.** (Ch. 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 3.7, 7.7)
Essential Question(s): • What are extrema and how can you find them on open and closed intervals? • What is the Mean Value Theorem and how is it used? • How can you determine the intervals on which a function is increasing or decreasing and the location of the function's relative extrema? • How do you determine the concavity of a function and find its inflection points? • How do you analyze a function and sketch its graph? • How do you maximize or minimize quantities? • How are differentials used to explain the tangent line approximation?	**Enduring Understanding(s):** Students will be able to: • Understand the definition of extrema of a function on an interval. • Understand the definition of relative extrema of a function on an open interval. • Find extrema on a closed interval. • Understand and use Rolle's Theorem. • Understand and use the Mean Value Theorem. • Determine intervals on which a function is increasing and decreasing. • Apply the First Derivative Test to find relative extrema of a function. • Determine intervals on which a function is concave upward or concave downward. • Find any points of inflection of the graph of a function. • Apply the Second Derivative Test to find relative extrema of a function. • Analyze and sketch the graph of a function. • Solve applied maximum and minimum problems. • Understand the concept of a tangent line approximation. • Compare the value of the differential, dy, with the actual change in y, Δy. • Find the differential of a function using differentiation formula • Recognize limits that produce indeterminate forms. • Apply L'Hopital's Rule to evaluate a limit.

• How do you evaluate a limit when direct substitution produces an indeterminate form?	

PART II: INSTRUCTIONAL STRATEGIES AND RESOURCES

DESCRIBE THE LEARNING TARGETS.

Application of Mathematical Practices for Calculus

Learning Target	Mathematical Practices :
1. Have students take the first and second derivatives of a polynomial function such as $f(x) = x^4 - 4x^3$ and set each of these equal to zero finding all critical values. Apply the first derivative test and concavity test to determine what these values represent (max, min or points of inflection) and then substituting them into the original function to find the y component of the coordinate. This allows students to understand how to analyze a function's behavior and how to accurately sketch these functions without the use of a graphing calculator	1. MPAC 2- Connecting Concepts
2. To sketch a curve accurately students must algebraically manipulate the given equation to determine characteristics such as domain, intercepts, asymptotes, and holes. They must then find the first two derivatives of the function and analyze and interpret their critical values to provide maximums, minimums, points of inflection, intervals of increase/decrease and intervals of concavity. Students gain an understanding of how important derivatives are for analyzing and understanding how functions behave	2. MPAC 3- Implementing Algebraic/ Computational Processes
3. While curve sketching students can connect the algebraic component of derivatives with the graphical interpretation of the function and first and second derivatives graphs.	3. MPAC4 – Connecting multiple representations
4. Students should be able to make connections to a given function, its first derivative and second derivative and what graphical characteristics each one yields about the given function.	4. MPAC 5- Building notational Fluency
5.Students practice their writing to clearly explain and justify their answers in the context of a problem and how this information allows us to make decisions contextually.	5. MPAC 6 Communicating
6. Students are able to make connections, apply, discuss and justify their finial answers for problems that involve the Roll's Theorem and the Mean Value Theorem.	6. MPAC 6 Communicating

Inter-Disciplinary Connections:

Word problems included in text. Each textbook has a plethora of inter-disciplinary questions at the conclusion of each lesson.

Students will engage with the following text:

Textbook:

Calculus for AP 2nd Edition: Larson and Battaglia

Online Resources incorporated throughout the year, include but not limited to:

- LarsonCalculusforAP.com: videos explaining concepts, proofs, view three-dimensional graphs, review sample scoring for free-response questions, ect..
- WebAssign
- CalcChat- website provides free solutions to all odd number sections and review exercises; also students can chat with a tutor during hours posted on the site
- CalcView- video solutions of selected problems
- Desmos-Graphing Calculator online tool

Calculator:

TI-84 Plus

The Following 21st Century Skills and the 8 mathematical practices are embedded throughout the course and are evident in daily lessons, assignments, activities, assessments and projects:

21st Century skills:

- Critical thinking
- Creativity
- Collaboration
- Communication
- Information literacy
- Technology literacy
- Media literacy
- Flexibility
- Leadership
- Initiative
- Productivity
- Social Skills

Mathematical Practices:

