Geometry Unit 2
Similarity, Congruence, and Proofs

References

Textbook Connection:
Holt McDougal Analytic Geometry: Unit 1

Helpful Links:

- ☐ Dilations: http://mathbitsnotebook.com/Geometry/Transformations/TRTransformationDilations.html
- ☐ Dilations: http://mathbitsnotebook.com/Geometry/Similarity/SMdilation.html
- ☐ Similarity: http://mathbitsnotebook.com/Geometry/Similarity/SMSimilar.html
- ☐ Proving Similar Triangles: http://mathbitsnotebook.com/Geometry/Similarity/SMProofs.html
- ☐ Triangle Theorems: http://mathbitsnotebook.com/Geometry/CongruentTriangles/CTtriangleMethods.html
- ☐ Ratio Segments: http://www.walter-fendt.de/m14e/propsegments.htm
- ☐ Congruent Triangles: http://www.analyzemath.com/Geometry/congruent_triangles.html
- ☐ Points of Concurrency: http://www.onlinemathlearning.com/c

Dear Parents

In this unit, students will understand similarity in terms of similarity transformations, prove theorems involving similarity, understand congruence in terms of rigid motions, prove geometric theorems, and make geometric constructions.

Concepts Students will Use & Understand

- Understand similarity in terms of similarity transformations (dilations).
- Prove theorems involving similarity (proportionality & Pythagorean Theorem)
- Understand congruence in terms of rigid motion (ASA, SAS, SSS)
- Prove geometric theorems (special angles, triangles, parallelograms)
- Make geometric constructions (copy segment/angle; bisect segment/angle; construct perpendicular/parallel lines; equilateral triangle, square and a regular hexagon inscribed in a circle

Vocabulary

- **Adjacent Angles:** Angles in the same plane that have a common vertex and a common side, but no common interior points.
- **Alternate Exterior Angles**: Alternate exterior angles are pairs of angles formed when a third line (a transversal) crosses two other lines. These angles are on opposite sides of the transversal and are outside the other two lines. When the two other lines are parallel, the alternate exterior angles are equal.
- **Alternate Interior Angles**: Alternate interior angles are pairs of angles formed when a third line (a transversal) crosses two other lines. These angles are on opposite sides of the transversal and are in between the other two lines. When the two other lines are parallel, the alternate interior angles are equal.
- **Bisector:** A bisector divides a segment or angle into two equal parts.
- **Centroid:** The point of concurrency of the medians of a triangle.
- **Circumcenter:** The point of concurrency of the perpendicular bisectors of the sides of a triangle.
- **Coincidental:** Two equivalent linear equations overlap when graphed.
- **Dilation**: Transformation that changes the size of a figure, but not the shape.
- **Equiangular:** The property of a polygon whose angles are all congruent.
- **Equilateral:** The property of a polygon whose sides are all congruent.
- **Exterior Angle of a Polygon:** an angle that forms a linear pair with one of the angles of the polygon.
- **Incenter:** The point of concurrency of the bisectors of the angles of a triangle.
- **Intersecting Lines:** Two lines in a plane that cross each other. Unless two lines are coincidental, parallel, or skew, they will intersect at one point.
- **Linear Pair:** Adjacent, supplementary angles. Excluding their common side, a linear pair forms a straight line.
- **Measure of each Interior Angle of a Regular n-gon:** $\frac{180^\circ(n-2)}{n}$
- **Orthocenter:** The point of concurrency of the altitudes of a triangle.
- **Plane:** One of the basic undefined terms of geometry. Traditionally thought of as going on forever in all directions (in two-dimensions) and is flat (i.e., it has no thickness).
- **Reflection:** A transformation that "flips" a figure over a line of reflection

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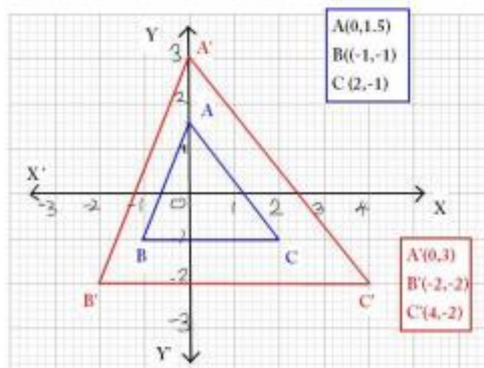
- ☐ Isosceles Triangles: http://mathbitsnotebook.com/Geometry/SegmentsAnglesTriangles/SATIsosceles.html
- ☐ Constructions: http://www.mathsisfun.com/geometry/constructions.html

