

## Materials

- TI-Nspire Math and Science Learning Handheld
- Investigating Triangles and Congruence worksheet

**Teacher's COPY**

## Introduction

The following activity allows you to investigate triangles and congruence.

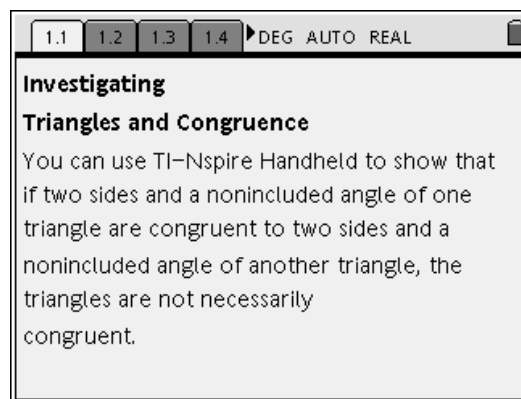
In this activity we will use the TI-Nspire handheld to show that if two sides and a nonincluded angle of one triangle are congruent to two sides and a nonincluded angle of another triangle, the triangles are not necessarily congruent.

## CONSTRUCT

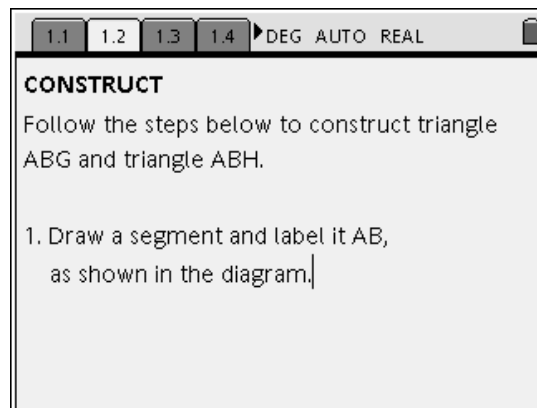
Follow the following steps below to construct  $\triangle ABG$  and  $\triangle ABH$ .

1. Draw a segment and label it segment AB.

**(Follow the steps given next page)**



**Figure 1**



**Figure 2**

- Press  $\text{\textcircled{H}}$  then choose 2: Graphs & Geometry (Figure 3 & 4).

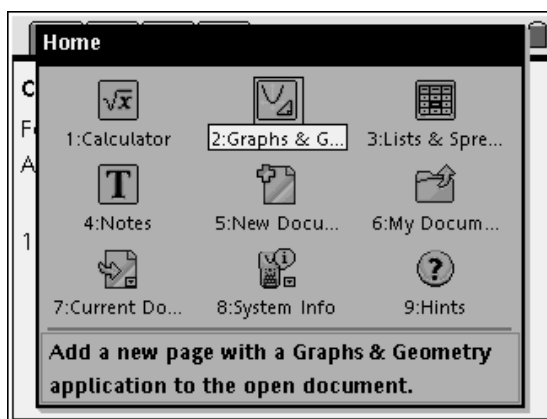


Figure 3

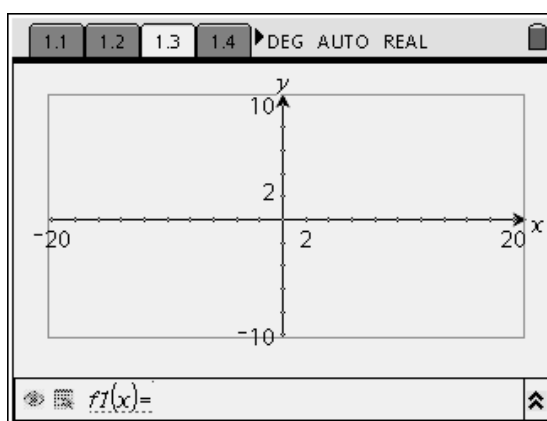


Figure 4

- Press  $\text{\textcircled{M}}$  Choose  $\text{\textcircled{V}}$  View,  $\text{\textcircled{1}}$  Hide Axes and press  $\text{\textcircled{M}}$   $\text{\textcircled{2}}$   $\text{\textcircled{3}}$  Hide Entry Line. This will allow you to have a blank screen. (Figure 5 & 6)

