BOB JONES *University*

College of Arts and Sciences
Division of Mathematical Sciences

Ma 211

Theory of Geometry

Fall/2023

Instructor:	Dr. Kathy Pilger
Office:	AL 55
Office Hours:	2 p.m. M-F, Others by appointment
Email:	kpilger@bju.edu (This is the best way to contact me. I read email often.)
Textbook(s):	*Elementary Geometry for College Students*, by Alexander, D.C. & Koeberlein, G.M, (7th ed.), Cengage, 2020, ISBN: 978-1-337-61408-5.
	Welcome to WebSketchpad (geometricfunctions.org)

Catalog Description:
Structure of proof, deductive reasoning, a survey of the theory of Euclidean geometry with an emphasis on proofs involving lines, angles, triangles, polygons, circles, and 3-D figures including transformational geometry and analytical geometry. Experience with Mathematical Action Technology (MAT) such as Web sketchpad /Desmos/Geogebra.

Context: The faculty of the Division of Mathematical Sciences has developed four broad goals and has aligned these goals with the Bob Jones University Institutional Goals and Liberal Arts Core. The Division Goals (DG) are as follows:

The student will…

1. Understand the essential theory of mathematics … and appropriately apply the theory in solving problems.
2. Use critical-thinking/analytical skills to understand mathematical … problems and design solutions with the aid of appropriate tools.
3. Apply an understanding of how mathematics/computing can be used in service to Christ as tools to the examination of the world He created.
4. Construct a foundation upon which they, after graduation, can continue the development of their God-given abilities and the learning necessary for work and life.

Course Goal (CG):

1. To develop a Christian perspective of geometry (DG 3, 4)
2. To develop Christlike qualities such as perseverance, diligence, and dependence on God. (DG 3, 4)
3. To develop mathematical maturity and independent thinking (DG 1, 2, 3)
4. To develop a greater appreciation for the beauty and power of geometry (DG 2, 3, 4)
5. To develop a greater interest in exploring mathematical ideas independent of the teacher (DG 1, 2, 3, 4)
6. To develop the foundation of Euclidean geometry (DG 1, 2)

Course Objectives: With at least 70% accuracy, the student will be able to do the following:

Course Objectives	Course Goals Supported	Course Content	Primary Assessment
A. Reason, construct, and evaluate mathematical arguments and develop an appreciation for mathematical rigor and inquiry. (NCTM/CAEP 1e, 2b)*	3, 5	Chapters P, 1, 2	Geometry Proof Portfolio
B. Recognize reasoning and proof as fundamental aspects of mathematics. (NCTM/CAEP 1e, 2b)	3, 4	Chapters P, 1, 2, 3	Tests
C. Make and investigate mathematical conjectures. (NCTM/CAEP 1e, 2b)	3, 5	Chapters P, 4, 5	Tests
D. Use spatial visualization, dynamic geometric software and geometric modeling to explore and analyze geometric shapes, structures, and their properties. (NCTM/CAEP 4c)	2, 3, 4, 5, 6	Chapters 3, 4, 6	Polyhedra Project

E.	Demonstrate knowledge of core concepts and principles of Euclidean geometry in two and three dimensions. (NCTM/CAEP 1e, 2b, 4c, 4d)	4, 6	Chapter P, 1, 2, 3, 4, 5, 6, 8, 9	Test
F.	Specify locations and describe relationships using coordinate geometry. (NCTM/CAEP 1e, 4d)	3, 5, 6	Chapter 10	Self-Study Project
G.	Demonstrate knowledge of the historical development of Euclidean and non-Euclidean geometries including contributions from diverse cultures.	1, 4, 6	Chapter P, 1, 2, 3, 4, 5, 6, 8, 9	Paper/Perspective On History Readings
H.	Perform transformations in the plane including reflections, rotations, translations, glide reflections and dilations and relate these to congruence and similarity. (NCTM/CAEP 1e, 2b, 4c, 4d)	2, 3, 4, 5, 6	Chapter 2, Transfor-mation Handouts	Transformational Geometry Project

*NCTM/CAEP Program Standards 2020

General Policies:

Materials Requirements:

Straightedge and compass

Course Reading:

The textbooks should be read thoroughly. Students are responsible for all the information in the textbook.

