Math 460: Homework # 1. Due Tuesday August 28

Rules for writing up proofs on the homework:

- Any fact you use must be from the Course Notes or from previous homework.
- The formath should be arranging your argument in two columns; in the first is a statement, and in the second is the justification.
- You must give a justification for every step in your proof (but there are three exceptions: when you draw in a line you don't have to mention BF 7, when you extend a line you don't have to mention BF 9, and when you know two lines are parallel you can assume that any segments on those lines are parallel.)
- If you are using a definition, say which one it is (that is, say "definition of parallelogram" or "definition of congruent triangles"). If you are using a Basic Fact or Theorem, refer to it by number. If you are using a fact from a previous homework problem, say which problem it was, and make it clear what fact you have in mind.
- When you use a definition, Basic Fact, or Theorem, say how it applies to your situation. For example, if you use BF 5 or Theorem 2, say what pair of lines you are using and what the transversal is; if you use BF 4, say what pair of similar triangles you are using; if you are using Theorem 7, say what triangle you are applying it to and what the base is.
- For an if and only if ($\Longleftrightarrow$) proof you must say specifically what the given and to prove are for both directions. For example, to prove $A \Longleftrightarrow B$, line 1 might be: proof that $A \Rightarrow B$, line 5 might appear as

  5. Thus $A \Rightarrow B$.

  Then line 6 would start the proof that $A \Leftarrow B$ (or $B \Rightarrow A$), and line 11 would be: Hence $A \Leftarrow B$.
- You must sum up at the end of the proof to show that you proved what was required.
- If your proof is too complicated for the grader to follow, you may lose points. After all, the purpose of giving a proof is so that the reader is convinced of the argument!

For this assignment you may use anything in the course notes up to Theorem 16.

1. Give the proof of Theorem 2(c).
2. Give the proof of Theorem 12.
3. Give the proof of Theorem 13.
4. (See Figure 1) Given: $ABCD$ is a parallelogram, and the lines which look straight are straight. To prove: E is the midpoint of FG.

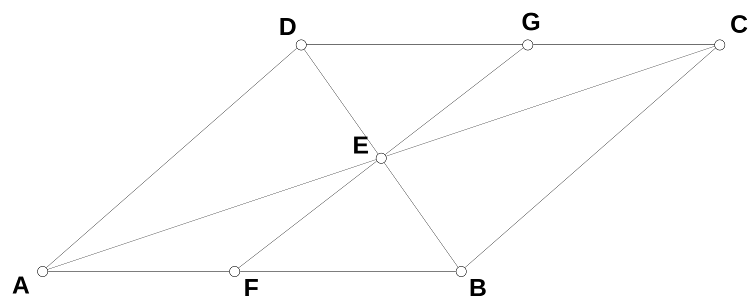

Figure 1

5. (See Figure 2) Given: $MK = MQ$, $\angle K = \angle Q$, $PM \perp MK$ and $LM \perp MQ$. To prove: $\angle L = \angle P$.

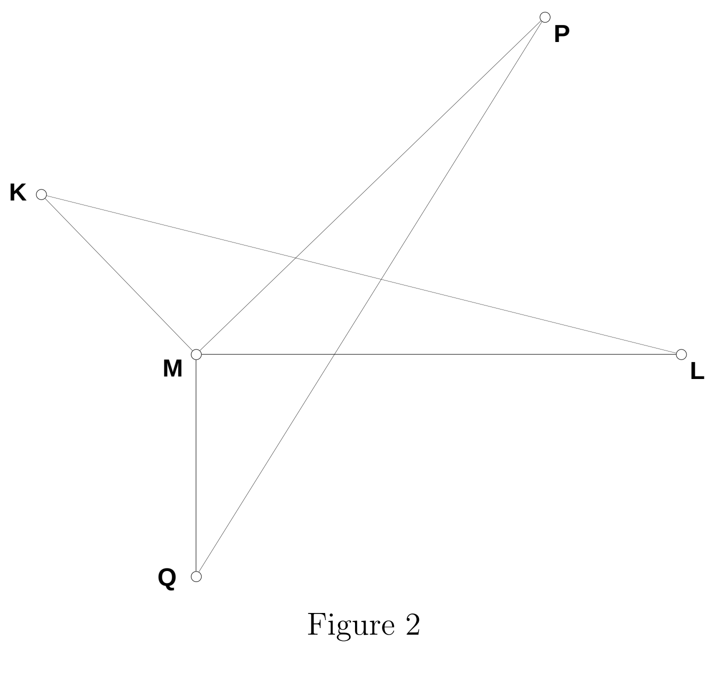

Figure 2

6. (See Figure 3) Given that AB is perpendicular to AC, that AD is perpendicular to BC, and that $AB = EB$, prove that $\angle 1 = \angle 2$.