- Make sense of problems and persevere in solving
- them
- Reason abstractly and quantitatively
- Construct viable arguments and critique the
- reasoning of others
- Model with mathematics
- Use appropriate tools strategically
- Attend to precision
- Look for and make use of structure
- Look for and express regularity in repeated
- reasoning

Students will write:

Writing/Open Ended Problems: The graph of a function on a closed interval given extrema locations.
Explain why or why not the Mean Value Theorem applies to a function on a closed interval.
Explain how the Mean Value Theorem and Rolle's theorem are similar and different.
How you can determine the intervals on which a function is increasing or decreasing.
How you can determine the location of a function's relative extrema using derivatives.
How to determine the concavity of a function using derivatives.
How can derivatives be used to sketch the graph of a function precisely.

Calculus 2nd Edition, Larson and Battaglia:
*All "Exploring Concepts" highlighted questions at the conclusion of each section.
*All Review, Concept and Test problems at the conclusion of each section

PART III: TRANSFER OF KNOWLEDGE AND SKILLS

DESCRIBE THE LEARNING EXPERIENCE.

How will students uncover content and build skills.

Section 3.1: Extrema on an Interval	
Focus and Motivate Starting Options (Lesson Warm Up)	Suggestions include but not limited to Have students identify locations of a maximum using the feature on the calculator. Refer to Lesson Motivator in textbook
Teaching Objectives	• Understand the definition of extrema of a function on an interval. • Understand the definition of relative extrema of a function on an open interval. • Find extrema on a closed interval
Checking for Understanding	Suggestions include but not limited to: Exit Tickets (teacher made supplement) Inquiry Formative Assessment Lesson Closer in textbook
Practice and Apply Assigning Homework	Section 3.1 p.217-219 # 2, 5, 11, 14, 17, 20, 23, 26, 29, 32, 35, 38, 41, 44, 45, 48, 49, 62, 68, 75-78

Section 3.2: Rolle's Theorem and the Mean Value Theorem	
Focus and Motivate Starting Options (Lesson Warm Up)	Suggestions include but not limited to: Complete Exploration-Extreme Values in a Closed Interval on p.220. Also refer to Lesson Motivator in textbook
Teaching Objectives	• Understand and use Rolle's Theorem. • Understand and use the Mean Value Theorem.
Checking for Understanding	Suggestions include but not limited to: Exit Tickets (teacher made supplement) Inquiry Formative Assessment Lesson Closer in textbook
Practice and Apply Assigning Homework	Section 3.2 p. 224-226 #1, 2, 9-21 odd, 24-26, 29, 31, 35, 40-48 even, 52, 53, 64-66, 81-83

Section 3.3: Increasing and Decreasing Functions and the First Derivative Test	
Focus and Motivate Starting Options (Lesson Warm Up)	Suggestions include but not limited to: Have students identify intervals of increase and decrease by viewing a graph. Also refer to Lesson Motivator in textbook
Teaching Objectives	• Determine intervals on which a function is increasing and decreasing. • Apply the First Derivative Test to find relative extrema of a function
Checking for Understanding	Suggestions include but not limited to: Exit Tickets (teacher made supplement) Inquiry Formative Assessment Lesson Closer in textbook
Practice and Apply Assigning Homework	Section 3.3 P 233-236 #10, 13, 16, 19, 22, 25, 28, 31, 34, 37, 40, 43, 46, 49, 52, 55, 57, 58, 59-65 odd, 75, 76, 80, 81-86, 90, 97, 99, 101, 115-117

Section 3.4: Concavity and Second Derivative Test	
Focus and Motivate Starting Options (Lesson Warm Up)	Suggestions include but not limited to: Have students find the first two derivatives of a rational function. Also refer to Lesson Motivator in textbook
Teaching Objectives	• Determine intervals on which a function is concave upward or concave downward. • Find any points of inflection of the graph of a function. • Apply the Second Derivative Test to find relative extrema of a function.
Checking for Understanding	Suggestions include but not limited to: Exit Tickets (teacher made supplement) Inquiry Formative Assessment Lesson Closer in textbook
Practice and Apply Assigning Homework	Section 3.4 p. 242-244 # 3, 7, 12, 13, 18, 23, 26, 27, 31, 37, 41-51 odd, 59, 67, 69-71, 74, 80, 92-94