Assignments:

A. **Historical Paper (30 points)** - A paper on a historical figure in the development of Geometry is required. Be sure to include a reference section. You should have at least one print source in your references. The paper should include the life, culture and works of one of the following mathematicians. Include the mathematicians work on Euclid's Parallel Postulate. Each student will be required to choose a different figure to research and write about so that a collection of papers can be made and distributed to the members of the class.

Archimedes (Greek)
Claudius Ptolemy (Greek)
Proclus (Greek)
Appollonius of Perga (Greek)
Zhang Heng (Chinese)
Thabit ibn Qurra (Islamic)
Giovanni Ceva (Italian)
Leonardo da Vinci (Italian)
John Playfair (Scottish)
Farkas Bolyai (Hungarian)
John Wallis (English)
Girolamo Saccheri (Italian)
Johann H. Lambert (German)
Adrain Marie Legendre (French)
Nicolai Lobachevsky (Russian)
Juanos Bolyai (Hungarian)
Bernhard Riemann (German)
August Mobius (German)
Benoit Mandelbrot (Polish)
Magnus Wenninger (American)

B. **Transformational Geometry Project (80 points)** – This project will assess understanding of basic Transformational Geometry and its application to real-world problems as well as congruence and similarity. Students will be able to use their notes and the Canvas source materials to work through this project.

C. **Construction Project (50 points) –** After you are exposed to a variety of basic constructions early in the course, you will be introduced to an online tool called Constructions - Math Open Reference. Using the knowledge learned from the textbook and this reference tool, you will complete a take-home construction project using only a straightedge and compass.

D. **Geometry Proof Portfolio (100 points)** – This assignment requires you to demonstrate a knowledge of geometry proof techniques discussed in class. You will be given ten geometric statements, eight of which are to be completed and included in a professionally designed Geometry Proof Portfolio. You may work on these problems and submit proposed solutions to me. The proofs may be e-mailed to me a maximum of two times to be critiqued. I will make recommendations about these solutions (such as, “Start over”, Wonderful – don’t make any changes.”) If necessary, you should then consider rewriting and resubmitting the proofs for further comment. Professional math type and diagrams are required.

E. **Self-Study Chapters –** See required problems on Schedule.
Chapter 7 (30 points)
Chapter 10 (50 points)

F. **Pocket-sized Pop-up Polyhedra Project (80 points)** – Go to Canvas to find the *Mathematics Teacher* article called *Ponderings on Pocket-sized Polyhedra* by S. Louis Gould and the rubric for this project. After reading this article, research the ideas of Platonic Solids and Euler's Formula. Write a two-page paper describing, defining, and discussing these ideas and the article. Be sure to include a third page of references and include at least one print source. The paper is worth 30 points. The other 50 points that make up the project involves working through the activities found in the article using a web-based tool called *WebSketchPad* found at geometricfunctions.org . Each correctly constructed pop-up polyhedra that is turned in will count 10 points to make a total of 50 points for the polyhedra. You should turn in five polyhedra to earn the maximum number of points on the construction part of the project. You should create a tetrahedron, cube, octahedron, dodecahedron and icosahedron. These should be quality products that you would be pleased to use in a real classroom setting in the future.

Grading Scale:

90% - 100%	A
80% - 89%	B
70% - 79%	C
60% - 69%	D

Homework:

Homework problems (10 points per chapter) will be assigned and should be attempted before the next class period. These problems will be discussed in class and students will present solutions in class for selected problems. A completed homework summary sheet will be uploaded to Canvas for each chapter.
Daily Practice Problems (4 points per week) Class will begin each day with a DPP. These problems are intended to keep students current with the material being presented in class and will help and not hurt you.

