Congruence
Teacher Notes

7 **8** 9 10 11 12

TI-Nspire CAS   Investigation   Student   30 min

Aim

The aim of this investigation is to confirm the congruence rules for triangles.

Equipment

For this activity you will need:

- TI-Nspire CAS (or TI-Nspire)
- TI-Nspire file – Congruence

National Curriculum Statement: Develop the conditions for congruence of triangles (ACMMG201)

Introduction

The concept of 'congruence' is similar to the concept of 'equality'. It is used in geometry to indicate when shapes are the same. A good way to think of congruence is to visualise one shape fitting exact on top of another.

In algebra, we use the equal sign $(=)$ to indicate equality. In geometry, we use the congruent sign $(\equiv)$ to indicate congruence. If line segments $\overline{AB}$ and $\overline{CD}$ are congruent, we write $\overline{AB} \equiv \overline{CD}$. If two triangles $\triangle ABC$ and $\triangle DEF$ are congruent, we write $\triangle ABC \equiv \triangle DEF$.

In this activity, we will be investigating tests for determining congruence in triangles. The four congruency tests we will be investigating are:

- **Side, Side, Side (SSS)**
- **Side, Angle, Side (SAS)**
- **Side, Side, Angle (SSA)**
- **Angle, Side, Angle (ASA)**

Setting up the activity

During this activity, students will need to use the TI-Nspire file: "Congruence". This file can be distributed using TI-Navigator, the TI-Nspire docking station or the teacher/student software. To distribute the file using the Teacher software, use the **Tools** menu and select the **Transfer Tool.** Locate the TI-Nspire file on your computer and then start the transfer. Once the file is transferred to the first handheld, unplug the handheld and continue plugging in each student's handheld device. Once all the students have the file, stop the transfer. Note that students can also transfer files from one handheld device to another from within the **My Documents** folder. Note also that multi-port USB connectors can be used to transfer files to several computers at the one time.

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This activity requires access to the "Congruence" TI-Nspire file. This file should be loaded on your device before proceeding.

Once the file is on your handheld, press **home** and select **My Documents**. Locate the "Congruence" file and press **enter** to open.

The location of the file depends on the selected location during the file transfer.
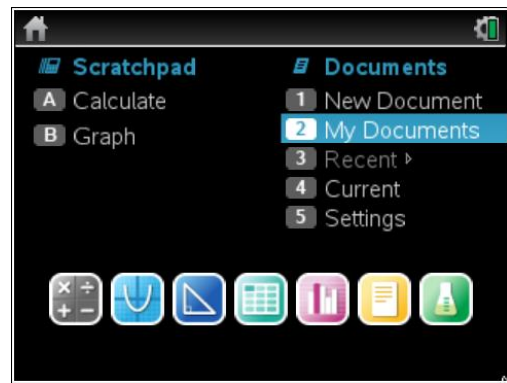
Side, Side, Side (SSS)

Navigate to page 1.2. On the right hand side of the screen, grab and move the line segments to form a triangle.

The line segments on the right hand side are fixed to the same length as those on the left. The students are to arrange the segments to form a triangle. Students may not get it to look exactly like the one on the left but they should still conclude that only one congruent triangle is possible.
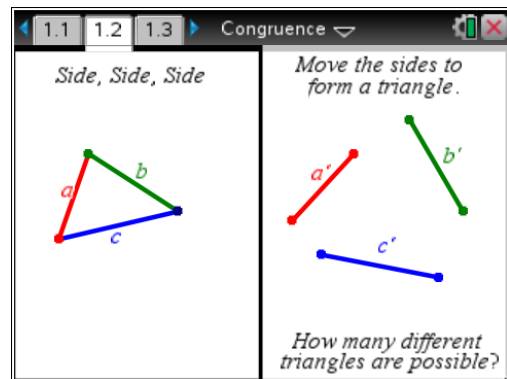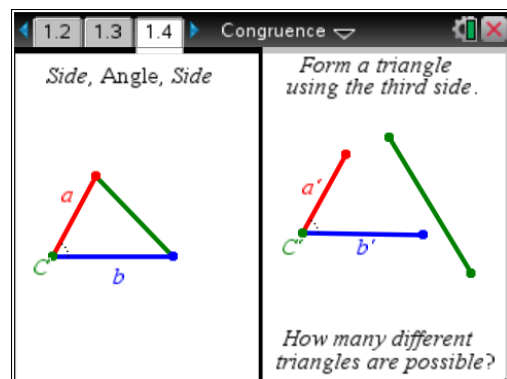
1. How many different triangles can be formed using three congruent sides? 1

2. Do you believe that the Side, Side, Side (SSS) test shows congruence? Why or why not?

   Yes. No matter how you fit the sides together, the triangle on the right will always be congruent to the one on the left.