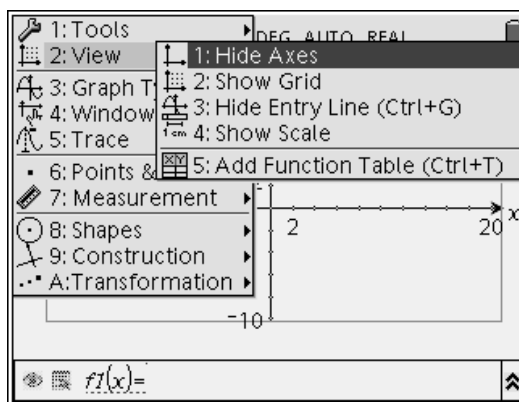


Figure 5

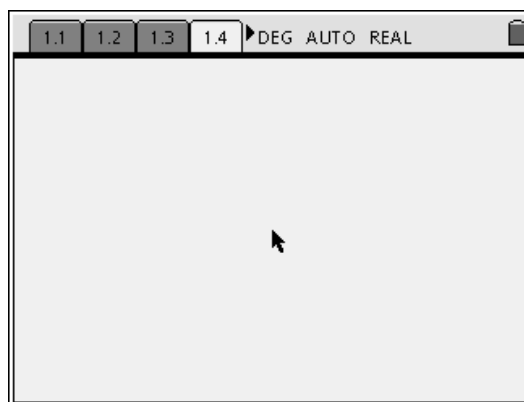


Figure 6

- Press  $\text{\textcircled{menu}}$  6: Points & Lines  $\blacktriangleright$  5: Segment (Figure 7).

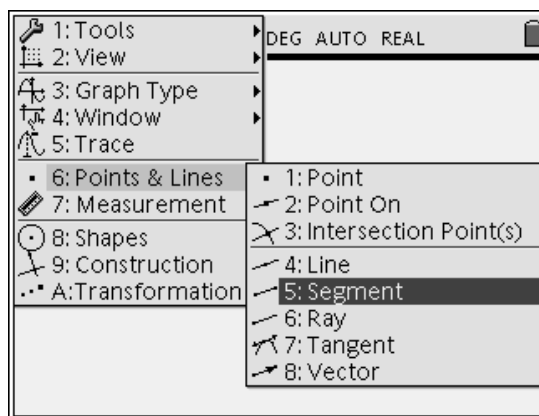


Figure 7

- Move the cursor (pointer) to middle left corner of the screen and press  $\text{\textcircled{enter}}$  followed by the letter  $\text{\textcircled{A}}$ , move the cursor, then press  $\text{\textcircled{enter}}$  again followed by the letter  $\text{\textcircled{B}}$  to label the line segment AB (Figure 8).

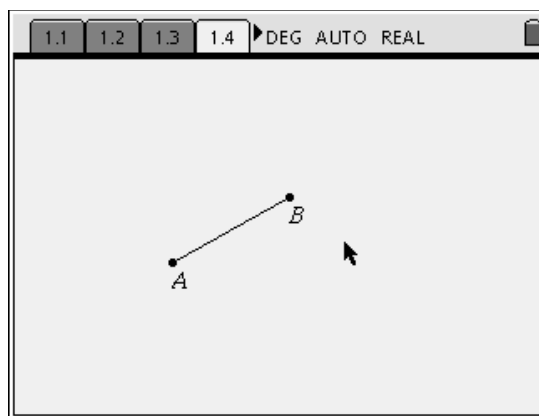


Figure 8

2. Draw another point not on segment AB. Label this point E and draw line AE.

- Press – choose 6: Points & Lines – 4: Line (Figure 9).

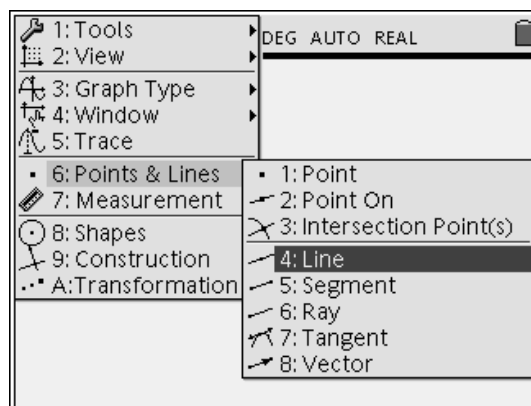


Figure 9

- Using the cursor, move it to the right of point A, press  $\text{Enter}$  followed by the letter  $\text{E}$ . Move your cursor to point A until the point starts blinking and then press  $\text{Enter}$  again. This action will draw a line through A and E. Press  $\text{Esc}$  (Figure 10).

