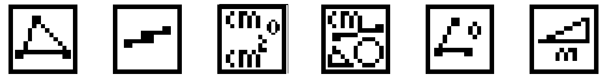
EXPLORATIONS™

Activity 16

Objective

- To investigate the properties of midsegments of a triangle

Cabri® Jr. Tools



Midsegments of a Triangle

Introduction

In this activity you will investigate a geometric construction by making and testing conjectures about a figure. You will begin with the construction of one midsegment of a triangle and will look to formulate statements that always appear to be true about the construction. You will then add two more midsegments to form the midsegment triangle and continue to look for statements that appear to be true about the construction.

This activity makes use of the following definition:

Midsegment — a line segment connecting the midpoints of any two sides of the triangle.

Part I: Midsegment of a Triangle

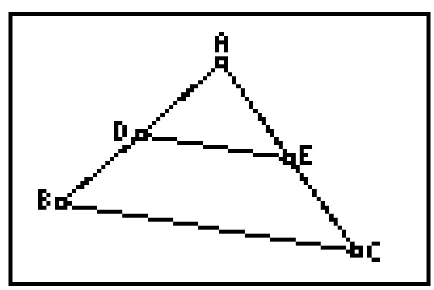
Construction

Construct a triangle and one of its midsegments.

Draw $\triangle ABC$ near the center of the screen.

Construct the midpoint of $\overline{AB}$ and label the point D. Construct the midpoint of $\overline{AC}$ and label the point E.

Construct $\triangle ADE$.



Exploration

Use various measurement tools (**Distance and Length**, **Area**, **Angle**, **Slope**) to explore the relationships that exist in this construction. Observe the relationships as you drag a vertex or side of $\triangle ABC$.

Questions and Conjectures

Make conjectures about any relationships that seem to always be true for this construction.

Part II: Midsegment Triangles

Construction

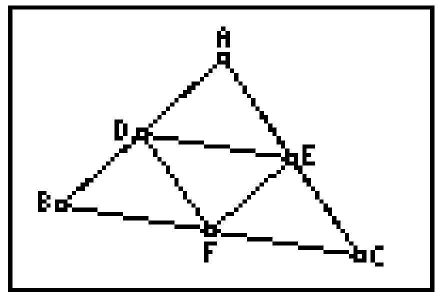
Construct the other two midsegments of $\triangle ABC$.

Continue using the previous construction.

You may want to hide or clear any measurement used in Part I.

Construct the midpoint of $\overline{BC}$ and label the point *F*.

Construct $\triangle BDF$, $\triangle FEC$, and $\triangle DEF$.



Exploration

Use various measurement tools (**Distance and Length**, **Area**, **Angle**, **Slope**) to explore the relationships among $\triangle ABC$ and the triangles formed by the midsegments. Observe these relationships while dragging the sides and/or vertices of $\triangle ABC$.

Questions and Conjectures

1. Make conjectures about any relationships that seem to always be true for this construction.
2. Measure the angles of each of the four interior triangles formed by the midsegments. How do the angle measures compare to the measures of the angles of the original triangle? Explain your reasoning.

Teacher Notes

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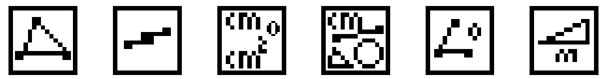


Additional Information

This activity is simple for many students to complete. Students should be encouraged to try a variety of comparisons with as little assistance from the teacher as possible.

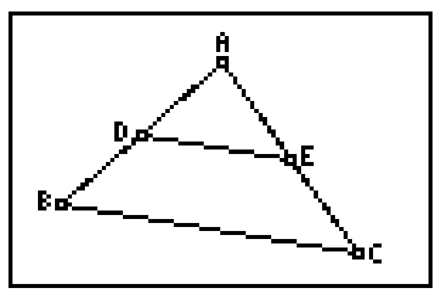
Part I: Midsegment of a Triangle

Answers to Questions and Conjectures

Make conjectures about any relationships that seem to always be true for this construction.

Possible conjectures include, but are not limited to:

- The length of segment $\overline{DE}$ is half the length of segment $\overline{BC}$.
- $m\angle ADE = m\angle ABC$ and $m\angle AED = m\angle ACB$.
- $\overline{BC}$ is parallel to $\overline{DE}$. ($\overline{BC}$ and $\overline{DE}$ have the same slope.)
- $\triangle ADE$ is similar to $\triangle ABC$.
- The area of $\triangle ABC$ is four times the area of $\triangle ADE$.
- The perimeter of $\triangle ABC$ is twice the perimeter of $\triangle ADE$.



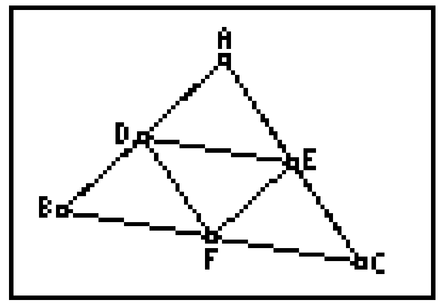
Part II: Midsegment Triangles

Answers to Questions and Conjectures

1. Make conjectures about any relationships that seem to always be true for this construction.

   Possible conjectures include, but are not limited to:

   - The area of $\triangle ABC$ is four times the area of $\triangle DEF$, $\triangle BDF$, $\triangle FEC$, and $\triangle ADE$.
   - Because the midsegments divide $\triangle ABC$ into four congruent triangles, the areas of the four triangles ($\triangle DEF$, $\triangle BDF$, $\triangle FEC$, and $\triangle ADE$) are congruent and have equal area.
   - $\overline{DF}$ is parallel to $\overline{AC}$; $\overline{DE}$ is parallel to $\overline{BC}$; $\overline{EF}$ is parallel to $\overline{AB}$.



2. Measure all of the angles of each of the four interior triangles formed by the midsegments. How do the angle measures compare to the measures of the angles of the original triangle? Explain your reasoning.

   The three angles formed by the midsegments at the midpoint of each side are congruent to the original angles of the triangle. (This is another way to show that the three angles of a triangle add to 180°.) The properties of parallel lines lead to these angle equalities.