Section 3.5: A Summary of Curve Sketching	
Focus and Motivate Starting Options (Lesson Warm Up)	Suggestions include but not limited to: Have students list all information needed to sketch a polynomial function precisely without a calculator Also refer to Lesson Motivator in textbook
Teaching Objectives	• Analyze and sketch the graph of a function.
Checking for Understanding	Suggestions include but not limited to: Exit Tickets (teacher made supplement) Inquiry Formative Assessment Lesson Closer in textbook
Practice and Apply Assigning Homework	Section 3.5 P253-256 # 1, 12, 15, 22, 27, 31, 35, 36, 42, 43, 49, 53, 57, 64, 90, 99-102

Section 3.6: Optimization Problems	
Focus and Motivate Starting Options (Lesson Warm Up)	Suggestions include but not limited to: Have students list possible dimensions for a rectangular yard given the area. Also refer to Lesson Motivator in textbook
Teaching Objectives	• Solve applied maximum and minimum problems
Checking for Understanding	Suggestions include but not limited to: Exit Tickets (teacher made supplement) Inquiry Formative Assessment Lesson Closer in textbook
Practice and Apply Assigning Homework	Section 3.6 P 262-266 # 2, 5, 9-23 odd, 29, 31, 37, 41, 48, 54-56

Section 3.7 Linear Approximation and Differentials	
Focus and Motivate Starting Options (Lesson Warm Up)	Suggestions include but not limited to: Have students complete the exploration on p267. Also refer to Lesson Motivator in textbook
Teaching Objectives	• Understand the concept of a tangent line approximation. • Compare the value of the differential, dy, with the actual change in y, Δy. • Find the differential of a function using differentiation formula
Checking for Understanding	Suggestions include but not limited to: Exit Tickets (teacher made supplement) Inquiry Formative Assessment Lesson Closer in textbook
Practice and Apply Assigning Homework	Section 3.7 P 272-275 #3-5 9, 11, 14, 16-19, 25-28, 35, 40, 52-55

Section 7.7 Indeterminate Forms and L'Hopital's Rule	
Focus and Motivate Starting Options (Lesson Warm Up)	Suggestions include but not limited to: Find the limit of a rational function with an asymptote. Also refer to Lesson Motivator in textbook
Teaching Objectives	• Recognize limits that produce indeterminate forms. • Apply L'Hopital's Rule to evaluate a limit
Checking for Understanding	Suggestions include but not limited to: Exit Tickets (teacher made supplement) Inquiry Formative Assessment Lesson Closer in textbook
Practice and Apply Assigning Homework	Section 7.7 P513-516 # 1, 4, 5, 8-11, 15, 18, 21, 24, 27, 30, 33, 36, 39, 42, 45, 48, 51, 54, 57, 60, 63, 65, 69-72, 80-82, 101, 102, 113-115

PART IV: EVIDENCE OF LEARNING

IDENTIFY THE METHODS BY WHICH STUDENTS WILL DEMONSTRATE THEIR UNDERSTANDING OF CONTENT AND THEIR ABILITY TO APPLY SKILLS.
IDENTIFY BLOOM'S LEVELS.

Formative Assessments:

The effectiveness of the instructional program will be based on teacher observations, students doing quality of work together, questioning strategies, self and peer assessment, student record-keeping, quizzes, performance tasks, diagnostic tests, and homework.

Accommodations/Modifications:

As per individual student's IEP or 504 plan

Summative Assessments:

Section tests, Benchmark Tests (Including Midterm), End of Course Test

Accommodations/Modifications:

As per individual students' IEP or 504 plan.

Performance Assessments:

The following assessments require students to utilize various strands of mathematics.

- Projects
- Homework
- Classwork

Accommodations/Modifications:

As per individual students' IEP or 504 plan.

Revised

Black Horse Pike Regional School District Curriculum Template

ENGAGING STUDENTS • FOSTERING ACHIEVEMENT • CULTIVATING 21ST CENTURY GLOBAL SKILLS

Course Name: Calculus

Course Number: 034100

UNIT 4

PART I: UNIT RATIONALE

WHY ARE STUDENTS LEARNING THIS CONTENT AND THESE SKILLS?

