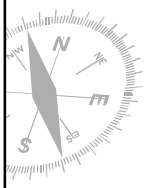
Math 119 – Plane Geometry



Preliminaries

Sections 1.1 and 1.2

Why is Geometry Interesting?

- Logic
  - Developed from simple statements
  - Derive array of results – Deductive Reasoning
  - Inspired Newton's *Principia* and Spinoza's *Ethics*
- Useful
  - Surrounded by geometric objects
    - Arcs of rainbows; hexagons in snowflakes; spheres in soap bubbles
    - Biochemistry: Shape essential to function – double helix DNA
    - Architecture: Pyramids of Egypt; Teepees; Skyscrapers
    - Astronomy:
      - Greek astronomers – Earth was not flat
      - 200 BC – Eratosthenes measured circumference of Earth
      - Orbits of planets; positions and motions of stars; size of universe

What is Geometry?

- Geometry comes from the Greeks
  - Geo = earth
  - Metron = measure
- Euclid
  - Greek mathematician (300 B.C.)
  - First to collect and logically organize isolated facts about geometry
  - 13 Volumes in *The Elements*
- Euclidean Geometry
  - The study of points, lines, planes, and other geometric figures.

Preliminaries

- Go Over Syllabus
- Grade Examples
  - Quiz Average: 76% Overall Average: 89.99%
  - Quiz Average: 92% Overall Average: 89.01%
- Demo http://thegradekeeper.com
- Expected homework load:
  - We will cover about 2 sections each class meeting
  - Most problems from each section will be assigned

Types of Reasoning

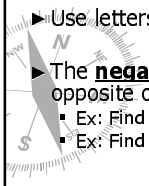
- Intuition
  - An inspiration leading to the statement of a theory
  - "Gut feeling"
  - Major Problem: May be jumping to conclusions
- Induction
  - An organized effort to test the theory
    - Experiments/observations
    - ie: Use characteristics of specific people to gain general results
  - Problem: Still may be jumping to conclusions
- Deduction
  - A formal argument that proves the tested theory
  - **Deduction** is the type of reasoning in which the knowledge and acceptance of selected assumptions guarantees the truth of a particular conclusion

Examples

- What can you conclude from each of the following? What type of reasoning did you use?
  - While in a grocery store, you examine several 8-oz cartons of yogurt. Although the flavors and brands differ, each carton is priced at 75 cents.
  - Given the following line segments, what might you conclude?

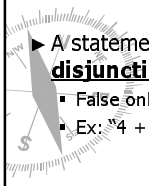
Statements

- A **statement** is a group of words that can be classified collectively as true or false.
  - Ex: 4 + 3 = 7
  - Ex: 7 < 3
  - Non ex: Look out!
- Use letters P, Q to represent statements
- The **negation** of a statement P claims the opposite of the original statement. (Denoted ~P).
  - Ex: Find the negation of 4 + 3 = 7
  - Ex: Find the negation of "All fish can swim"



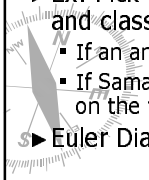
Disjunctions/Conjunctions

- A statement of the form "P and Q" is a **conjunction**.
  - True only if both P and Q are true
  - Ex: "4 + 3 = 7 and Babe Ruth was a US president"
- A statement of the form "P or Q" is a **disjunction**.
  - False only if P and Q are both false
  - Ex: "4 + 3 = 7 or Babe Ruth was a US president"



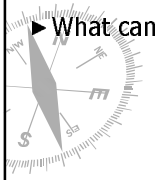
Conditional Statements

- "If P, then Q"; "P implies Q"
- Shorthand notation: P ⇒ Q
- P = Hypothesis; Q = Conclusion
- Ex: Pick out the hypothesis and conclusion, and classify as true or false:
  - If an animal is a fish, then it can swim.
  - If Samantha studies, then she will receive an A on the test.
- Euler Diagrams



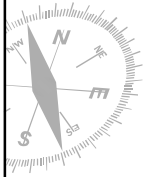
Valid Arguments

- Suppose the following statements are both true:
  - If a man walks home, then his car is broken.
  - Joe walks home.
- What can you conclude?



Law of Detachment

- Let P and Q represent simple statements, and assume that statements 1 and 2 are true. Then a valid argument having conclusion C has the form



1. If P, then Q
2. P

C. ∴ Q

} Premises

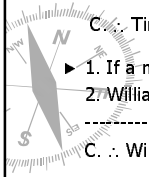
} Conclusion

Valid Arguments Examples

- Are the following arguments valid? Assume that premises 1 and 2 are true.
  - 1. If it is raining, then Tim will stay in the house.
    2. It is raining.

    C. ∴ Tim will stay in the house.
  - 1. If a man lives in London, then he lives in England.
    2. William lives in England.

    C. ∴ William lives in London.



Counterexamples disprove validity of arguments

Informal Geometry

- Point
  - Represent with uppercase letters
- Line
  - Represent by points on the line, or
  - By a lowercase italic letter
- Collinear
  - 3 points on the same line
  - Represent by A-X-B if X is between A and B
- Line Segment
  - Line above points – line segment
  - No line – Measure of line segment
- Angle - ∠ABC
  - Point B where sides meet is the vertex
  - ∠ABC is not the same as ∠BAC
  - ∠ABC is the same as ∠B
- Triangle - Δ DEF
  - Points D, E, and F are vertices of Δ DEF
- Rectangle – rect. WXYZ
  - Can we name the rectangle XYZW? WYXZ?

Measuring Line Segments

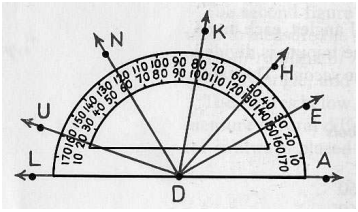
- Caution: Rulers may not be perfect!!!
- Which of $\overline{RS}$ and RS is a number? What does the other represent?
- Suppose A-B-C
  - If AB = BC, then B is the **midpoint** of $\overline{AC}$
  - When AB = BC, $\overline{AB}$ is **congruent** to $\overline{BC}$.
    - Denoted: $\overline{AB} \cong \overline{BC}$
- Ex: Suppose AB = 4 and BC = 8. What might intuition suggest AC is?

Measuring Angles

- Angles are measured using protractors.
- Why can't we measure angles using rulers?
- Notation for measurement: m∠ABC
- **Bisected** – separated into two parts of equal measure
- Angles of equal measure are **congruent**
- Angle measuring 180 is a **straight angle**
- Angle measuring 90 is a **right angle**
  - Formed when a straight angle is bisected

Example: Using a Protractor

- Find the measure of the following:
  1. ∠LDK
  2. ∠KDH
  3. ∠EDN
  4. ∠ADU
  5. ∠NDH
  6. ∠LDA



Lines

- When 2 lines have a point in common, they **intersect**
- When 2 lines intersect and form congruent adjacent angles, they are **perpendicular**
- If 2 lines never intersect, they are **parallel**

Homework

- Due Tuesday 6/15
  - Complete your Math Autobiography
  - Login to http://thegradekeeper.com
  - Read 1.1 and 1.2
  - 1.1: # 1-32, 37-50
  - 1.2: #1-20, 23-26, 29-42
  - Buy a straightedge and compass