Teacher: Core Multi Variable Calculus with Advanced Topics	Year: 2017-18
Course: Multi Variable Calculus with Advanced Topics	Month: All Months

S Vectors and Geometry of Space

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Essential Questions	Content	Knowledge and Skills	Vocabulary	Assessments	Lessons	Resources	Standards
p How do patterns and functions help us describe data and physical phenomena and solve a variety of problems?	Conic Sections	Graph points in a plane in three dimensions	conic sections				
t How are quantitative relationships represented by numbers?	Vectors	use the distance formula	parametrization				
e How do geometric relationships and measurements help us to solve problems and make sense of the world?	Parmetrized Curves	describe and sketch regions involving spheres	polar coordinates				
m	Polar Coodinates	describe vectors algebraically, graphically, and verbally.	vector functions				
b		compute with vectors using properties of vectors and vector operations.	scalar				
e		solve problems involving force and velocity using components of vectors.	magnitude				
r		compute the dot product of vectors.	dot product				
		use dot product to determine the angle between two vectors.	cross product				
			orthogonal vectors				
			cylindrical coordinates				

O Vectors and Geometry of Space

c

Essential Questions	Content	Knowledge and Skills	Vocabulary	Assessments	Lessons	Resources	Standards
t How do patterns and functions help us describe data and physical phenomena and solve a variety of problems?	Conic Sections	find scalar and vector projections.	conic sections				
o How are quantitative relationships represented by numbers?	Vectors	compute and use cross products.	parametrization				

b	How do geometric relationships and measurements help us to solve problems and make sense of the world?	Parmetrized Curves	compute and use scalar and vector triple products.	polar coordinates
e		Polar Coodinates	compute and use vector and parametric equations of lines.	vector functions
r			compute and use equations of planes.	scalar
			sketch graphs and describe properties of functions in two variables.	magnitude
			work with quadratic susrfaces.	dot product
			convert from one coordinate system to another.	cross product
			graph functions given in spherical and cylindrical coordinates.	orthogonal vectors
				cylindrical coordinates

N Vector Functions

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Essential Questions	Content	Knowledge and Skills	Vocabulary	Assessments	Lessons	Resources	Standards
v	Vector Function	sketch and recognize graphs of space curves given parametrically.	Component Test for Continuity				
e	Derivative of a Vector Function	find the domain, range, and limits of vector functions.	Velocity Vector				
m	Integral of a Vector Fuction	compute the derivatives of vector functions.	Acceleration Vector				
b	Curvature	determine tangent vectors of space curves	Projectile Motion				
e	Parametric Surface	computing the arc length of space curves	Arc length				
r		parameterize curves with repect to arc length.	Curvature				
			Torsion				
			Tangent Components				
			Normal Components				
			Planetary Motion				

D Vector Functions

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Essential Questions	Content	Knowledge and Skills	Vocabulary	Assessments	Lessons	Resources	Standards
c	Vector Functions	compute the curvature of a curve.	Component Test for Continuity				
e	Derivative of a Vector Function	compute the normal and binormal vectors and the associated planes of a curve.	Velocity Vector				
m	Integral of a Vector Function	compute the velocity and acceleration of a particle.	Acceleration Vector				

b		Parametric Surfaces	solve problems involving motion, acceleration, or force.	Projectile Motion				
e			graph and recognize parametric surfaces.	Arc length				
r			find parametric representations of surfaces.	Curvature				
				Torsion				
				Tangent Components				
				Normal Components				
				Planetary Motion				
J	Partail Derivatives							
a								
	Essential Questions	Content	Knowledge and Skills	Vocabulary	Assessments	Lessons	Resources	Standards
n		Partial Derivative	find domain and range of functions of two variables.	Bounded/Unbounded				
u		Directional Derivative	decribe the level surfaces of functions with three variables.	Contour Lines				
a		Gradient Vector	determine if a function f(x,y) has a limit at (a,b).	Limits and Continuity				
r		Lagrange Multiplier	determine the points of continuity of a function of f(x,y).	Second Order Partial Derivatives				
y			compute and interpret partial derivatives.	Linearization				
			use Clairault's Theorem to compute higher partial derivatives.	Differentials				
			verify whether or not a given function satisfies a partial differentiation equation.	Chain Rule				
			compute the tangent plane to a surface given by a function of two variables.	Implicit Differentiation				
			determine if a function is differentiable.	Directional Derivatives				
			use linearization to approximatthe values of a function.	Gradient				
				Tangent Planes				
				Saddle Points				
				Lagrange Multipliers				
F	Partial Derivatives							
e								
	Essential Questions	Content	Knowledge and Skills	Vocabulary	Assessments	Lessons	Resources	Standards
b		Partial Derivatives	compute tangent planes to parametric surfaces.	Bounded/Unbounded				
r		Directional Derivatives	compute derivatives using the chain rule.	Contour Lines				

u	Gradient Vector	use implicit differentiation to compute derivatives.	Limits and Continuity	
a	Lagrange Multiplier	compute directional derivatives.	Second Order Partial Derivatives	
r		find and apply the gradient vector.	Linearization	
y		find tangent planes and normal lines to level surfaces.	Chain Rule	
		find local maximum and minimum values.	Implicit Differentiation	
		compute the absolute minimum and maximum values of a function.	Directional Derivatives	
		determine the saddle points of a function.	Gradient	
		use the method of Lagrange multipliers to determine the extreme values of a function subject to constraints.	Tangent Planes	
			Saddle Points	
			Lagrange Multipliers	

M Multiple Integrals

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Essential Questions	Content	Knowledge and Skills	Vocabulary	Assessments	Lessons	Resources	Standards
r		use a double Riemann Sum to approximate integrals.					
c		evaluate double integrals by computing volumes.					
h		evaluate double integrals over general regions.					
		evaluate double integrals over polar regions.					
		use double integrals to compute mass.					
		compute moments of inertia and centers of mass.					

A Multiple Integrals

p

Essential Questions	Content	Knowledge and Skills	Vocabulary	Assessments	Lessons	Resources	Standards
r		Compute Triple Integrals.					
i		apply Fubini's theorem.					
l		apply triple integrals to problems of volume, density, and mass.					
		compute triple integrals using cylindrical coordinates.					
		compute triple integrals using spherical coordinates.					

find the image of a set under a transformation.
compute the Jacobian of a transformation.
use change of variables to simplify and evaluate multiple integrals.