High School (9-12)
Gateway High School
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Gateway School District
Curriculum Map

Curriculum Map: Mathematics

Course: Business Calculus
Grade(s): 11-12

Unit 1: Pre-Calculus Review

Brief Summary of Unit
This initial chapter, A Precalculus Review, is just that-a review chapter. This chapter will provide a solid understanding of essential algebraic skills that students may have forgotten over the summer months. As with all math courses, calculus is a building process. Therefore, previous taught algebra skills are necessary to be successful in this business calculus course.

Stage One—Desired Results

Established Goals: (Standards of Learning, Content Standards)

1. Calculate slope of a line.
2. Write an equation of a line.
3. Find the domain & range of a function.
4. Evaluate and simplify problems involving exponents & define exponential functions.
5. Factor polynomials.
6. Add, subtract, multiply, and divide rational expressions.

Understandings:	Essential Questions:
1. Understand that previously learned concepts concerning functions and graphs are the main building blocks of calculus. **2.** Understand that polynomial functions, and exponential functions describe real-world situations in mathematical terms.	1. How is real-world data modeled using graphs? 2. How are polynomial and exponential functions used to model real-world situations?

Stage Two—Assessment Evidence

Performance Tasks:

Other Evidence: :(quizzes, tests and so on)

Stage Three—Learning Plan

Unit 2: Functions, Graphs, and Limits

Brief Summary of Unit

This chapter introduces concepts that are essential for the study of calculus. Calculus is used to model many aspects of the world. Most ideas in calculus have useful geometric interpretations and can be visualized in term of functions. An essential feature of calculus covered in this chapter involves introducing and exploring the limit of a function and a related concept know as continuity.

Stage One—Desired Results

Established Goals: (Standards of Learning, Content Standards)

1. Calculate slope of a line & write an equation of a line.
2. Find the distance and midpoint of a line segment.
3. Write the standard form of an equation of a circle.
4. Find the domain & range of functions.
5. Use function notation and evaluate functions.
6. Find limits and use properties of limits to limits of functions.
7. Determine the continuity of functions.

Understandings:	**Essential Questions:**
1. **Understand that the concept of a limit is one of the ideas that distinguishes calculus from algebra.** 2. **Understand that continuous functions arise frequently in scientific work because they model such an enormous range of natural behavior.**	**1.** How does Calculus differ from Algebra? **2.** How do continuous functions model scientific work?

Stage Two—Assessment Evidence

Performance Tasks:

Other Evidence: :(quizzes, tests and so on)

Stage Three—Learning Plan

Unit 3: Differentiation

Brief Summary of Unit

In this chapter, the main ideas of differential calculus are developed. It begins with the limit definition of the derivative followed by a list of rules and formulas for finding the derivatives of a variety of expressions, including polynomial functions, rational functions, and root functions. Derivatives are then interpreted as a rate of change and methods are developed for making approximations using the derivative.

Stage One—Desired Results	
Established Goals: (Standards of Learning, Content Standards) 1. Identify tangent lines to a graph at a point. 2. Use the limit definition to find the slopes of graphs at points. 3. Use the limit definition to find the derivatives of functions. 4. Describe the relationship between differentiability and continuity. 5. Find the derivatives of functions using Constant Rule, Power Rule, Constant Multiple Rule, and the Sum and Difference Rules. 6. Find average rates of change of functions over intervals. 7. Find the instantaneous rates of change of functions at points. 8. Find marginal revenues, marginal costs, and marginal profits for products. 9. Find the derivatives of functions using the Product Rule and Quotient Rule. 10. Use derivatives to answer questions about real-life situations. 11. Find the derivatives using the Chain Rule and General Power Rule. 12. Write derivatives in simplified form. 13. Find higher-order derivatives. 14. Find and use position functions to determine the velocity and acceleration of moving objects. 15. Find derivatives explicitly and implicitly. 16. Solve related-rate problems.	
Understandings: 1. **Understand that a derivative is a rate of change that has numerous applications in real-life situations.** 2. **Understand that the rate at which a graph rises or falls at a single point is finding the slope of a tangent line.**	**Essential Questions:** **1.** How the derivative is a rate of change that models real-life situations?
Stage Two—Assessment Evidence	
Performance Tasks:	
Other Evidence: :(quizzes, tests and so on)	
Stage Three—Learning Plan	

Unit 4: Application of the Derivative

Brief Summary of Unit
The primary goal of this chapter is to examine the use of calculus in curve sketching, optimization, and other applications of calculus.
Stage One—Desired Results
Established Goals: (Standards of Learning, Content Standards) 1. Find critical numbers and find the intervals on which a function is increasing & decreasing.

2. Use the First-Derivative Test to find relative extrema.
3. Find intervals of concavity, and points of inflection.
4. Solve real-life optimization problems including business and economics optimization problems.
5. Find the price elasticity of demand for demand functions.
6. Find vertical & horizontal asymptotes.
7. Find limits at infinity.
8. Use differentials to approximate changes in functions.

Understandings:	**Essential Questions:**
1. **Understand that numerous real-life situations use derivatives to measure the increase or decrease of a function based upon a change in a specific variable.** 2. **Understand that a differential approximates the change in a function.**	**1.** How are real-life situations modeled as an increasing or decreasing function?