- **Reflection Line:** A line that is the perpendicular bisector of the segment with endpoints at a pre-image point and the image of that point after a reflection.
- **Regular Polygon:** A polygon that is both equilateral and equiangular.
- **Remote Interior Angles of a Triangle:** the two angles non-adjacent to the exterior angle.
- **Rotation:** A transformation that turns a figure about a fixed point through a given angle and a given direction.
- **Same-Side Interior Angles**: Pairs of angles formed when a third line (a transversal) crosses two other lines. These angles are on the same side of the transversal and are between the other two lines. When the two other lines are parallel, same-side interior angles are supplementary.
- **Same-Side Exterior Angles**: Pairs of angles formed when a third line (a transversal) crosses two other lines. These angles are on the same side of the transversal and are outside the other two lines. When the two other lines are parallel, same-side exterior angles are supplementary.
- **Scale Factor**: The ratio of any two corresponding lengths of the sides of two similar figures.
- **Similar Figures**: Figures that have the same shape but not necessarily the same size.
- **Skew Lines:** Two lines that do not lie in the same plane (therefore, they cannot be parallel or intersect).
- **Sum of the Measures of the Interior Angles of a Convex Polygon:** 180º(n – 2).
- **Transformation**: The mapping, or movement, of all the points of a figure in a plane according to a common operation.
- **Translation:** A transformation that "slides" each point of a figure the same distance in the same direction
- **Transversal:** A line that crosses two or more lines.
- **Vertical Angles:** Two nonadjacent angles formed by intersecting lines or segments. Also called opposite angles.

Try http://intermath.coe.uga.edu/dictnary/homepg.asp or http://www.amathsdictionaryforkids.com/ for further examples.

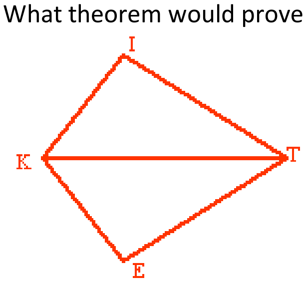
Example 1

Are these 2 triangles similar? Why or why not?



Example 2

What theorem would prove these 2 triangles congruent?



Given: $\overline{KT}$ bisects $\measuredangle IKE$ and $\measuredangle ITE$

Prove: $\Delta KIT \cong \Delta KET$

Example 3

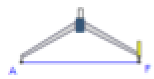
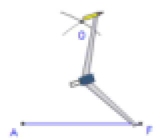
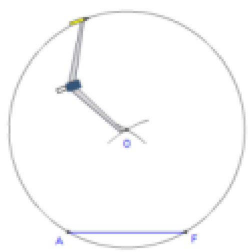
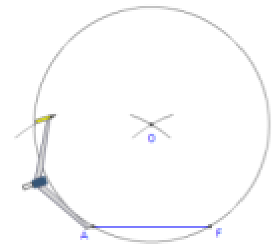
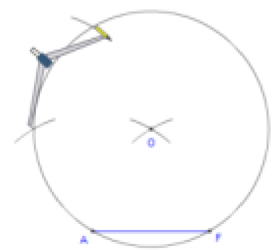
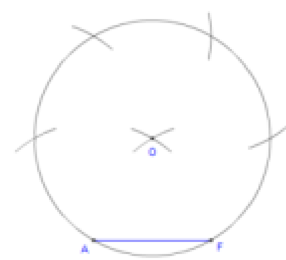
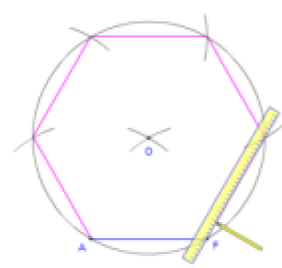
Construct a regular hexagon inside of a circle.

Key

<u>Example 1</u>: Yes these 2 triangles are similar because their sides are proportional. The scale factor of the dilation from the smaller triangle to the larger triangle is 2.

<u>Example 2:</u> ASA because $\overline{KT} \cong \overline{TK}$ and $\angle IKT \cong \angle EKT$; $\angle ITK \cong \angle ETK$

<u>Example 3:</u>

We start with a line segment AF. This will become one side of the hexagon. Because we are constructing a regular hexagon, the other five sides will have this length also.	
1. Set the compass point on A, and set its width to F. ***The compass must remain at this width for the remainder of the construction.***	
2. From points A and F, draw two arcs so that they intersect. Mark this as point O. This is the center of the hexagon's circumcircle.	
3. Move the compass to O and draw a circle. This is the hexagon's circumcircle - the circle that passes through all six vertices	
4. Move the compass on to A and draw an arc across the circle. This is the next vertex of the hexagon.	
5. Move the compass to this arc and draw an arc across the circle to create the next vertex.	
6. Continue in this way until you have all six vertices. (Four new ones plus the points A and F you started with.)	
7. Draw a line between each successive pairs of vertices.	
8. Done. These lines form a regular hexagon where each side is equal in length to AF.