Exemplar 2 To Find the Angle Sum of a Polygon

Objective： To explore the angle sum of the interior angles of polygons

Dimension： Measures, Shape and Space

Learning Unit： Angles Related with Lines and Rectilinear Figures

Key Stage： 3

Material Required： *Cabri Geometry II*

Prerequisite Knowledge： Basic concepts about angles

Description of the Activity：

1. The teacher explains the terms “quadrilateral”, “pentagon”, “hexagon”, “heptagon” and so on to the whole class.
2. The teacher distributes Worksheet 2.1 to students. Students are asked to complete the worksheet by using the dynamic geometry software *Cabri Geometry II.* See Figure 2.1.
3. Students complete Table 2.1 and make a conjecture on the formula of the angle sum of a polygon.
4. The teacher asks students to give a proof of the formula for quadrilateral, pentagon and hexagon. Students are then asked to try to give a formal proof for an n-sided polygon.
5. The teacher should give the formal proof if necessary.

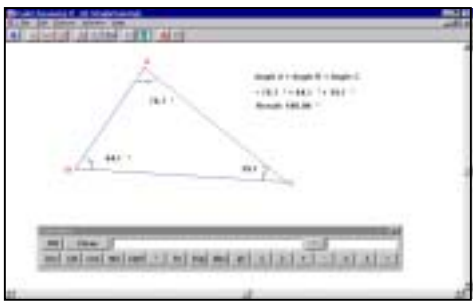

Figure 2.1

Worksheet 2.1 : Angle Sum of a Polygon

Instruction :

1. Draw a triangle.
2. Label the vertices by letters A, B and C.
3. Measure angles A, B and C.
4. Calculate the sum of all the interior angles of the triangle.
5. Drag each vertex and observe the angle sum of the triangle.
6. Write down your findings in Table 2.1.
7. Clear your drawing.
8. Draw a quadrilateral.
9. Repeat steps 2 to 6 to measure the sum of all the interior angles of a quadrilateral.
10. Try figures like “Pentagon”, “Hexagon”, “Heptagon”, “Octagon” and so on. Record your findings in Table 2.1.

Figure	**Number of sides (n)**	**Sum of all the interior angles of the figure (s)**	**Multiples of 180° $\left(\frac{s}{180^\circ}\right)$**
Triangle			
Quadrilateral			
Pentagon			
Hexagon			
Heptagon			
Octagon			

Table 2.1

11. Write down a conjecture on the sum of all the interior angles of a n-gon (a n-sided polygon).

Conjecture :

12. Give a proof of your conjecture for quadrilateral, pentagon and hexagon.

Proof for quadrilateral :

Proof for pentagon :

Proof for hexagon :

13. Try to give a formal proof of your conjecture for a n-sided polygon.

Notes for Teachers :

1. Suggested answers to Worksheet 2.1.

Figure	Number of sides (n)	Sum of all the interior angles of the figure (s)	Multiples of 180° $(\frac{s}{180^\circ})$
Triangle	3	180°	1
Quadrilateral	4	360°	2
Pentagon	5	540°	3
Hexagon	6	720°	4
Heptagon	7	900°	5
Octagon	8	1080°	6

2. Students should be able to discover that the angle sum of a polygon is $(n-2) \times 180°$. They can discuss among themselves on the formal proof.
3. Teachers should let students discover the formula of the angle sum of a polygon by themselves.
4. Teachers give the formal proof to students if they are not able to do it.

Operation Procedure :

1. Click the **Lines** button and choose Triangle or Polygon .
2. Construct a triangle in the drawing window.
3. Click the **Display** button and choose Label .
4. Click to select a vertex of the triangle. An edit box appears. Type the letter A to label the point.
5. Repeat step 4 to label the other two vertices as B and C.
6. Click the vertices A, B and C sequentially. Click the **Measure** button and choose Angle to measure ∠ ABC.
7. Click the **Display** button and choose Comments . Click anywhere in the drawing window. A text box appears. Type the words "Angle A + Angle B + Angle C". Press **Enter** and type "=". Move the cursor to angle A. Click the number at angle A. The number will appear in the text box after "=". Then type "+".
8. Repeat steps 6 and 7 to add in the other two angles.
9. Click the **Measure** and choose Calculate . A calculation box (Figure 2.2) will appear at the bottom of the screen. Click the measurement of Angle A, a small letter "a" representing the angle A will appear in the calculation box. Click the "+" button or type "+" sign. Repeat the procedure to add in the measurements of angles B and C (inside the ellipse in Figure 2.2), then click the "=" button. The result will come out (inside the circle in Figure 2.2). Move the cursor to the text box of the result and drag the result to an appropriate position in the drawing window. "Results: 180.00°" will be shown.

Figure 2.2