Course/Unit Title: Calculus **Grade Level(s):** 12	**Unit Summary**: Students will find antiderivatives and indefinite integrals. They will estimate the area under the curve using Riemann sums to find the definite integral. Students will learn and apply the Fundamental Theorem of Calculus Parts 1 and 2. They will perform techniques of integration using u-substitution and various other rules. (Ch. 4.1, 4.2, 4.3, 4.4, 4.6, 4.7, 6.1)
Essential Question(s): • What are antiderivatives and how they are used? • How can you approximate the area of a plane figure? • What is the process of using Riemann sums? • What is the Fundamental Theorem of Calculus? • How do you integrate composite functions? • How do you integrate rational functions and trigonometric functions other than sine or cosine?	**Enduring Understanding(s):** Students will be able to: • Write the general solution of a differential equation and use indefinite integral notation for antiderivatives. • Use basic integration rules to find antiderivatives. • Find a particular solution of a differential equations. • Use sigma notation to write and evaluate a sum. • Understand the concept of area. • Approximate the area of a plan region. • Find the area of a plan region using limits. • Understand the definition of a Riemann sum. • Evaluate a definite integral using limits and geometric formulas and using properties of definite integrals. • Evaluate a definite integral using the Fundamental Theorem of Calculus. • Understand and use the Mean Value Theorem for Integrals. • Find the average value of a function over a closed interval. • Understand the use the Second Fundamental Theorem of Calculus. • Use pattern recognition to find an indefinite integral. • Use a change of variables to find an indefinite integral. • Use the General Power Rule for Integration to find an indefinite integral. • Use a change of variables to evaluate a definite integral. • Evaluate a definite integral involving an even or odd function. • Use the Log Rule for Integration to integrate a rational function. • Integrate trigonometric functions. • Find the area of a region between two curves using integration. • Find the area of a region between intersecting curves using integration. • Describe Integration as an accumulation process.

• How do you find the area of a region between two curves?	

PART II: INSTRUCTIONAL STRATEGIES AND RESOURCES

DESCRIBE THE LEARNING TARGETS.

Applications of the Mathematical Practices for AP Calculus:

Learning Target

MPAC 1-Implementing Mathematical Processes

In all the activities through the unit students develop the ability to use the various FTC formulas to problem solve in a variety of different problems. Students need to be able to make conjectures on tasking derivatives of transcendental functions where the "rules" are different from polynomial functions. Students learn to build arguments about antiderivatives with +C creating a family of solutions rather than a single solution. Students will get to see how/why the formulas we use for area/volume work and how they are derived. Students learn to select appropriate strategies and complete algebraic computations correctly (like in u- substitution).

MPAC-2 Connecting Representations

Students will discover the derivative and integration and inverse operation. Students will quickly see during integration of e^x that transcendental functions behave differently from the polynomial functions they studied earlier.

In the Average Value of a Function, students can relate this new calculus formulato a very simple formula they studied in geometry, making the new formula easier to remember. Students will learn to visualize the "families" of vertically stacked functions and their connection to constant of integration +C.

Students will make a further connection to the definite integral of a Riemann Sum when working on volume of a shape with a known cross section as well as when studying rotation of solids.

MPAC-3 Justification

Students learn how to interpret the results from their graphing calculators for solving problems where answers need precision. Students need to explain the relationship between differential equations and the function. Students need to correctly use units in their final answers and explain their final answers in a contextual setting: i.e. for area problems units should be squared feet, and volume problems units should be feet cubed.

MPAC-4 Communication and Notation

When Deriving the Evaluative Component of the Fundamental Theorem of Calculus students learn how

important correct notation can help them understand problems and relationships between the first derivative and its corresponding functions. When defining e students will learn how to interpret various nomenclatures and to correctly differentiate and integrate the different transcendental functions. Students need to be comfortable using proper notation with differential equations and then solving for their final answer in the format y=.

Inter-Disciplinary Connections:

Word problems included in text. Each textbook has a plethora of inter-disciplinary questions at the conclusion of each lesson.

