Hamburg Area School District

Course Guide

Name:	Calculus (1475)
Grade(s):	*12*
Length:	*Place an X next to the correct option*
X	Full-Year (180 Sessions)
	Semester (90 Sessions)
	Quarter (45 Sessions)
	Other (Specify):
Text:	Larson. *Calculus: An Applied Approach*. Ninth Edition. 2013. (Cengage Learning)
Approved on:	2007-2008 (Reviewed 2021-2022)

Description:

This is a college level course. The class completes the topics not covered under the Precalculus course outline, then pursues a discussion on curve sketching, differential calculus, and integrals. Other applications in differential and integral calculus are covered as time permits.

Calculus

Unit: Coordinates, Lines, and Graphs
Unit Length: *2 weeks*

ESSENTIAL QUESTION- ESSENTIAL CONTENT	PERFORMANCE OBJECTIVES	STANDARDS/ ANCHORS
Real numbers, sets, and inequalities	Identify differences in number systems. Interpret set notation. Graph and compare inequalities.	M2.8.11.S
Absolute value	Graph absolute value functions. Compare translations, reflections, stretching, and compressing to basic absolute value graphs.	M2.8.11.S
Coordinate planes and graphs	Graph points on a coordinate system. Identify different types of symmetry.	M2.8.11.S
Distance, circles, and quadratics	Derive a formula for distance between two points and midpoint between two points. Write equations and graph circles. Write equations and graph quadratics.	M2.8.11.S

Calculus

Unit: Functions
Unit Length: *2 weeks*

ESSENTIAL QUESTION- ESSENTIAL CONTENT	PERFORMANCE OBJECTIVES	STANDARDS/ ANCHORS
Functions	Define what a function is. Identify properties of functions including domain and range.	M2.8.11.S 2.11.11
Operations on functions	Form functions by using the basic operations. Form functions by using the concept of compositions.	M2.8.11.S 2.11.11
Graphs of functions	Graph functions and forms of functions using transformation. Apply both the vertical and horizontal line tests.	M2.8.11.S

Calculus

Unit: Limits
Unit Length: *3 weeks*

ESSENTIAL QUESTION- ESSENTIAL CONTENT	PERFORMANCE OBJECTIVES	STANDARDS/ ANCHORS
Limits (An intuitive approach)	Estimate limits by using the graphs.	2.11.11
Limits (A computational approach)	Calculate limits algebraically. Derive when a limit does not exist.	2.11.11
Continuity	Describe continuity. Identify lack of continuity when asymptotes occur.	2.11.11
Limits and continuity of trigonometric functions	Calculate basic limits using trigonometric properties and their continuity.	2.11.11

Calculus

Unit: Differentiation
Unit Length: *6 weeks*

ESSENTIAL QUESTION- ESSENTIAL CONTENT	PERFORMANCE OBJECTIVES	STANDARDS/ ANCHORS
Tangent lines and rates of change	Establish a basic relationship between tangent lines and rates of change.	2.11.11.C
The derivative	Define the slope-producing function f. Apply the properties of f'.	2.11.11.C
Techniques of differentiation	Apply the derivative of a constant and a power. Apply the derivative of sums and differences. Apply the derivative of products and quotients. Apply the derivative of a power.	2.11.11.C
Derivatives of trigonometric functions.	Obtain the derivatives of the trigonometric functions. Apply the derivatives of the trigonometric functions.	2.11.11.C
The chain rule	Apply the chain rule for compositions.	2.11.11.C
Implicit differentiation	Apply the rules for implicit differentiation. Compare the differences between explicit and implicit differentiation.	2.11.11.C

Calculus

Unit: Applications of Differentiation
Unit Length: *5 weeks*

ESSENTIAL QUESTION- ESSENTIAL CONTENT	PERFORMANCE OBJECTIVES	STANDARDS/ ANCHORS
Related rates	Find the rate at which some quantity is changing by relating it to other quantities whose rates of change are known.	2.11.11.C
Intervals of increase and decrease; concavity	Determine intervals of increase and decrease by applying the first derivative. Determine intervals of concavity by applying the second derivative.	2.11.11.C
Relative extrema; first and second derivative tests	Locate relative and absolute extrema by applying the derivative tests.	2.11.11.A
Graphs of polynomial and rational functions	Graph these functions with a focus on critical points, inflection points, intervals of increase and decrease, concavity, and points of discontinuity.	2.11.11.B
Cusps and vertical tangents	Graph functions with the characteristics of cusps and vertical tangents.	2.11.11.B
Maximum and minimum values of a function	Determine maximum and minimum values of a function.	2.11.11
Applied maximum and minimum problems	Apply the concepts of maximum and minimum to problems of optimization.	2.11.11
Rolle's theorem; mean-value theorem	Determine Rolle's theorem.	2.11.11

	Determine the mean-value theorem.	
Motion along a line	Apply the derivative to show particle motion.	2.11.11

Calculus

Unit: Integration
Unit Length: *5 weeks*

ESSENTIAL QUESTION- ESSENTIAL CONTENT	PERFORMANCE OBJECTIVES	STANDARDS/ ANCHORS
Antiderivatives; the indefinite integral	Define the antiderivative. Find the indefinite integrals.	2.11.11.E
Integration by substitution	Apply integration by substitution for indefinite integrals.	2.11.11.E
Areas as limits	Find area by applying the summation formulas and using the concept of a limit.	2.11.11.D
The definite integral	Define the definite integral. Find the definite integrals.	2.11.11.E
The first fundamental theorem of calculus	Apply the first fundamental theorem of calculus to find the definite integrals.	2.11.11.E
Evaluating definite integrals by substitution	Apply integration by substitution for definite integrals. Apply integration by parts for definite integrals.	2.11.11.E
The mean-value theorem for integrals; the second fundamental theorem of calculus	Determine the value found by the mean-value theorem for definite integrals. Apply the second fundamental theorem of calculus to determine which functions actually have antiderivatives.	2.11.11.E

Calculus

Unit: Applications of the Definite Integral
Unit Length: *4 weeks*

ESSENTIAL QUESTION- ESSENTIAL CONTENT	PERFORMANCE OBJECTIVES	STANDARDS/ ANCHORS
Area between two curves	Determine the area between two curves.	2.11.11.E
Volumes by disks and washers	Determine the volume of a three-dimensional solid by the disk method. Determine the volume of a three-dimensional solid by the washer method.	2.11.11.E
Volumes by cylindrical shells	Determine the volume of a three-dimensional solid by the shell method.	2.11.11.E
Application of integration to motion along a line	Determine motion along a line by integration.	2.11.11.E

Calculus

Unit: Logarithm and Exponential Functions
Unit Length: *3 weeks*

ESSENTIAL QUESTION- ESSENTIAL CONTENT	PERFORMANCE OBJECTIVES	STANDARDS/ ANCHORS
Inverse functions	Find inverse functions. Prove inverse functions. Graph inverse functions.	2.11.11.C
Logarithms and irrational exponents	Review the rules for exponents and logarithms.	2.11.11.C
Differentiation and integration of the natural logarithm	Apply the rules for differentiation of lnx functions. Apply the rules for integration of lnx functions.	2.11.11.C 2.11.11.E
Differentiation and integration of exponential functions	Apply the rules for differentiation of exponential functions. Apply the rules for integration of exponential functions.	2.11.11.C 2.11.11.E
Graphs of equations involving exponentials and logarithms	Find the limits at points on the graphs of equations involving exponentials and logarithms.	2.11.11.C