Course Guide Advanced Calculus: Spring 2026:

Date	Topic classes begin 1-19	Lecture Notes/ Text	Assignment
T: 1-20	vector spaces, norms, topological foundations	p. 9-27 / no need	
R: 1-22	limits, continuity, sequences	p. 9–27 / no need	
T: 1-27	Frechet derivative, partial differentiation and directional derivatives	p. 29-58 / no need	
R: 1-29	one chain rule to rule them all and product rules galore	p. 29-58 / no need	
T: 2-3	higher derivatives, calculus over an algebra, partial derivatives commute	p. 29-58 / no need	
R: 2-5	inverse mapping thm, implicit function thm. & implicit differentiation	p. 59-81 / no need	Tour 1 Due
T: 2-10	an implicit and explicit talk about tangent and normal spaces	p. 83-96 / no need	
R: 2-12	optimization on the edge, the Lagrange multiplier technique	p. 83-96 / no need	
T: 2-17	a study of quadratic forms & local extrema	p. 97-116 / no need	
R: 2-19	Contraction mapping arguments, survey of existence proofs	p. 229-264 / no need	Tour 2 Due
T: 2-24	variational calculus (the Euler-Lagrange Equations)	p. 113-132 / no need	
R: 2-26	Henchman Fight 1		
T: 3-3	Boss Fight 1		
R: 3-5	tensors and their coordinate change	p. 133-165 / Chapter 2	
T: 3-10	wedge products, flux and work form, determinants	p. 133-165 / Chapter 2	
R: 3-12	more on metrics and musical morphisms, more on Hodge duality	p. 133-165 / Chapter 2	
	March 16-20, Spring Break		
T : 3-24	manifolds, partial differentiation on manifold, derivation, push-forwards	p. 167-214 / Chapter 3	
W: 3-25	Assessment Day: no class.		
R: 3-26	differentials as the dual basis, tensor fields, exterior derivatives,	p. 167-214 / Chapter 3	Tour 3 Due
T : 3-31	pull-backs, Lie derivative, flows, Cartan's formula etc.	p. 167-214 / Chapter 3	
R: 4-2	exact and closed forms, Poincare Lemma, potential theory	p. 167-214 / Chapter 4	
M: 4-6	Easter Monday		
T: 4-7	Generalized Stokes' Theorem & Electromagnetism in 4D or 5D	p. 203-227 / Chapter 6	
R: 4-9	Matrix Lie Groups and Lie Algebras	Supplement/Chapter 3	Tour 4 due
T: 4-14	Frobenius Theorem as seen from distributions and flows	Supplement/Appendix F	
R: 4-16	Frobenius Theorem as seen from annihilating one forms and kernels	Supplement/Appendix F	
T: 4-21	Riemannian Geometry and the flatness problem	Supplement /Chapter 8	
R: 4-23	Cartan's Calculus of Frames Part 1	Supplement	
T: 4-28	Cartan's Calculus of Frames Part 2	Supplement	Tour 5 due
R: 4-30	Henchman Fight 2		
T: 5-5	Boss Fight 2		
W: 5-6	Reading Day (May 6)		
T: 5-12	Final Boss Fight (May 12, 10:30-12:30, Tuesday)		

Course Guide Advanced Calculus: Spring 2026:

Grading: usual 1000pt scale with:

Boss Fight 1 = 200pts,
Boss Fight 2 = 200pts,
Henchmen Fights = 100pts (these are like practice tests to help you get up to speed for the Boss Fight)
Tours = 300pts, (I'll keep the highest 4 of the 5, there is some bonus to earn here)
Final Boss Fight = 200pts.

Grade Replacement Policy: the Final Boss Fight may replace the grade for Boss Fight 1 or 2 if helpful.

Advice: There really is no substitute for working through the Missions. They cannot be done quickly. They will required sustained effort over several days for best results. If you understand the Missions then the Boss Fights should be unsurprising. Once the solution to the Mission is posted submissions are no longer accepted. Otherwise there is a 10pt per day late penalty. It is best practice to turn them in at the start of class when they are due.

I do not take off points for missed classes, but you should come to class and pay attention for best results. If you plan to work on other classes during my class then please do not attend. My email is jcook4@liberty.edu. (Canvas Messaging does not work well, please use email instead)