Calculus 12

Foundational Outcomes

NOVA SCOTIA
NOUVELLE-ÉCOSSE

2021

Website References

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Prepared by the Department of Education and Early Childhood Development

This is the most recent version of the current curriculum materials as used by teachers in Nova Scotia.

Outcomes Framework Calculus 12 **(2021-22)**

The **Foundational Outcomes** identified in this document represent outcomes determined to be relevant for future learning in mathematics. Decisions about foundational outcomes were made in consultation with teachers, provincial mathematics team, Board and Regional Centre staff. In response to feedback, some changes have been made to the 2021-2022 foundational outcomes to ensure continuity of learning within and across grade levels. The foundational outcomes are meant to guide teachers in making decisions about creating learning experiences that will prepare and engage their learners in a responsive way. However, a teacher's professional judgment remains the most important guide to effectively responding to the needs of their learners.

Colour coding has been used to identify outcomes and indicators as foundational (**green**), optional (**orange**) or non-foundational (**red**) for the 2021-2022 school year.

A1 Apply, understand, and explain average and instantaneous rates of change and extend these concepts to secant line and tangent line slopes.
A2 Demonstrate an understanding of the definition of the derivative
A3 Demonstrate an understanding of implicit differentiation and identify situations that require implicit differentiation
B1 Calculate and interpret average and instantaneous rate of change
B2 Calculate limits for function values and apply the properties with and without technology
B3 Remove removable discontinuities by extending or modifying a function
B4 Apply the properties of algebraic combinations and composites of continuous functions
B5 Find where a function is not differentiable and distinguish between corners, cusps, discontinuities, and vertical tangents
B6 Derive, apply, and explain power, sum, difference, product and quotient rules
B7 Apply the chain rule to composite functions
B8 Use derivatives to analyze and solve problems involving rates of change
B9 Apply the rules for differentiating the six trigonometric functions

B10 (Optional) Apply the rules for differentiating the six inverse trigonometric functions (recognition)
B11 Calculate and apply derivatives of exponential and logarithmic functions
B12 (Optional) Apply Newton's method to approximate zeros of a function
B13 Estimate the change in a function using differentials and apply them to real world situations
B14 Solve and interpret related rate problems
B15 Demonstrate an understanding of critical points and absolute extreme values of a function
B16 Find the intervals on which a function is increasing or decreasing
B17 Solve application problems involving maximum or minimum values of a function
B18 Apply rules for definite integrals
B19 Apply the Fundamental Theorem of Calculus
B20 Compute indefinite and definite integrals by the method of substitution
B21 (Optional) Apply integration by parts to evaluate indefinite and definite integrals
B22 Solve problems in which a rate is integrated to find the net change over time
B23 (Optional) Solve a differential equation of the form $dy/dx = g(x)h(y)$, in which the variables are separable
B24 (Optional) Solve problems involving exponential growth and decay
B25 (Optional) Apply Euler's method to find approximate solutions to differential equations with initial values
C1 Identify the intervals upon with a given function is continuous and understand the meaning of a continuous function
C2 Understand the development of the slope of a tangent line from the slope of a secant line
C3 Find the equations of the tangent and normal lines at a given point
C4 Demonstrate an understanding of the connection between the graphs of f and f'.
C5 Apply the First and Second Derivative Tests to determine the local extreme values of a function

C6 Determine the concavity of a function and locate the points of inflection by analyzing the second derivative
C7 Solve initial value problems of the form $dy/dx = f(x)$, $y_0 = f(x_0)$, where f(x) is a function that students recognize as a derivative.
C8 Understand the relationship between the derivative and the definite integral as expressed in both parts of the Fundamental Theorem of Calculus
C9 Construct antiderivatives using the Fundamental Theorem of Calculus
C10 Find antiderivatives of polynomials, ekx, and selected trigonometric functions of kx
C11 (Optional) Construct slope fields using technology and interpret them as visualizations of differential equations
D1 Apply and understand how Riemann's sum can be used to determine the area under a polynomial curve
D2 Demonstrate an understanding of the meaning of area under the curve
D3 Express the area under the curve as a definite integral
D4 Compute the area under the curve using numerical integration procedures
D5 Apply integration to calculate areas of regions in a plane
D6 (Optional) Apply integration (by slices or shells) to calculate volumes