Stage Two—Assessment Evidence

Performance Tasks:

Other Evidence: :(quizzes, tests and so on)

Stage Three—Learning Plan

Unit 5: Chapter 4 Exponential & Logarithmic Functions

Brief Summary of Unit

Many pure and applied mathematical topics require the natural exponential function and the natural logarithmic function. Applications of these functions as they relate to the derivative are explored in this chapter.

Stage One—Desired Results

Established Goals: (Standards of Learning, Content Standards)

1. Use properties of exponents to evaluate & simplify.
2. Solve compound interest & present value problems.
3. Find derivatives of natural exponential functions.
4. Use properties of logarithms to simplify, expand, and condense expressions.
5. Find the derivatives of logarithmic functions.
6. Use properties of natural logarithms to answer questions about real-life situations.
7. Use exponential growth & decay to model real-life situations.

Understandings:	**Essential Questions:**
1. **Understand that numerous real-life situations use derivatives of exponential functions to measure change.** 2. **Understand that numerous real-life situations use derivatives of logarithmic functions to measure change.**	**1.** How do you know which integration rule to use when taking a derivative of an exponential function? **2.** How do you apply the integration rules with real world applications?

Stage Two—Assessment Evidence
Performance Tasks:
Other Evidence: :(quizzes, tests and so on)

Stage Three—Learning Plan

Unit 6: Chapter 5: Integration & Its Applications

Brief Summary of Unit
This chapter formally introduces the second fundamental concept of calculus, integral calculus. The key concept in integral calculus is integration, a procedure that involves computing a special kind of limit of sums called the definite integral. Finding integral and solving differential equations are extremely important processes in calculus.

Stage One—Desired Results	
Established Goals: (Standards of Learning, Content Standards) 1. Use basic integration rules to find antiderivatives. 2. Use initial conditions to find particular solutions of indefinite integrals. 3. Use substitution to find indefinite integrals. 4. Use the Exponential Rule & Log Rule to find indefinite integrals. 5. Evaluate definite integrals using the Fundamental Theorem of Calculus. 6. Find the areas of regions bounded by 2 graphs. 7. Find consumer & producer surpluses.	
Understandings: 1. **Understand that numerous real-life situations use integration to find area under a curve.** 2. **Understand that numerous real-life situations involving physics use integration.**	**Essential Questions:** **1.** How do you find the area under the curve?

Stage Two—Assessment Evidence
Performance Tasks:
Other Evidence: :(quizzes, tests and so on)

Stage Three—Learning Plan

Unit 7: Chapter 6: Techniques of Integration

Brief Summary of Unit
In this chapter, the number of techniques and procedures for integrating a function increases. One of the most important techniques, substitution, is reviewed and then expanded in several different contexts. Other important integration procedures include using tables, integration by parts, and partial fractions. In addition, improper integrals are discussed.

Stage One—Desired Results	
Established Goals: (Standards of Learning, Content Standards) 1. Use substitution to evaluate definite integrals. 2. Use integration by parts to find indefinite and definite integrals. 3. Use substitution to find indefinite integrals. 4. Use integration tables to find indefinite integrals. 5. Use completing the square to find indefinite integrals. 6. Use Trapezoidal & Simpson's Rules to approximate definite integrals. 7. Evaluate improper integrals with infinite limits of integration.	
Understandings: 1. **Understand that that major part of integration is determining which basic integration formula or formulas to use to solve the problem.** 2. **Understand that Trapezoidal Rule & Simpson's Rule are methods used in real-life situations to approximate the area and volume of complicated curves.**	**Essential Questions:** **1.** How do you find the area and volume of complicated curves?
Stage Two—Assessment Evidence	
Performance Tasks:	
Other Evidence: :(quizzes, tests and so on)	
Stage Three—Learning Plan	

Unit 8: Chapter 7: Functions of Several Variables

Brief Summary of Unit
The goal of this chapter is to extend the methods of single-variable differential calculus functions of several variables. Functions involving several variables are analyzed as well as solving rate and optimization problems.

Stage One—Desired Results
Established Goals: (Standards of Learning, Content Standards) 1. Find the first partial derivative of a two variable function. 2. Find higher-order partial derivatives. 3. Use the First-Partials Test to find the relative extrema of functions of 2 variables. 4. Use the Second-Partials Test to find the relative extrema of functions of 2 variables.

5. Use Lagrange multipliers with one & two constraints to find extrema of functions of several variables.

Understandings:	**Essential Questions:**
3. **Understand that optimizing a 3D graph in real-life various methods of partial derivatives must be implemented.**	**1.** What real world problems use partial differentiation to model and solve?

Stage Two—Assessment Evidence

Performance Tasks:

Other Evidence: :(quizzes, tests and so on)

Stage Three—Learning Plan

Unit 9: Appendix C: Differential Equations

Brief Summary of Unit

In this chapter, basic terminology of differential equations and how such equations can be used to model applications are introduced. Additionally, more sophisticated issues regarding differential equations are developed as a necessary mathematical tool.

Stage One—Desired Results

Established Goals: (Standards of Learning, Content Standards)

1. Find general solutions of differential equations.
2. Use separation of variables to solve differential equations.
3. Use differential equations to model & solve real-life situations.

Understandings:	**Essential Questions:**
1. **Understand that differential equations model real-life events.**	**1.** When is it appropriate to use differential equations to model real world events?

Stage Two—Assessment Evidence

Performance Tasks:

Other Evidence: :(quizzes, tests and so on)

Stage Three—Learning Plan