Students will engage with the following text:

Textbook:

Calculus for AP 2nd Edition: Larson and Battaglia

Online Resources incorporated throughout the year, include but not limited to:

- LarsonCalculusforAP.com: videos explaining concepts, proofs, view three-dimensional graphs, review sample scoring for free-response questions, ect..
- WebAssign
- CalcChat- website provides free solutions to all odd number sections and review exercises; also students can chat with a tutor during hours posted on the site
- CalcView- video solutions of selected problems
- Desmos-Graphing Calculator online tool

Calculator:

TI-84 Plus

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- Critical thinking
- Creativity
- Collaboration
- Communication
- Information literacy
- Technology literacy
- Media literacy
- Flexibility
- Leadership
- Initiative
- Productivity
- Social Skills

Mathematical Practices:

- Make sense of problems and persevere in solving
- them
- Reason abstractly and quantitatively
- Construct viable arguments and critique the
- reasoning of others
- Model with mathematics
- Use appropriate tools strategically
- Attend to precision
- Look for and make use of structure
- Look for and express regularity in repeated
- reasoning

Students will write:

Explain the difference, as you understand it so far, between definite integral and indefinite integral.
The difference between a differential and a derivative.
The difference between mean value theorem and the intermediate value theorem.
What are the different kinds of Riemann sums?
What evidence can you think of to show that Riemann sums really do get to the value of a definite integral found by the fundamental theorem as n approaches infinity.

Calculus 2nd Edition, Larson and Battaglia:
*All "Exploring Concepts" highlighted questions at the conclusion of each section.
*All Review, Concept and Test problems at the conclusion of each section

PART III: TRANSFER OF KNOWLEDGE AND SKILLS

DESCRIBE THE LEARNING EXPERIENCE.

How will students uncover content and build skills.

Section 4.1: Antiderivatives	
Focus and Motivate Starting Options (Lesson Warm Up)	Suggestions include but not limited to: Approximate Antiderivatives from Derivatives. Also refer to Exploration on p.280 in textbook.
Teaching Objectives	• Write the general solution of a differential equation and use indefinite integral notation for antiderivatives. • Use basic integration rules to find antiderivatives. • Find a particular solution of a differential equations.
Checking for Understanding	Suggestions include but not limited to: Exit Tickets (teacher made supplement) Inquiry Formative Assessment Lesson Closer in textbook
Practice and Apply Assigning Homework	Section 4.1 p. 287-289 #2, 3, 9-11, 14, 17, 20, 23, 26, 29, 32, 35, 38, 39, 42, 44, 48, 52, 53, 57, 65, 67, 74-77

Section 4.2 Area:	
Focus and Motivate Starting Options (Lesson Warm Up)	Suggestions include but not limited to:

	Discuss Archimedes method of exhaustion for finding area. Also refer to Lesson Motivator.
Teaching Objectives	• Use sigma notation to write and evaluate a sum. • Understand the concept of area. • Approximate the area of a plan region. • Find the area of a plan region using limits.
Checking for Understanding	Suggestions include but not limited to: Exit Tickets (teacher made supplement) Inquiry Formative Assessment Lesson Closer in textbook
Practice and Apply Assigning Homework	Section 4.2 p.299-301 # 1, 4, 7-35 odd, 41, 45, 48, 53, 58, 61, 68, 69, 75, 76, 78, 81-83

Section 4.3 Riemann Sums and Definite Integrals:	
Focus and Motivate Starting Options (Lesson Warm Up)	Suggestions include but not limited to: Model Riemann sum by drawing smaller rectangles and discuss trapezoid rule to approximate area under curve. Also refer to Lesson Motivator
Teaching Objectives	• Understand the definition of a Riemann sum. • Evaluate a definite integral using limits and geometric formulas and using properties of definite integrals.
Checking for Understanding	Suggestions include but not limited to: Exit Tickets (teacher made supplement) Inquiry Formative Assessment Lesson Closer in textbook
Practice and Apply Assigning Homework	Section 4.3 p. 312-316 #1-5 odd, 9-14, 18, 20, 25, 30, 31-35 odd, 40-50 even, 51, 53, 54, 57, 89, 92, 94, 114-117

Section 4.4 The Fundamental Theorem of Calculus:	
Focus and Motivate Starting Options (Lesson Warm Up)	Suggestions include but not limited to: Discuss notation difference between the definite and Indefinite Integral.

