3. Constructing Midpoints

Problem 1. What is an *equilateral triangle*? What is a *rhombus*? Give a minimal description that will force one to draw exactly that figure.

An *equilateral triangle* is:

_____

_____

A *rhombus* is:

_____

_____

_____

Problem 2. Using only a straightedge and compasses, draw
   a) an equilateral triangle;
   b) a rhombus.

Problem 3. Draw the diagonals in the rhombus which you constructed. What two very special things can you say about the diagonals in the rhombus?

The *diagonals in a rhombus* seem to be always:

_____

_____

The *diagonals in a rhombus* do NOT have to be:

_____

Problem 4. Construct two more rhombi: one here below and one on the graph paper. Test your conjectures about the diagonals in each rhombus. Do they still hold?

The *diagonals in these rhombi* are:

_____

_____

Definition 1. An *equilateral triangle* is a triangle with three equal sides.

**Definition 2.** A *rhombus* is a quadrilateral with four equal sides.

Theorem 1. The diagonals in a rhombus are (always!) *perpendicular* and they *bisect* each other, i.e., they intersect in their midpoints.

Problem 5. Below is drawn a segment *AB*. Imagine that the segment is a *diagonal* in a rhombus. Reconstruct the rhombus using a straightedge and compasses.
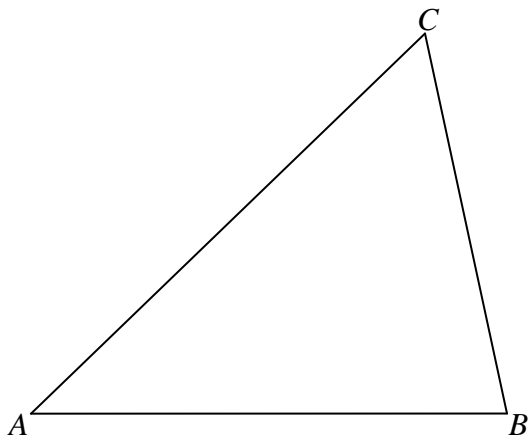
Corollary 1. *M* is the midpoint of *AB*.

Problem 6. Repeat the construction to find the *midpoints* of the two segments below.
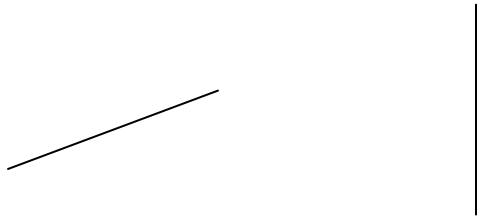
Problem 7. Below is the original triangle *ABC*, the midpoints of whose sides you found before by measuring. Now, using only a straightedge and compasses, locate the exact midpoints of the three sides of the triangle. Find also the centroid of *ABC*.

A —————————— *B*

Question 1. Let your rhombus be *ACBD* and let *M* be the intersection of the two diagonals in the rhombus. What can you tell about point *M* in relation to segment *AB*? Why is that?