MTH 534, Differential Geometry  
Oregon State University

Catalog Description: Curves and surfaces in Euclidean space; geodesics; curvature; introduction to tensor algebra and differential forms; selected applications.

Credits: 3  (This course combines approximately 90 hours of instruction and assignments.)

Terms offered: W

Prerequisites: Enforced: MTH 255 and MTH 342 with C- or better, or instructor permission. Recommended: MTH 311.

Meets: Three 50 minute lectures weekly.

Course Content: Curves, Frenet-Serret frames, covariant derivatives, connection forms, surfaces in R^3, differentiable functions and tangent vectors, differential forms on a surface, mappings of surfaces, integration of forms, topological properties of surfaces, manifolds, the shape operator on a surface, normal and Gaussian curvature, special curves in a surface and surfaces of revolution.


Math 534 Student Learning Outcomes: A successful student in MTH 534 will be able to:

• Write clear and concise arguments involving the use of the cross product and the dot product in R^3 as well as 1-, 2- and 3-forms in R^3.

• Write clear and concise arguments involving basic notions and constructions of 1-dimensional Riemannian geometry in R^3, as well as identify curves whose curvature and torsion is constrained and be able to understand and repeat proofs of basic recognition theorems about curves.

• Write clear and concise arguments involving basic notions and constructions of 2-dimensional Riemannian geometry in R^3 including the definition of surfaces in R^3, the definition of the shape operator of a surface in R^3, as well as the identification of important types of curves in surfaces, including principal curves, asymptotic curves and geodesics.

• Define and write logical arguments involving standard geometrical properties such as Gaussian and mean curvature, principal curvatures. Be able to derive basic proofs involving properties of the shape operator as it relates to the Gaussian and mean curvatures.

• Identify and enumerate some standard examples in geometry, such as surfaces of constant Gaussian curvature, compact and non-compact surfaces, surfaces of revolution.

• Compute Gaussian and mean curvatures via a variety of methods including patch computations, direct calculation of the shape operator and be able to verify these in special cases such as surfaces defined implicitly and surfaces of revolution.

• Articulate connections between geometry and other disciplines, possibly including topology, algebra, analysis, or applied mathematics.
Evaluation of Student Learning: Your grade and measurement of your progress on the course outcomes will be based on written homework (assigned in class and collected approximately weekly) along with written midterm and final exam. Additional in-class activities will include problem sessions with blackboard presentations.

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<thead>
<tr>
<th>Component</th>
<th>Weight</th>
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<tbody>
<tr>
<td>Homework</td>
<td>30%</td>
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<tr>
<td>Midterm Exam</td>
<td>30%</td>
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<tr>
<td>Final Exam</td>
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<td>In-Class Activities</td>
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Student learning for Math 434 and 534 will be respectively evaluated using the differentiated learning outcomes.

You may collaborate on homework but you should write up your own solutions in your own words. If you use external sources, you should cite them. The midterm and final exams will be closed book.

Students With Disabilities: Accommodations are collaborative efforts between students, faculty and Disability Access Services (DAS). Students with accommodations approved through DAS are responsible for contacting the faculty member in charge of the course prior to or during the first week of the term to discuss accommodations. Students who believe they are eligible for accommodations but who have not yet obtained approval through DAS should contact DAS immediately at 737-4098. Consult http://ds.oregonstate.edu/home.

Academic Honesty and Student Conduct: Students are expected to be familiar with the Homework and Exam policies stated in this syllabus, as well as Oregon State University's Student Conduct Code.