# Calculus

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| **Number and Quantity** | |
| **Compute and determine the reasonableness of results in mathematical and real world situations** | |
| 1 | Estimate limits from graphs or tables. |
| 2 | Estimate numerical derivatives from graphs or tables of data. |
| 3 | Prove statements using mathematical induction. |
| **Algebra** | |
| **Demonstrate basic knowledge of functions, including their behavior and characteristics** | |
| 4 | Predict and explain the characteristics and behavior of functions and their graphs (domain, range, increasing/decreasing intervals, intercepts, symmetry, and end behavior). |
| 5 | Investigate, describe, and determine asymptotic behavior using tables, graphs, and analytical methods |
| 6 | Determine and justify the continuity and discontinuity of functions |
| **Evaluate limits and communicate an understanding of the limiting process** | |
| 7 | Solve mathematical situations and application problems involving or using derivatives, including exponential, logarithmic, and trigonometric functions. |
| 8 | Calculate limits using algebraic methods. |
| 9 | Verify the behavior and direction of non-determinable limits. |
| **Use the definition and formal rules of differentiation to compute derivatives** | |
| 10 | State and apply the formal definition of a derivative. |
| 11 | Apply differentiation rules to sums, products, quotients, and powers of functions. |
| 12 | Use the chain rule and implicit differentiation. |
| 13 | Describe the relationship between differentiability and continuity. |
| **Apply derivatives to find solutions in a variety of situations** | |
| 15 | Define a derivative and explain the purpose/utility of the derivative. |
| 16 | Apply the derivative as a rate of change in varied contexts, including velocity, speed, and acceleration. |
| 17 | Apply the derivative to find tangent lines and normal lines to given curves at given points. |
| 18 | Predict and explain the relationships between functions and their derivatives. |
| 19 | Model rates of change to solve related rate problems. |
| 20 | Solve optimization problems. |

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| **Employ various integration properties and techniques to evaluate integrals** | |
| 21 | State and apply the First and Second Fundamental Theorem of Calculus. |
| 22 | Apply the power rule and u-substitution to evaluate indefinite integrals. |
| **Geometry** | |
| **Use geometric concepts to gain insights into, answer questions about, and graph various implications of differentiation** | |
| 23 | Demonstrate and explain the differences between average and instantaneous rates of change. |
| 24 | Apply differentiation techniques to curve sketching |
| 25 | Apply Rolle's Theorem and the Mean Value Theorem and their geometric consequences. |
| 26 | Identify and apply local linear approximations. |
| 27 | Analyze curves with attention to non-decreasing functions (monotonicity) and concavity. |
| **Statistics and Probability** | |
| **Adapt integration methods to model situations to problems** | |
| 28 | Apply integration to solve problems of area. |
| 29 | Utilize integrals to model and find solutions to real-world problems such as calculating displacement and total distance traveled. |
| **Apply appropriate techniques, tools, and formulas to determine values for the definite integral** | |
| 30 | Interpret the concept of definite integral as a limit of Riemann sums over equal subdivisions. |