Side, Angle, Side (SAS)

Navigate to page 1.4. On the right hand side of the screen, grab and move the third line segment to form a triangle.

The two adjacent line segments and the angle are fixed. The separate line segment is not. Students should move and adjust the line segment to make a congruent triangle.
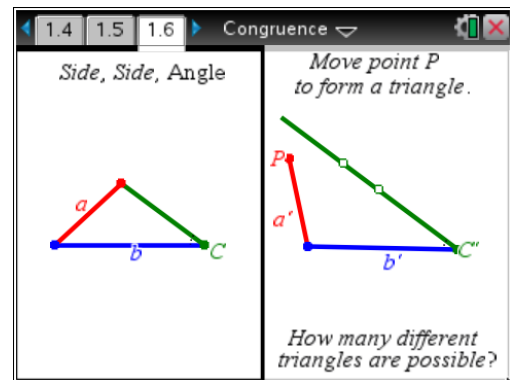
3. How many different triangles can be formed using a congruent side, a congruent angle and another congruent side? 1

4. Do you believe that the Side, Angle, Side (SAS) test demonstrates congruence? Why or why not?
   Yes. When you move the line segment into place, only one congruent triangle is possible.

Side, Side, Angle (SSA)

Navigate to page 1.6. On the right hand side of the screen, grab and move the point P to form a triangle.

The line segment a' is a fixed length but the angle is not fixed. When the students move point P, they should be able to form two triangles, one at each of the gaps.
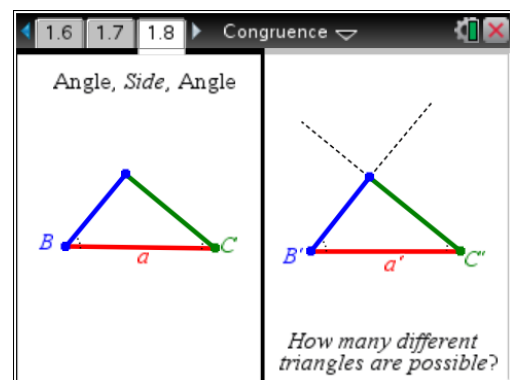

5. How many different triangles can be formed using two congruent sides followed by a congruent angle? 2

6. Do you believe that the Side, Side, Angle (SSA) test demonstrates congruence? Why or why not?

   No. Two different triangles are possible.

Angle, Side, Angle (ASA)

Navigate to page 1.8. Observe the triangle on the right hand side of the screen.

Students are not required to move anything on as all measurements are fixed. They should simply observe that only one congruent triangle is possible.

7. How many different triangles can be formed using a congruent angle, a congruent side followed by another congruent angle? 1

8. Do you believe that the Angle, Side, Angle (ASA) test demonstrates congruence? Why or why not?

   Yes. The two congruent angles at the end of the line segment result in only one possible congruent triangle.

9. Would an Angle, Angle, Side (AAS) test demonstrate congruence? Why or why not?

   Yes. The three angles of a triangle add to 180°. If you are given two angles of a triangle then you can determine the third angle. Consequently, the ASA test will confirm congruence.

10. Would an Angle, Angle, Angle (AAA) test demonstrate congruence? Why or why not?

   No. The two triangles will be similar as they will have the same shape. However, without at least one congruent side, the triangles will not be congruent.

11. Copy and complete the following table to summarise your results. Write 'Yes' if you believe the congruency test is valid. Write 'No' if you believe it is not valid.

Congruency Test	Yes/No
Side, Side, Side (SSS)	Yes
Side, Angle, Side (SAS)	Yes
Side, Side, Angle (SSA)	No
Angle, Side, Angle (ASA)	Yes
Angle, Angle, Side (AAS)	Yes
Angle, Angle, Angle (AAA)	No

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