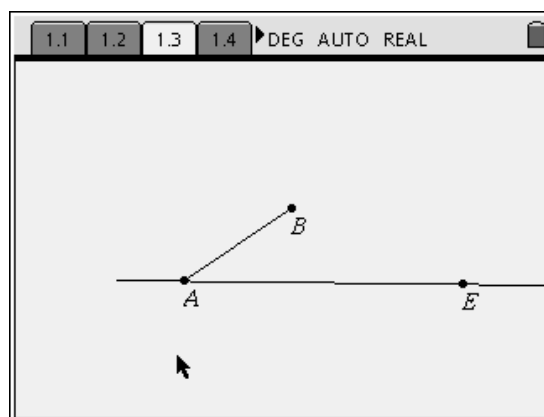


Figure 10

3. Draw a circle with center at point B that intersects line AE in two points. Label the intersection points G and H.

- Press  $\text{Menu}$  8: Shapes 1: Circle (Figure 11). Press  $\text{Enter}$
- Move your cursor to point B and press  $\text{Enter}$
- Draw a circle intersecting line AE at two points (Figure 12).

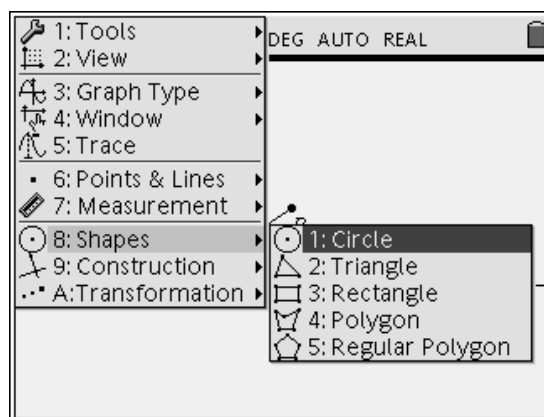


Figure 11

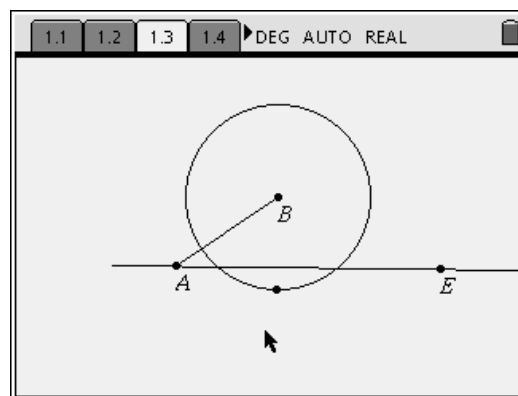


Figure 12

4. Draw segments BG and BH.

- Press (menu) 6 3: Intersection Point(s). Press (menu) 6 5: Segment to draw line segments BG and BH (Figure 13).

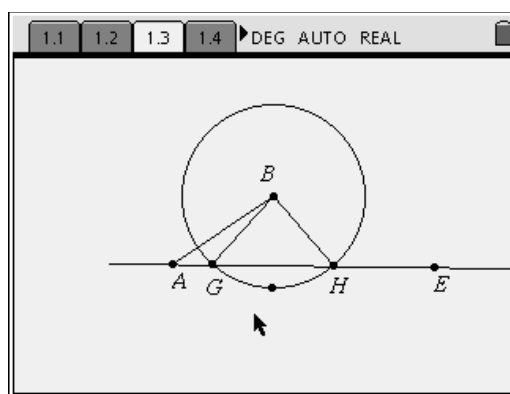


Figure 13

- Press (menu) 1 2 Hide/Show then (enter), then move your cursor to the circle until it starts blinking then press (enter) to hide the circle (Figures 14 & 15).

