Math 241: Workshop on Geometry Software

Day 2, 2015-9-03

Construction Tools

The most fundamental geometric construction tools are the straightedge and compass, which can draw a line and a circle. Geogebra has several composite tools, built from a sequence of the fundamental straightedge and compass operations. Here are the most important, from left to right in the Geogebra toolkit.

Point constructions

- Point: anywhere on the plane.
- Point on Object: The point is restricted to lie on the object (e.g. a line or circle).
- Intersection Point(s): of two objects (e.g two circles will give two points).
- Midpoint: Choose two point, or a segement, or a circle.

Line Constructions

- Line: Choose two points to determine the line.
- Ray: From the first point to and on past the second point.
- Segment: Just the portion of the line between the two points.
- Segment of Given Length: Choose one point and a length (number or slider name).

Perpendicular and Parallel Constructions

- Perpendicular Bisector: Choose the endpoints of the segment.
- Perpendicular through a Point to a Line: Choose point then line.
- Angle Bisector: Choose three points, the middle being the vertex of the angle.
- Parallel Through a Point to a Line: Choose point then line.

Polygon

- Polygon: Choose a sequence of different points, then back to the first.
- Regular Polygon:

Circle Constructions

- Circle with Center through Point: Choose center then the point the circle contains.
- Circle with Center and Radius: Choose center then length (number or slider name).

Angle Constructions

- Angle: Choose point, vertex, point–the measure will be shown in green.
- Angle with measure: Choose a point, then vertex, then measure (degrees, radians, or slider name)

Important First Theorems

- Isoceles Triangle Theorem (ITT)
- Triangle Congruences (SSS, SAS, ASA, SAA, RASS)
- Congruent Parts of Congruent Triangles are Congruent (CPCTC)
- Vertical Angles
- Tangent to a Circle: Is perpendicular to the radius at the intersection point.
- Perpendicular Bisector: Is also the set of points equidistant from the endpoints.
- Angle Bisector: Is also the set of points equidistant from the two sides.
- Angles and Parallels (AP): Alternate interior angles congruent, and similar results.
- Midpoint Triangle: The segments formed by the midpoints of a triangle break the triangle into create four congruent triangles.
- Midpoint Quadrilateral:

Quadrilaterals

Here are definitions about special quadrilaterals.

- A *square*: All sides are congruent and all angles are right angles.
- A *rhombus*: All sides are congruent.
- A *rectangle*: Both pairs of opposite sides are congruent and all angles are right angles.
- A *parallelogram*: Both pairs of opposite sides are parallel.
  (Theorem: this is equivalent to both pairs of opposite sides being congruent.)
- A *kite*: One set of adjacent sides is congruent, and the other set of adjacent sides is also congruent.
- An *isosceles trapezoid*: One pair of opposite sides is parallel and the other pair of opposite sides is congruent.

Explore properties of the diagonlas of these figures:

- Are they congruent?
- Are they perpendicular?
- Do they bisect each other?