Math 6140: Homework # 4.

This assignment covers up through the end of Section 4.1 in the course notes.
Note: Problems 1, 2 and 4 all use Geometer's Sketchpad.

1. (Use Geometer's Sketchpad.) Construct a quadrilateral $ABCD$ and let M, N, P and Q be the midpoints of the sides. Find the areas of the quadrilaterals $ABCD$, $MNPQ$ and of the four small triangles at the corners of $ABCD$ (use "Triangle Interior" or "Quadrilateral Interior" from the "Construct" menu and then "Area" from the "Measure" menu). Find an equation relating the areas of the four triangles. Then find an equation relating the areas of the two quadrilaterals. Print out a picture with the calculations that demonstrate the equations you found. You do not have to prove anything for this problem.

2. (Use Geometer's Sketchpad.) Draw a triangle ABC and a point P in the interior of ABC. Draw the lines (not just the line segments) connecting P to each of the vertices, and let D, E, and F be the points where these lines meet AB, AC and BC, respectively. Find an equation relating the three ratios $\frac{DA}{DB}$, $\frac{EC}{EA}$ and $\frac{FB}{FC}$. Print out a copy of your picture, including the measurements and calculations.

3. Prove Theorem 26. (Hint: Use ideas similar to those of the proof of Theorem 24, but note that there is only one case.) Make a picture to illustrate your proof with Geometer's Sketchpad.

4. Let ABC be an equilateral triangle and let P be a point which is outside the triangle but in the interior of $\angle ABC$. Let a, b, and c be the distances from P to $\overleftrightarrow{AB}$, $\overleftrightarrow{AC}$ and $\overleftrightarrow{BC}$ respectively. Let h be the height of triangle ABC. To prove: $a - b + c = h$.

5. (See Figure 1.) Given: $AD = BC$, $AC = BD$, $AK = BN$. To prove: $KG = NH$.

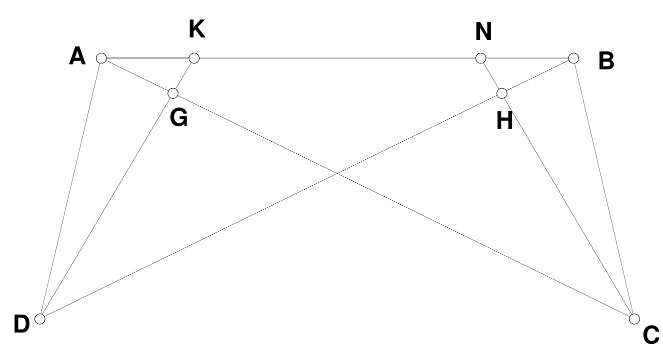

Figure 1

6. (See Figure 2.) Given: $ABCD$ is a parallelogram, $\angle 1 = \angle 2$, $\angle 3 = \angle 4$, EF is parallel to AD. To prove: $AF = FB$.

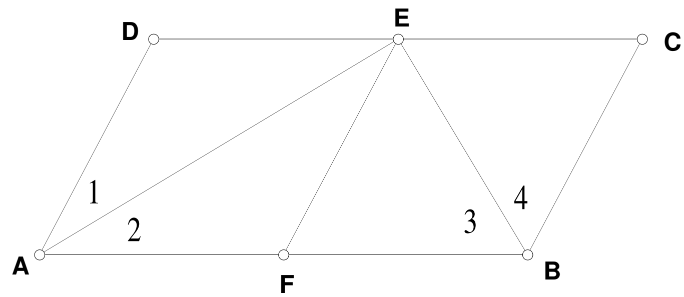

Figure 2

7. (See Figure 3.) Given: O is the center of the circle. To prove: $\angle AOC = 2\angle ABC$.

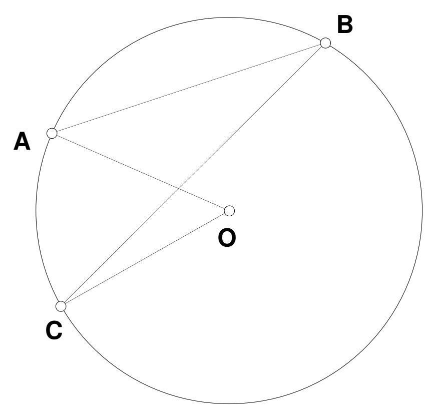

Figure 3

8. (See Figure 4.) Given that AD is parallel to BE and BE is parallel to CF, prove that $\dfrac{AB}{AC} = \dfrac{DE}{DF}$.

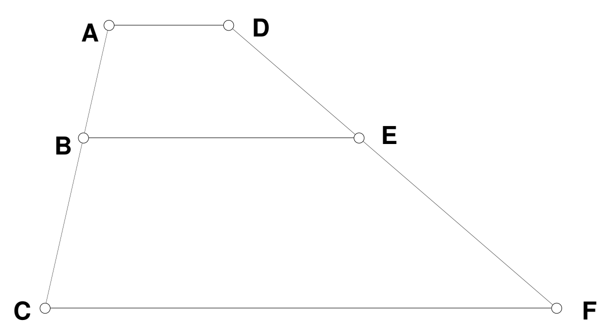

Figure 4

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