	Also refer to Lesson Motivator
Teaching Objectives	• Evaluate a definite integral using the Fundamental Theorem of Calculus. • Understand and use the Mean Value Theorem for Integrals. • Find the average value of a function over a closed interval. • Understand the use the Second Fundamental Theorem of Calculus.
Checking for Understanding	Suggestions include but not limited to: Exit Tickets (teacher made supplement) Inquiry Formative Assessment Lesson Closer in textbook
Practice and Apply Assigning Homework	Section 4.4 p.326-328 #5-25 odd, 29, 32, 35-39 odd, 44, 45, 48, 50, 59, 65, 67, 70-72, 75, 76, 79, 80, 83, 84, 89-91

Section 4.6 Integration	
Focus and Motivate Starting Options (Lesson Warm Up)	Suggestions include but not limited to: Show how the need for a new technique arises with the introduction of composite functions. Also refer to Lesson Motivator
Teaching Objectives	• Use pattern recognition to find an indefinite integral. • Use a change of variables to find an indefinite integral. • Use the General Power Rule for Integration to find an indefinite integral. • Use a change of variables to evaluate a definite integral. • Evaluate a definite integral involving an even or odd function.
Checking for Understanding	Suggestions include but not limited to: Exit Tickets (teacher made supplement) Inquiry Formative Assessment Lesson Closer in textbook
Practice and Apply Assigning Homework	Section 4.6 p.343-346 # 1-4, 5, 8, 11, 14, 17, 20, 23, 26, 29, 32, 35, 38, 41, 44, 47, 50, 53, 59, 63, 67-79 odd, 82, 86, 91-95 odd, 117-120

Section 4.7 The Natural Logarithmic Functions: Integration:	
Focus and Motivate Starting Options (Lesson Warm Up)	Suggestions include but not limited to: Give examples of Integrating Rational Functions. Also refer to Lesson Motivator
Teaching Objectives	• Use the Log Rule for Integration to integrate a rational function. • Integrate trigonometric functions
Checking for Understanding	Suggestions include but not limited to: Exit Tickets (teacher made supplement) Inquiry Formative Assessment Lesson Closer in textbook
Practice and Apply Assigning Homework	Section 4.7 p.353-355 #1, 5, 9, 13, 17, 21, 25, 29, 33, 37, 41, 43, 44, 47-49, 53, 55, 58, 68, 70, 71-77 odd, 81, 92, 94, 104-107.

Section 6.1 Area of a Region Between Two Curves:	
Focus and Motivate Starting Options (Lesson Warm Up)	Suggestions include but not limited to: Explain subtraction of the area of regions and how it will pertain to f(x)-g(x) where f(x)>g(x) Also refer to Lesson Motivator
Teaching Objectives	• Find the area of a region between two curves using integration. • Find the area of a region between intersecting curves using integration. • Describe Integration as an accumulation process.
Checking for Understanding	Suggestions include but not limited to: Exit Tickets (teacher made supplement) Inquiry Formative Assessment Lesson Closer in textbook
Practice and Apply Assigning Homework	Section 6.1 P416-419 #3, 6, 7, 10, 11, 13, 15, 18, 21, 24, 27, 30, 33, 36, 39, 42, 45, 48, 53-57 odd, 66, 78, 83-85.

PART IV: EVIDENCE OF LEARNING

IDENTIFY THE METHODS BY WHICH STUDENTS WILL DEMONSTRATE THEIR UNDERSTANDING OF CONTENT AND THEIR ABILITY TO APPLY SKILLS.

IDENTIFY BLOOM'S LEVELS.

Formative Assessments:

The effectiveness of the instructional program will be based on teacher observations, students doing quality of work together, questioning strategies, self and peer assessment, student record-keeping, quizzes, performance tasks, diagnostic tests, and homework.

Accommodations/Modifications:

As per individual students' IEP or 504 plan.

Summative Assessments:

Section tests, Benchmark Tests (Including Midterm), End of Course Test

Accommodations/Modifications:

As per individual students' IEP or 504 plan.

Performance Assessments:

The following assessments require students to utilize various strands of mathematics.

- Projects
- Homework
- Classwork

Accommodations/Modifications:

As per individual students' IEP or 504 plan