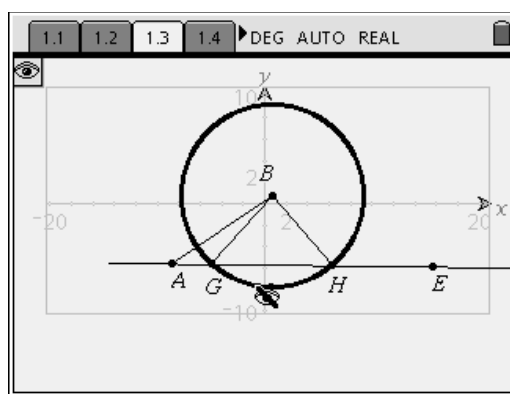


Figure 14

**INVESTIGATE**

1. Measure the lengths of segments AB, BH, BG, AG, and AH.

- Press  $\text{[menu]} \text{[1]} \text{[5]}$  Text, to create a text box. Type  $AB = \text{[enter]}$  and repeat this for each one of the segments (Figure 16).

- Press  $\text{[menu]} \text{[7]} \text{[1]}$ : Length, to measure the length of each segment. Move your cursor to the beginning of a segment, press  $\text{[enter]}$ , then move the cursor to the end of the segment, press  $\text{[enter]}$  once more. The measurement appears, move the cursor to the right label. Repeat the process for the other segments (Figure 17).

*Answers will vary, but  $BH = BG$*

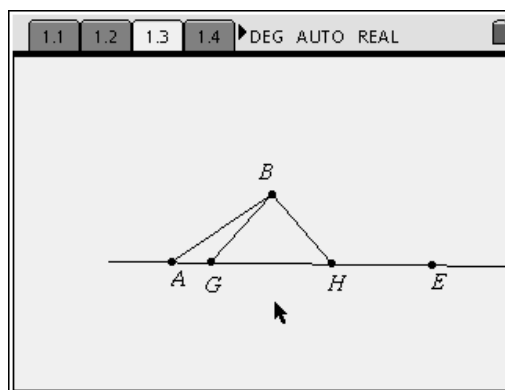


Figure 15

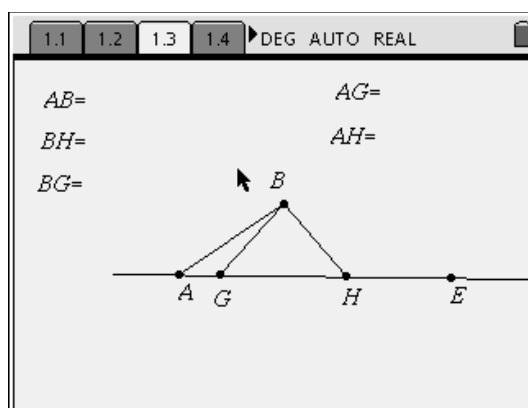


Figure 16

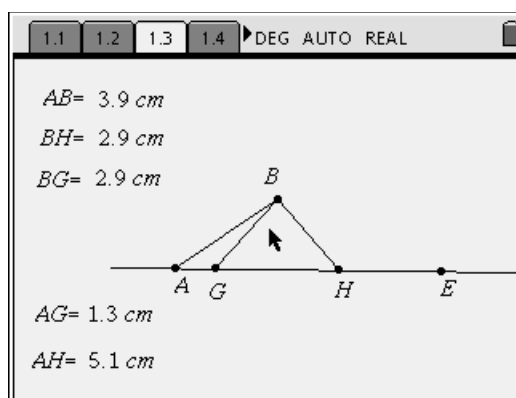


Figure 17

2. Measure  $\angle ABG$ ,  $\angle BAG$ ,  $\angle AGB$ ,  $\angle ABH$ ,  $\angle BAH$ , and  $\angle AHB$ .
  - To achieve this goal repeat the process as above except use angles instead of lengths.

Answers will vary. Samples are shown on the screen shot.

