

## 92.427/92.527 Geometry

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Marvin Stick, Olney 428 G, (978)934-2441, [Marvin\\_Stick@uml.edu](mailto:Marvin_Stick@uml.edu)

**Note that this is a preliminary version of the syllabus. Page numbers and problem numbers will be adjusted for the 6<sup>th</sup> edition that will be used. Listed homework as shown is for the 5<sup>th</sup> edition.**

### Overview

This course is designed for current and prospective geometry teachers. Most of the term will be devoted to a technical and instructive development of Euclidean geometry. Included will be discussions and applications of transformational geometry with translations, reflections, rotations and dilations. We will also discuss tessellations and fractals and examine software generated applications. There will also be an introduction to non-Euclidean geometries (spherical and hyperbolic geometry) and we will compute triangle measurements for each type. The interrelationship between the geometry topics and higher-level mathematics material will be discussed whenever appropriate. In particular, we will discuss 3D surfaces, compute areas of spherical triangles, find angles of a hyperbolic triangle, and will perform calculus based derivations of area and volume for surfaces and solids and relate them to Euclidean geometry. Discovery through the use of technology will be an integral part of the course. Students will become familiar with geometry applications in Geometer's Sketchpad software, and to a lesser degree with Maple and Mathematica. Technology projects will be assigned and competence in the geometry tools is expected. Students will also be exposed to the use of the online software Geogebra and Cabri for a graphing calculator environment.

### Evaluation

Evaluation will be based on two projects worth 12 points each, classroom participation worth 3 points, three quizzes and three assignments worth eight points each, and a take home examination worth 30 points,. One of the quizzes will be take home quiz. It is expected that participants will frequently present in class problem and project solutions. Grading will be consistent with University established guidelines for undergraduate and graduate students.

A tentative schedule for all work due is:

Project one, 12 points, due 7/16

Quiz one, 8 points, due 7/21

Assignment one, 8 points, due 7/23

Quiz two, 8 points, due 7/28

Assignment two, 8 points, due 7/30

Take home quiz three, 8 points, due 8/4

Project two, 12 points, due 8/6

Assignment three, 8 points, due 8/11

Take home exam, 30 points, due 8/13

### Text

Alexander and Koeberlein, *Elementary Geometry for College Students*, 6th edition, Cengage Learning, 2015 and accompanying student solution manual. The UML bookstore will carry the text and student manual. The texts are available separately and may be able to be obtained through Amazon or other online sites at a reduced price. There will also be handouts and online files to address material dealing with spherical and hyperbolic geometry, transformations in geometry, and explorations with Euclidean geometry.

### Tools

In addition to the textbook, the geometry software that will be used is:

- Geometer's Sketchpad: student edition in both a PC and Mac platform. This is the primary tool to be used throughout the course. There are two versions: single-student home use for one year license for version 5 and a single-student home use non-expiring license for version 5. For both products, installations can be done on up to three personal computers provided only one copy of Sketchpad is used at a time. Both versions are downloadable and are dual platform, i.e. will work on either a Mac or PC for any of the three installations. The main website for all resources is at <http://www.keycurriculum.com>. The main telephone

number for Key Curriculum Press is (800)995-6284. The UML bookstore will carry the code for the non-expiring version 5. Their price does not include a handling cost that may exist at the Key Curriculum Press site.

Cabri for the TI-89 can be downloaded from [education.ti.com](http://education.ti.com). Cabri Jr. is an application provided with the TI-84 Plus Silver Edition. Also a PC or Mac demo version of Cabri can be downloaded from the same site. It is suggested that students wait to discuss in class the pros and cons of these packages before making any purchase.

### Links

A few links that should prove to be helpful are:

- Massachusetts Department of Education MCAS material at [www.doe.mass.edu/mcas](http://www.doe.mass.edu/mcas)
- Cabri geometry reference material can be found at a Texas Instrument's web site [education.ti.com](http://education.ti.com)
- Course material at [92.427/92.527](http://92.427/92.527)