Extra Credit:

Four points of extra credit can be earned for each Chapter covered in class. Self-study chapters are not included. The extra credit requires completion of the Chapter Test found at the end of each chapter. The extra credit can be turned in on the day of the associated Chapter Test or on the day of the Final Exam.

Help:

Whenever Mack Building is open you have a free math tutor. Go to the Math Lab on second floor of Mack Building, ML 1. There you will find a qualified upperclassman math student who is willing and capable to help you.

Classroom Deportment:

Compliance with student handbook policies is expected during class.

Attendance Policy:

Regular attendance is very important in this class. If you miss a class you will be missing some essential information that will help you be more successful in your career. I will follow the BJU Attendance Policy that is set forth in your Student Handbook. For additional information, please see the Bob Jones University 2023-24 Student Handbook.

Naturally, if you are absent on a day when you have been informed in advance that work is due, then the late policy is (10% deduction for each calendar day late) and applies for that assignment regardless of the nature of the absence.

Academic Integrity:

Doing your own work brings Glory to God. The claiming of someone else's work as your own is cheating and is a sin. All work done for this class needs to be your own. If information is taken from other sources, it always needs to be referenced and credit given where it is due. Since the goal of the assignments in this course is to learn to develop the skills covered NOT complete the tasks assigned, and since the use of AI to complete or jumpstart tasks defeats the goal of the assignments, you may not use generative AI tools (i.e. Chat GPT, Bing Chat, Google Bard, etc.) in this course for any assignment without the professors express permission. Should an AI tool be used with permission, its use must be documented. I value academic integrity. Therefore, I will take appropriate action if cheating or plagiarism occurs in this course. For additional information, please see the Bob Jones University 2023-24 student handbook.

