

MATH 5200/7200 class notes, September 22, 24, 26 - Becky Mohl

(Figures have been omitted due to technical problems with MS Word.)

Monday 9/22

-HW due Wednesday: correct test and turn the corrections in with the original test.

-Grade is determined according to syllabus.

-If you did poorly on the test come talk to Dr. McCrory during office hours or make an appointment to talk about the exam or homeworks.

-After Wednesday, Dr. McCrory will post the complete solutions to the exam.

-final exam is based on each test, 1/3 comes from each test.

**If you believe a statement is true, it will be easier to prove.

**If you believe a statement/theorem, you will understand it; therefore, able to prove it.

AXIOMS

-No HW on axioms due Wednesday since test corrections are due.

-George Birkhoff came up with the axioms and definitions.

-He wrote a geometry book and taught high school.

-only undefined concept is a point; lines, rays, segments are defined using properties of distance.

**basic functions are distance, angle, and area.

Summary (refer to the website because most of the notes are there):

1. Distance axiom: Distance is a function which assigns a real number to every ordered pair A, B of points
2. The distance between a point and itself is zero.
3. Symmetry: $d(A, B) = d(B, A)$
4. Triangle inequality: For all A, B, C , $d(A, B) \leq d(A, C) + d(C, B)$

-Going from A to B by way of C is going out of your way.

-Applies to all points even the degenerate triangle with points on a line.

5. Line axiom:

-define a line: a line L is a set of points such that there is a function P from the real number line onto L such that for all a and b , if $P(a) = A$ and $P(b) = B$ then $d(A, B) = |a - b|$.

***Birkhoff: The points on any straight line can be numbered so that number differences measure distances.

6. Angles: measured mod 360°

$90^\circ=450^\circ$, $360^\circ=0^\circ$ same angle

$+180^\circ=-180^\circ$ are the same

$-90^\circ=270^\circ$

***GSP degrees between 0 and 180

***GSP directed degrees between -180 and 180

***Birkhoff: All half lines (rays) having the same end point can be measured so that number differences measure angles.

*using unsigned angles (absolute value) in geometry increases the gap between plane geometry and trigonometry because students get confused when trig begins to use signed angles

7. Betweenness axiom

Navigate GSP

-experiment with degrees and directed degrees in GSP

-Angle is 3 points in GSP, not 2 rays

***Directed degrees shows sign change

Measures counterclockwise – positive, clockwise – negative

Angles AOB and BOA will always have opposite signs.

Engineers use “grad” to measure angles: $100 \text{ grad} = 90^\circ$, so $400 \text{ grad} = 360^\circ$.

Philosophy of Teaching

-Math makes connections with science by measurement.

-Gap between plane geometry and trigonometry should not be there.

-Connections with the real world make geometry more concrete.

Wednesday 9/24

When is ray OB between ray OA and ray OC?

Case 1: AOC is positive. $0 < AOB < AOC$

Case 2: AOC is negative. $AOC < AOB < 0$

8. Congruence axiom: SAS

-positive and negative congruence

9. Parallel axiom:

-Note: We want that if L is parallel to M and M is parallel to N then L is parallel to N. This means we must say L is parallel to itself. (L is parallel to M and M is parallel to L, so L is parallel to L.)

*Intersecting lines: Given 2 lines and a transversal, if the sum of two same side interior angles is $<180^\circ$ then the two lines will intersect at some point if they are extended out.

10. Area axiom:

-MSG group said that area is not important ***BUT IT IS!!

-Euclid uses area

*Derive theorems from axioms; commonly done in geometry books.

Friday 9/26

Grading scale for test 1

A 85	At the end of the semester averages scores
B 65	according to the syllabus,
C 50	then orders the class by scores, and
D 40	gives you at least your GPA as a grade.

HW Presentation

1. Laura Hill (chords and arcs)

-2 way proof

- If arcs are equal, chords are the same length.
- If chords are the same length, arcs are equal.

-Used the congruence axiom, SSS theorem, definition of arc angle measure, definition of a circle, and definition of a chord.

***if you did not use SAS and SSS, you missed this problem.

2. Kim Newman (trapezoid inscribed in circle)

-How do you know vertex angles are equal?

3. Mandy Shealy (inradius and circumradius of equilateral triangle)

-Good idea using congruent triangles; however, 2 points have to be found and proved.
(1) Both circles have the same center.

-Median, perpendicular bisector, angle bisector, prove they are equal. This tells that both of the circles do have the same center.

(2) In 30, 60, 90 triangles, the short leg is $\frac{1}{2}$ the hypotenuse. Have to prove since it is not a basic theorem.

-By the AAA similarity theorem, all 30,60, 90 triangles have this property.

-look for:

a. Did I assume that the center of the circles were the same?

b. Did I assume that a 30, 60, 90 triangles has short leg that is half the hypotenuse?

Next week

-Start with axioms

-Prove basic theorems

-Group presentation

HW 10

-Current rules; use only axioms or theorems to prove HW

-If you use a fact that is not a basic theorem, prove it or derive it. If you are unable to derive it, list it on your HW and we will discuss them in class.

-Grad students: On HW 10, find where the 1st 4 axioms are used; put as footnotes.