Math Curriculum: CALCULUS

Instructional Focus: Calculus is an introductory course to mathematics of change. Traditional calculus topics included are limits, derivatives and their applications, and integrals and their applications. Calculus concepts will be represented graphically, numerically, and algebraically in order to lay the basic foundation for further study in calculus in college. Technology will aid the algebraic manipulation process.

Grade Overview:

- **Functions, Graphs, and Limits:** Analyze graphs, find limits of functions, describe asymptotic and unbounded behavior, understand continuity as a property of a function.
- **Derivatives:** Understand the concept of a derivative, compute and describe the derivative at a point, write and interpret the derivative as a function, calculate and interpret second derivatives, apply the derivative.
- **Integrals:** Interpret integrals, understand the properties of definite intergrals, applications of integrals, understand and apply the Fundamental Theorem of Calculus, learn techniques of antidifferentiation, applications of antidifferentiation, use numerical approximations to definite integrals.

Overarching Mathematical Practices Learning Targets:

- **I can make sense of problems and persevere in solving them.**
- **I can reason abstractly and quantitatively.**
- **I can construct viable arguments and critique the reasoning of others.**
- **I can model with mathematics.**
- **I can use appropriate tools strategically.**
- **I can attend to precision.**
- **I can look for and made use of structure.**
- **I can look for and express regularity in repeated reasoning.**

Learning Targets

Functions, Graphs, and Limits	Derivatives	Integrals
Analyze Graphs: - I understand that with the aid of technology graphs of functions are often easy to produce. The emphasis is on the interplay between the geometric and analytic information and on the use of	**Concepts of Derivatives:** - I can present derivatives graphically, numerically, and analytically. - I can interpret derivative as an instantaneous rate of change. - I can define a derivative as	**Interpretations and Properties of Definite Integrals:** - I can find the definite integral as a limit of Reimann Sum. - I understand the definition of the definite integral. - I can apply basic properties

calculus to predict and explain the observed local and global behavior of a function. **Limits of Functions:** - I can show an intuitive understanding of the limiting process. - I can calculate limits using algebra. - I can estimate limits using graphs or tables. **Asymptotic and Unbounded Behavior:** - I can understand asymptotes in terms of graphical behavior. - I can describe asymptopic behavior in terms of limits involving infinity. I can compare relative magnitudes of functions and their rates of change. **Continuity as a property of functions:** - I have an intuitive understanding of continuity. - I understand continuity in terms of limits. - I have a geometric understanding of graphs of continuous functions.	the limit of the difference quotient. - I understand the relationship between differentiability and continuity. **Derivative at a Point:** - I can find slope of a curve at a point. - I can find the tangent line to a curve at a point and give local linear approximations. - I understand the instantaneous rate of change as the limit of average rate of change. - I can approximate the average rate of change from graphs and tables. **Derivative as a Function:** - I understand corresponding characteristics of the graphs of f and f' and the relationship between the increasing and decreasing behavior of f and the sign of f'. - I can use the Mean Value Theorem and its geometric interpretation. - I can solve equations involving derivatives. **Second Derivatives:** - I understand corresponding characteristics of the graphs f, f', and f''. - I understand the relationship between the concavity of f and f''. - I understand that points of inflection are places where the concavity changes. **Applications of Derivatives:** - I can analyze curves, including the notions of monotonicity and concavity. - I can optimize problems. - I can model rates of change.	of definite integrals. - I can apply definite integrals. **Fundamental Theorem of Calculus:** - I can use the fundamental theorem of calculus to evaluate definite integrals. - I can use the fundamental theorem of calculus to represent a particular antiderivative, and the analytical and graphical analysis functions. **Techniques of Antidifferentiation:** - I can find antiderivatives following directly from derivatives of basic functions. - I can find antiderivatives using basic substitution. **Numerical Approximations to Definite Integrals:** - I can use Reimann Sums and the Trapezoidal Sums to approximate the definite integrals of functions represented algebraically, graphically, and by tables of values.

	- I can use implicit differentiation to find the derivative of an inverse function. - I can interpret the derivative as a rate of change in various applied contexts, including velocity, acceleration, and speed. - I can interpret differential equations geometrically. **Computation of Derivatives:** - I have knowledge of derivatives as basic functions. - I understand the rules for differentiation; sum, product, and quotient rule. - I can use the chain rule and implicit differentiation.	