Definition 28

Parallel Two lines are parallel in a plane if they don't intersect.

***Postulate* 16**

Parallel Postulate Through a point not on a given line there is exactly one parallel to the line.

***Postulate* 17**

Lobachevsky and Bolya Postulate Through a point not on a given line there are infinitely many parallels to the line. Poincare came up with a model for this one using circles that are perpendicular to each other.

***Postulate* 18**

Riemann Postulate Through a point not on a given line there are no parallels to the line. This is modeled by great circles on a sphere.

We will be doing something with these later if there is time.

Definition 29

Exterior Angle Given $\triangle ABC$ and $A-B-D$ then $\angle CBD$ is an exterior angle. $\angle A$ and $\angle C$ are the remote interior angles to $\angle CBD$.

Definition 30 $\angle ABC$ is smaller than $\angle DEF$ if there exists a point P in the interior of $\angle DEF$ with $\angle PEF \cong \angle ABC$.

***Theorem* 46** An exterior angle of a triangle is greater in measure than either remote interior angle.

***Theorem* 47** If two angles of a triangle are not congruent, the sides opposite these angles are not congruent.

***Theorem* 48** If two sides of a triangle are not congruent the angles opposite these sides are not congruent, and the angle with the larger measure is opposite the longer side.

***Theorem* 49** If two angles of a triangle are not congruent, the sides opposite these angles are not congruent, and the longer side is opposite the angle with larger measure.

***Theorem* 50** If two lines in a plane are perpendicular to a third line in the same plane then the two lines are parallel.

Homework 9

1. Given triangle $\triangle ABD$ and $A-C-D$.
   (a) Given $m\angle D < m\angle A < m\angle ACB$ Prove $BC < AB < BD$.
   (b) Given $AC = CD, m\angle ABC \neq m\angle CBD$. Prove $m\angle ACB \neq m\angle DCB$.
2. Given $\triangle ABE$ and $A-C-D-E$.
   (a) Given $\triangle ABC \ncong \triangle EBD$ and $AC = DE$. Prove $m\angle BCD \neq m\angle BDC$
   (b) Given $AB = BE, AC \neq DE$. Prove $m\angle ABC \neq m\angle EBD$
   (c) Given $m\angle BCD \neq m\angle BDC$ and $AC = DE$. Prove $AB \neq BE$.
   (d) Given $\angle ACB \cong \angle BDE$ and $m\angle ABC \neq m\angle DBE$. Prove $AC \neq DE$.

Definition 31

Transversal A transversal is a line that intersects two other lines at different points. The angles that contain both intersection points are called interior angles. The other four are called exterior angles. The two nonadjacent interior angles on opposite sides of the transversal are alternate interior angles. The two nonadjacent exterior angles are called alternate exterior angles.

Definition 32 Two nonadjacent angles on the same side of the transversal are corresponding angles if one is interior and one is exterior.

***Theorem* 51** If two lines are cut by a transversal so that alternate interior angles are congruent, then the lines are parallel.

***Theorem* 52** If two parallel lines are cut by a transversal, then the alternate interior angles are congruent.

***Theorem* 53** Corresponding angles formed by two lines and a transversal are congruent if and only if the lines are parallel.

***Theorem* 54** Alternate exterior angles formed by two lines and a transversal are congruent if and only if the lines are parallel.

***Theorem* 55** Interior angles formed by two lines and a transversal, such that the angles are on the same side of the transversal, are supplementary if and only if the lines are parallel.

***Theorem* 56** The sum of the measures of the angles of a triangle is 180.

***Theorem* 57** An exterior angle of a triangle is equal in measure to the sum of the remote interior angles.

Homework 10

1. Given $a \| b$ $D - A - G$ on a and $E - B - C - F$ on b.
   (a) Prove $m\angle DAB + m\angle GAC = m\angle ABC + m\angle ACB$
   (b) Prove $m\angle DAB + m\angle ABE = 180$
   (c) Prove $m\angle ACF > m\angle DAB$
2. Given $\overleftrightarrow{GH} \| \overleftrightarrow{IJ}$ $G - B - E - H$ and $I - A - D - C - F - J$.
   (a) Given $\angle GBA \cong \angle EDC$, prove $\overleftrightarrow{AB} \| \overleftrightarrow{DE}$.
   (b) Given $\angle HEF \cong \angle ACB$, prove $\overleftrightarrow{BC} \| \overleftrightarrow{EF}$.
   (c) Given $\triangle ABC \cong \triangle DEF$, prove $\overleftrightarrow{AB} \| \overleftrightarrow{DE}$ and $\overleftrightarrow{BC} \| \overleftrightarrow{EF}$.
3. Prove $\triangle ABC \cong \triangle DEF$ if $\angle A \cong \angle D$, $\angle C \cong \angle F$ and $\overline{BC} \cong \overline{EF}$.