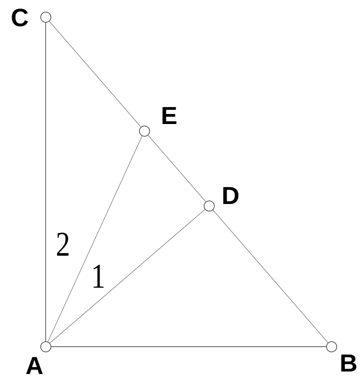

Figure 3

7. (See Figure 4) Given: AB is parallel to CD. To prove: $\triangle ACD$ has the same area as $\triangle BCD$.

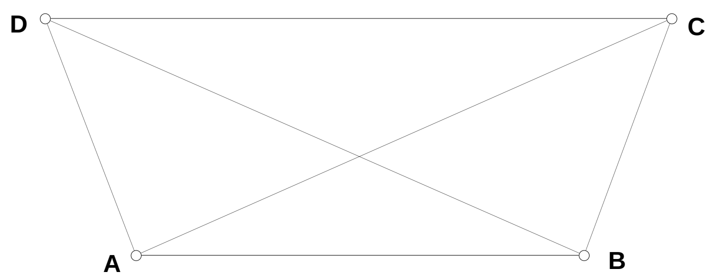

Figure 4

8. (See Figure 5) Given $AB = AC = BC$ (that is, $\triangle ABC$ is an *equilateral* triangle). Let P be a point inside the triangle. Let a, b, and c be the distances from P to $\overleftrightarrow{AB}$, $\overleftrightarrow{AC}$ and $\overleftrightarrow{BC}$ respectively. Let h be the distance from A to $\overleftrightarrow{BC}$. To prove: $a + b + c = h$. (Hint: think about areas.)

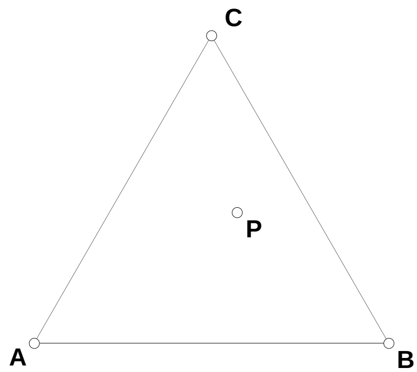

Figure 5

9. (See Figure 6) Given: D is the midpoint of AC and E is the midpoint of BC. To prove: $\dfrac{AF}{FE} = 2$. (Hint: Use similar triangles.)

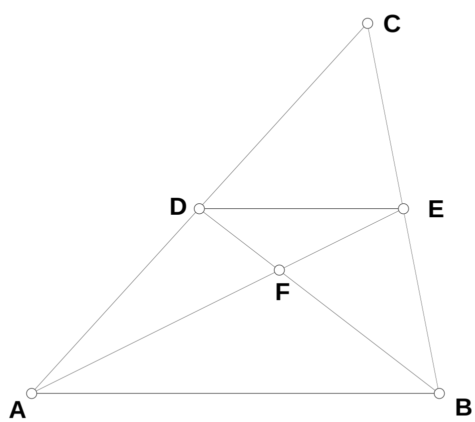

Figure 6

10. (See Figure 7) Given: CD is parallel to AB, $AD = BC$, and AD is **not** parallel to BC. To prove: $AE = BE$.

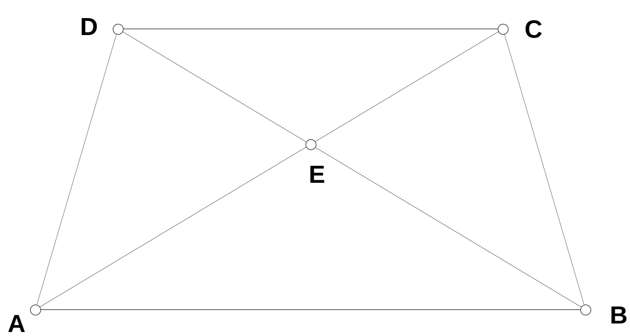

Figure 7