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Tentative Schedule			
Date	Day	Class	Assignment Due on this Date
8/23	W	Intro, P.1	
8/25	F	P.1, P.2	
8/28	M	P.2	**P.1:** 9, 11, 13-17, 19, 21, 25, 27, 31-37 (odd)
8/30	W	P.3	**P.2:** 1, 3, 5-11, 13-27 (odd), 31-35 (odd)
9/1	F	1.1	**P.2:** 39-43 (odd), 49-55 (odd), 56; **P.3:** 4-6, 9-17, 19-23
9/4	M	**Labor Day**	
9/6	W	1.2, 1.3	**P.3:** 27, 33-37 (odd), 40, 41, 43, 47; 1.1: 2, 3, 5-10, 13-15, 17, 19, 23, 25-27, 29-35 (odd), 38, 41
9/8	F	1.4	**1.2:** 1, 3, 5-11, 13, 17-27 (odd), 31-37 (odd), 41, 43, 46; **1.3:** 1-11 (odd), 12-16, 23-31 (odd), 35-39 (odd)
9/11	M	1.5	**1.4:** 1-5, 7-19 (odd), 23, 26, 28
9/13	W	2.1, 2.2	**Historical Paper Due** **1.5:** 1-9 (odd), 10-11, 13-33 (odd)
9/15	F	2.2, 2.3	**2.1:** 1-7 (odd), 8, 9-23 (odd), 27-31 (odd), 37, 39
9/18	M	2.4, 2.5	**2.2:** 1-21 (odd), 25, 27, 35; 2.3 3-23 (odd), 27-37 (odd)
9/20	W	Review, 2.6	**2.4:** 3-33 (odd), 37, 39, 45, 49; **2.5:** 1-19 (odd), 23-27, 31, 33-35, 37, 41, 45, 49
9/22	F	**Ch. P-2 Exam**	**Ch. P-2 Exam**
9/25	M	Transformational Geo.	**2.6:** 1-9 (odd), 13-23 (odd), 27, 31-35 (odd)
9/27	W	3.1	
9/29	F	3.2, 3.3	**3.1:** 1-9 (odd), 10-13, 15-21 (odd), 22-25, 27-37 (odd), 43
10/2	M	3.4	**Transformational Geometry Project Due** **3.2:** 1, 3, 7, 9, 13, 17-29 (odd), 33, 37, 41, 43, 44
10/4	W	3.5	**3.3:** 1-7 (odd), 11-23 (odd), 27, 29, 33, 35, 41-43, 49
10/6	F	4.1	**3.4:** 3, 5, 13, 15, 17, 21, 25, 29, 31, 35, 38; **3.5:** 3, 7, 9, 13-19 (odd), 23, 27, 29, 31, 35
10/9	M	4.2, 4.3	**4.1:** 3-11 (odd), 15, 17, 21-25 (odd), 29-35 (odd), 39, 41, 46
10/11	W	4.4	**4.2:** 3, 5, 11-15 (odd), 21, 25, 37, 39, 44; **4.3:** 1-3, 5, 9, 13, 17, 21-24, 29, 35, 39
10/13	F	5.1	**Construction Project Due** **4.4:** 5, 7, 11-17 (odd), 29, 31, 45
10/16-17	M-T	**Fall Break**	
10/18	W	5.2, 5,3	**5.1:** 3, 7, 11, 15, 17, 21, 25, 27, 33, 37
10/20	F	5.4, 5.5	**5.2:** 1, 3, 7, 9, 11, 17, 23, 29, 33, 39; **5.3:** 1-7 (odd), 11-15 (odd), 27, 29, 33, 35, 41
10/23	M	5.6	**5.4:** 1, 3, 5, 11, 13, 17, 19, 23, 25, 31, 35, 39, 41; **5.5:** 5-11 (odd), 15, 17, 25, 29, 33, 37
10/25	W	6.1	**5.6:** 3, 5, 7, 11, 13, 17, 21, 23, 31, 33, 37, 39
10/27	F	**Ch. 3-5 Exam**	**Ch. 3-5 Exam**
10/30	M	6.2	**6.1:** 1-11 (odd), 17, 19, 23, 33, 35, 37, 43
11/1	W	6.3	**6.2:** 1, 3, 7, 13, 15, 17, 23, 27, 31, 37, 41, 47
11/3	F	6.4	**6.3:** 1-9 (odd), 13, 17, 21, 23, 25, 29, 33, 45
11/6	M	8.1	**6.4:** 1, 3, 9, 13, 17, 23, 27, 31, 35
11/8	W	8.2	**8.1:** 1, 5, 7, 13-21 (odd), 25-33 (odd), 39, 45, 47, 53, 55
11/10	F	8.3	**Proof Portfolio Project Due** **8.2:** 3, 7, 9, 11, 19, 23, 29, 35, 39 50, 57
11/13	M	8.4	**8.3:** 3, 9, 11, 17, 21, 29, 37
11/15	W	8.5	**8.4:** 3, 7, 13, 17, 21-25 (odd), 29, 33, 37, 45
11/17	F	**WebSketchPad Work Day**	**Chapter 7 Self-Study Due** **8.5:** 3, 7, 11, 15, 19, 23, 27, 33
11/20-24	M-F	**Thanksgiving Break**	
11/27	M	9.1	
11/29	W	9.2	**9.1:** 1-15 (odd), 19, 25, 29, 37, 43
12/ 1	F	9.3, 9.4	**9.2:** 5-13 (odd), 19, 23, 27, 31, 35, 37, 41
12/ 4	M	**Review**	**Pop-up Polyhedra Project Due** **9.3:** 5, 7, 9, 13, 15, 21-27 (odd), 31. 35, 37, 41, 43, 45; **9.4:** 3, 7, 21, 25, 31
12/ 6	W	**Ch. 6, 8, 9 Exam**	**Ch. 6, 8, 9 Exam**
12/ 8	F	**Final Exam Review**	**Chapter 10 Self-Study Due**
12/ 12	T	**Final Exam 9:30 a.m.**	