<u>Section</u>	<u>Topic</u>	<u>Homework</u>
Chapter 1	Line and Angle Relationships	
1.1	Statements and Reasoning	p.8/1-23 odd
1.2	Informal Geometry and Measurement	p.18/1-13 odd, 17-27 odd
1.3	Early Definitions and Postulates	p.28/9-31 odd
1.4	Angles and Their Relationships	p.37/1-13 odd, 17-41 odd
1.5	Introduction to Geometric Proof	p.44/7-15 odd,21,22,23,29
1.6	Relationships: Perpendicular Lines	p.50/3-15 odd,25
1.7	The Formal Proof of a Theorem	p.58/1-15 odd,25,27,29
Chapter 2	Parallel Lines	
2.1	The Parallel Postulate and Special Angles	p.78/5-19 odd,33,35
2.2	Indirect Proof	p.84/1-23 odd
2.3	Proving Lines Parallel	p.91/7-25 odd,31,33
2.4	The Angles of a Triangle	p.96/11-19 odd,23,25,31,43,45
2.5	Convex Polygons	p.105/1-13 odd,20,27,29,31,37
2.6	Symmetry and Transformations	p.115/1-31 odd
Chapter 3	Triangles	
3.1	Congruent Triangles	p.134/1-17 odd,21-29 odd
3.2	Corresponding Parts of Congruent Triangles	p.142/1-15 odd,23,25
3.3	Isosceles Triangles	p.151/13-33 odd
3.4	Basic Constructions Justified	p.158/3-11 odd,15,21,23,29,31
3.5	Inequalities in a Triangle	p.165/1-9 odd,13,19-27 odd,31,33
Chapter 4	Quadrilaterals	
4.1	Properties of a Parallelogram	p.184/3-15 odd, 23,25,35
4.2	The Parallelogram and Kite	p.193/3-13 odd,19,23,25,27
4.3	The Rectangle, Square, and Rhombus	p.201/1-5 odd,9,19,23
4.4	The Trapezoid	p.208/1,3,6,11,15,17,37
Chapter 5	Similar Triangles	
5.1	Ratios, Rates, and Proportions	p.224/3-9 odd,15-27 odd
5.2	Similar Polygons	p.230/7-17 odd,21-35 odd
5.3	Proving Triangles Similar	p.240/11-27 odd,31,33,37,39
5.4	The Pythagorean Theorem	p.250/7,11-19 odd,27-35 odd,39,41
5.5	Special Right Triangles	p.257/5,9,21,24,25,27,31
5.6	Segments Divided Proportionally	p.265/1,7,15,17,21,31,33,34,35,37
Chapter 6	Circles	
6.1	Circles and Related Segments and Angles	p.286/1-5 odd,9-27 odd,35
6.2	More Angle Measures in the Circle	p.296/1,3,6,7,9,13,23,27,29,34,41,47
6.3	Line and Segment Relationships in the Circle	p.306/1,28,29,33,35,37,42

6.4	Some Constructions and Ineq. for the Circle	p.314/9,11
Chapter 7	Locus and Concurrence	
7.1	Locus of Points	p.329/2-9 odd,13,23
7.2	Concurrence of Lines	p.336/7-21 odd,27,29,31
7.3	More About regular Polygons	p.343/1-7 odd,13,15,19,21,23,26-29,31
Chapter 8	Areas of Polygons and Circles	
8.1	Area and Initial Postulates	p.359/1,5,11,13,15,19,21,22, 25-29 odd,33,35,41,47,49
8.2	Perimeter and Area of Polygons	p.370/1,3,5,9,13,15,21,23,27,38,41,42
8.3	Regular Polygons and Area	p.378/7,13,15,17,21,29,31
8.4	Circumference and Area of a Circle	p.384/1,5,7,9,15,21,27,33,34,35
8.5	More Area Relationships in the Circle	p.391/1-13 odd,17,23,27
Chapter 9	Surfaces and Solids	
9.1	Prisms, Area, and Volume	p.411/1,7,9,14,17,31,33,34,35
9.2	Pyramids, Area, and Volume	p.421/19,20,27,29,31,34,35
9.3	Cylinders and Cones	p.431/11,19,21,29,36,41,42
9.4	Polyhedrons and Spheres	p.440/10,13,15,17,18,21,26,34,35,37,39
Chapter 10	Analytic Geometry	p.488/46
Chapter 11	Introduction to Trigonometry	
11.1	The Sine Ratio and Applications	p.502/21,23,27,29,33,34
11.2	The Cosine Ratio and Applications	p.509/1,17,31,33,36,40
11.3	The Tangent Ratio and Other Ratios	p.517/37,40,41,46
11.4	Applications with Acute Triangles	p.527/29,31,37,38