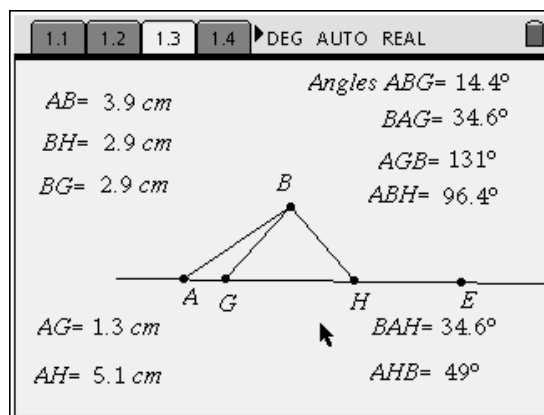


Figure 18

3. Name the sides of  $\triangle ABG$  that are congruent to the sides of  $\triangle ABH$ .

Answer:  $AB = AB$ ,  $BG = BH$

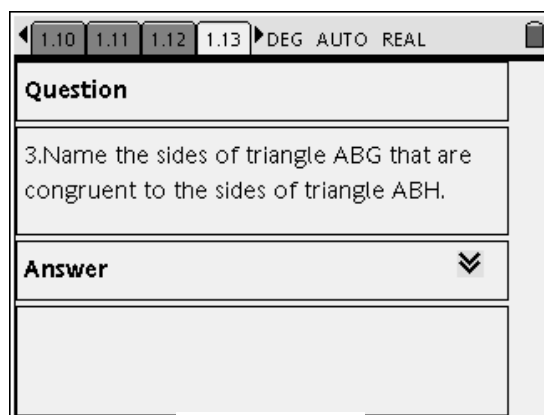


Figure 19

4. Name the angles of  $\triangle ABG$  that are congruent to the angles of  $\triangle ABH$ .

Answer:  $\angle BAG$  and  $\angle BAH$

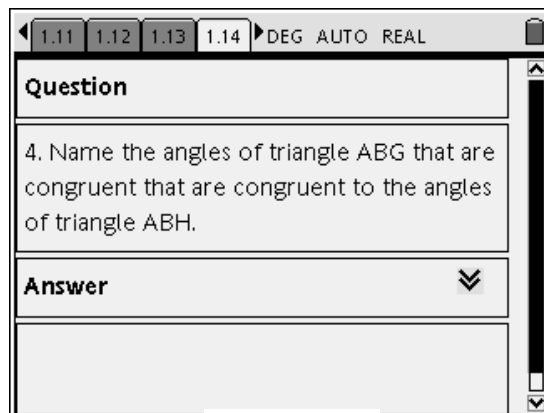


Figure 20

5. Explain why the following conjecture is false.

*If two sides and a nonincluded angle of one triangle are congruent to two sides and a nonincluded angle of the other triangle, then the triangles are congruent.*

*Answer:  $\triangle ABG$  and  $\triangle ABH$  provide a counterexample.*

## EXTENSION

**CRITICAL THINKING** If you know that three angles of one triangle are congruent to three angles of another triangle, can you prove that the triangles are congruent?

In other words, is there an Angle-Angle-Angle Congruence Postulate or Theorem? Make a conjecture. Then test your conjecture by drawing a triangle with angle measures of  $40^\circ$ ,  $60^\circ$ , and  $80^\circ$ . Compare your triangle with those of others in your class. Is your conjecture true or false? Explain.

*Answer: It is possible to have two noncongruent triangles in which three angles of one are congruent to three angles of the other. (Consider two equilateral triangles, one with sides 3 cm long, the other with 3 cm long). There is no AAA Congruence Postulate of Theorem.*

## ACTIVITY ASSESSMENT.

Can SSA be used to prove two triangles are congruent? Explain.

*Answer: No; it is no enough information to ensure that the triangles are congruent.*

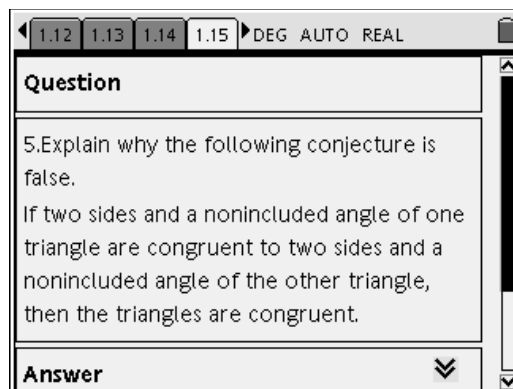


Figure 21

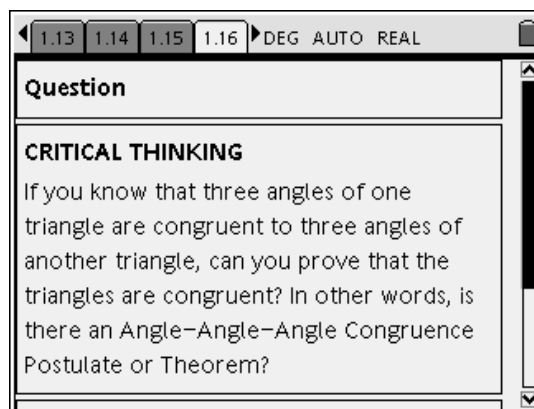


Figure 22