Calculus 12 Outcomes

GCO A: Students will demonstrate number sense and apply number theory concepts.
Students will be expected to:

1. Apply, understand and explain average and instantaneous rates of change and extend these concepts to secant line and tangent line slopes (2.4).
2. Demonstrate an understanding of the definition of the derivative (3.1).
3. Demonstrate understanding of implicit differentiation and identify situations that require implicit differentiation (3.7).

GCO B: Students will demonstrate operation sense and apply operation principles and procedures in both numeric and algebraic situations.
Students will be expected to:

1. Calculate and interpret average and instantaneous rate of change (2.1).
2. Calculate limits for function values and apply the properties with and without technology (2.1).
3. Remove removable discontinuities by extending or modifying a function (2.3).
4. Apply the properties of algebraic combinations and composites of continuous functions (2.3).
5. Find where a function is not differentiable and distinguish between corners, cusps, discontinuities, and vertical tangents (3.2).
6. Derive, apply, and explain power, sum, difference, product and quotient rules (3.3).
7. Apply the chain rule to composite functions (3.6).
8. Use derivatives to analysis and solve problems involving rates of change (3.4).
9. Apply the rules for differentiating the six trigonometric functions (3.5).
10. Apply the rules for differentiating the six inverse trigonometry functions (3.8). (Optional)
11. Calculate and apply derivatives of exponential and logarithmic functions (3.9).
12. Apply Newton's method to approximate zeros of a function (4.5). (Optional)
13. Estimate the change in a function using differentials and apply them to real world situations (4.5).
14. Solve and interpret related rate problems (4.6).
15. Demonstrate an understanding of critical points and absolute extreme values of a function (4.1).
16. Find the intervals on which a function is increasing or decreasing (4.2).
17. Solve application problems involving maximum or minimum values of a function (4.4).
18. Apply rules for definite integrals (5.3).
19. Apply the Fundamental Theorem of Calculus (5.4).
20. Solve problems in which a rate is integrated to find the net change over time (7.1).
21. Compute indefinite and definite integrals by the method of substitution (6.2).

22. Apply integration by parts to evaluate indefinite and definite integrals (6.3). (Optional)
23. Solve a differential equation of the form $dy/dx = g(x)h(y)$, in which the variables are separable (6.2). (Optional)
24. Solve problems involving exponential growth and decay (6.4). (Optional)
25. Apply Euler's method to find approximate solutions to differential equations with initial values (6.6). (Optional)

GCO C: Students will explore, recognize, represent, and apply patterns and relationships, both informally and formally.
Students will be expected to:

1. Identify the intervals upon which a given function is continuous and understand the meaning of a continuous function (2.3).
2. Understand the development of the slope of a tangent line from the slope of a secant line (2.4).
3. Find the equations of the tangent and normal lines at a given point (2.4).
4. Demonstrate an understanding of the connection between the graphs of f, and f' (3.1).
5. Apply the First and Second Derivative Tests to determine the local extreme values of a function (4.3).
6. Determine the concavity of a function and locate the points of inflection by analyzing the second derivative (4.3).
7. Solve initial value problems of the form $dy/dx = f(x)$, $y_0 = f(x_0)$ (6.1).
8. Understand the relationship between the derivative and the definite integral as expressed in both parts of the Fundamental Theorem of Calculus (5.4).
9. Construct antiderivatives using the Fundamental Theorem of Calculus (6.1).
10. Find antiderivatives of polynomials, e^{kx}, and selected trigonometric functions of kx (6.1).
11. Construct slope fields using technology and interpret them as visualizations of differential equations (6.1). (Optional)

GCO D: Students will demonstrate an understanding of and apply concepts and skills associated with measurement.
Students will be expected to:

1. Apply and understand how Riemann's sum can be used to determine the area under a polynomial curve (5.1).
2. Demonstrate an understanding of the meaning of area under the curve (5.2).
3. Express the area under the curve as a definite integral (5.2).
4. Compute the area under a curve using a numerical integration procedure (5.2).
5. Apply integration to calculate areas of regions in a plane (7.2).
6. Apply integration (by slices or shells) to calculate volumes of solids (7.3). (Optional)