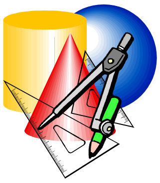

EXEMPLAR 24：

Mid-point Theorem

Objective: To explore the mid-point theorem of triangles

Key Stage: 3

Learning Unit: Quadrilaterals

Materials Required: Dynamic geometry software such as *Geometer's Sketchpad* (later referred as *Sketchpad*)

Prerequisite Knowledge: Parallel lines, similar triangles

Description of the Activity:

1. The teacher briefly revises the properties of similar triangles to students and explains the objective of this activity.

2. The teacher distributes Worksheet to students. Students are asked to draw a triangle using computer and explore the mid-point theorem.

3. The teacher may ask students to present their findings to the whole class. The teacher gives the conclusion as the mid-point theorem.

4. The teacher asks students to form groups to suggest a formal proof to the theorem. The teacher may guide students to consider the simple proof by using similar triangles. Here are some suggested questions for discussion.

   (a) What is the relation between ΔABC and ΔADE? Can you use the given information to prove this relation?
   (b) Can you find a relation between DE and BC?
   (c) Is DE parallel to BC? Why?
   (d) Can you find a relation between $\angle ADE$ and $\angle ABC$?

5. The teacher invites some students to present their formal proofs to the whole class and gives comments if necessary.

Worksheet: Mid-point Theorem

1. Open a new *Sketchpad* file.

2. Draw a triangle and label it as ΔABC.

3. Construct the mid-points D and E of the sides AB and AC respectively.

4. Draw the line segment DE (see Fig.1).

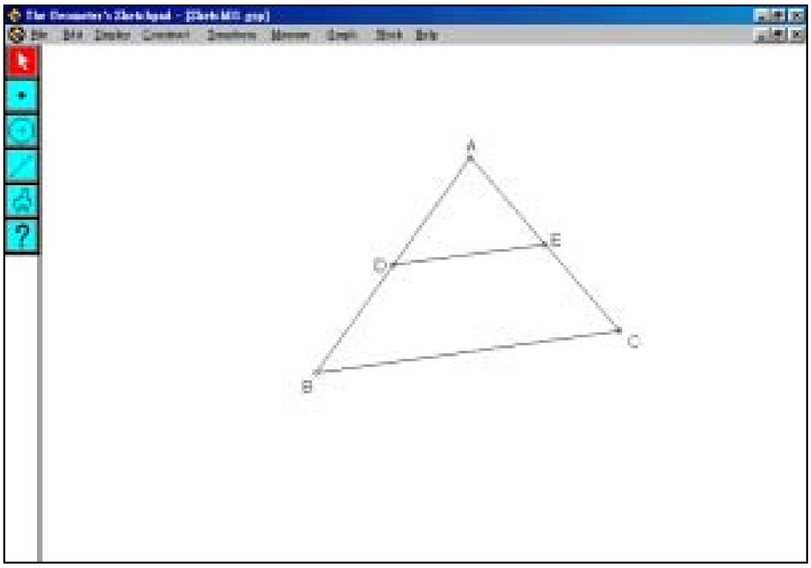

Fig.1

5. Drag the points A, B and C respectively to observe the change. Record five sets of data in Table 1.

Set	DE	BC	$\angle ADB$	$\angle ABC$	$\angle AED$	$\angle ACB$
1						
2						
3						
4						
5						

Table 1

6. What is/are the relation(s) between DE and BC? Write down your findings below.

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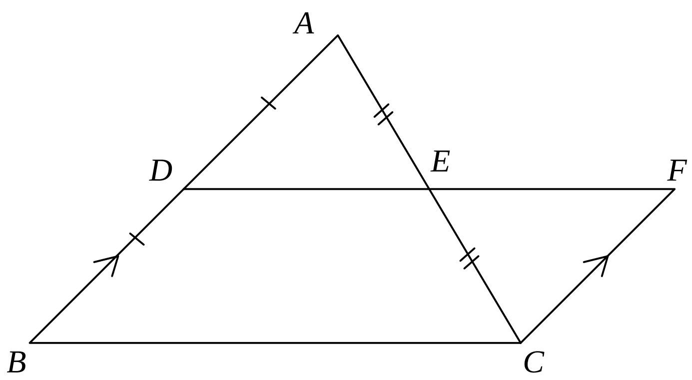
____

Notes for Teachers:

1. The first part of this exemplar adopts an inquiring approach to build up the concept of mid-point theorem. Students are expected to explore the theorem by themselves.

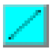
2. The suggested proof of the theorem is using the theorem of "2 sides proportional, one included angle". The teacher may introduce another classic proof, which is outlined below. The teacher may further explain why this proof is different from that suggested in the activity.

   (a) Draw a line through C parallel to BA and meet DE produced at F.
   (b) Show that $\Delta ADE \cong \Delta CFE$.
   (c) Deduce that $BCFD$ is a parallelogram.
   (d) Deduce that $DE = \frac{1}{2} BC$ and $DE // BC$.

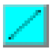


Annex

Operation Procedure:

1. Select the **Segment** icon  to construct three sides of a triangle. Label the triangle as ΔABC.

2. Hold down the **Shift** key and click the segments *AB* and *AC*. Select **Construct**|**Point At Midpoint** in the pull-down menu to construct the two mid-points. Label it as point *D* and *E* respectively.

3. Select the **Segment** icon  . Draw a line segment joining the points *D* and *E*.

4. To measure the lengths of *DE* and *BC*, hold down the **Shift** key. Click the segments *DE* and *BC*. Select **Measure** |**Length**. To measure $\angle ADE$, hold down the **Shift** key. Select points *A*, *D* and *E* sequentially. Select **Measure** |**Angle**. Similar method to measure $\angle ABC$.

5. To find $\frac{BC}{DE}$, hold down the **Shift** key. Click the segments *BC* and *DE* sequentially. Select **Measure** |**Ratio**.