Triangle Sides & Angles

About the Lesson

In this activity, students use the Cabri™ Jr App to create and manipulate dynamic sketches of triangles to explore and conjecture many triangle properties. As a result, students will:

- Discover where the longest (and shortest) side is located relative to the largest (and smallest) angle.
- Explore the Isosceles Triangle Theorem and its converse.
- Determine the number of acute, right, or obtuse angles that can exist in any one triangle.

Vocabulary

- acute
- obtuse
- Isosceles Triangle Theorem

Teacher Preparation and Notes

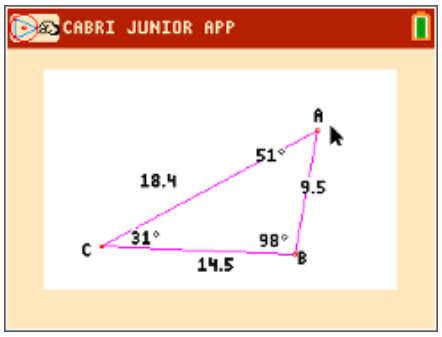
- When using the Cabri™ Jr App, measurements can display 0, 1, or 2 decimal digits. If 0 digits are displayed, the value shown will round from the actual value. To change the number of digits displayed:
    1. Move the cursor over the coordinate value so it is highlighted.
    2. Press [+] to display additional decimal digits or [−] to hide digits.

Activity Materials

- Compatible TI Technologies:

TI-84 Plus*
TI-84 Plus Silver Edition*
TI-84 Plus C Silver Edition
TI-84 Plus CE

** with the latest operating system (2.55MP) featuring MathPrint™ functionality.*



Tech Tips:

- This activity includes screen captures taken from the TI-84 Plus CE. It is also appropriate for use with the rest of the TI-84 Plus family. Slight variations to these directions may be required if using other calculator models.
- Watch for additional Tech Tips throughout the activity for the specific technology you are using.
- Access free tutorials at http://education.ti.com/calculators/pd/US/Online-Learning/Tutorials
- Any required calculator files can be distributed to students via handheld-to-handheld transfer.

Lesson Files:

- Triangle_Sides_Angles_Student.doc
- Triangle_Sides_Angles_Student.pdf
- ISOSTRI1.8xv
- ISOSTRI2.8xv

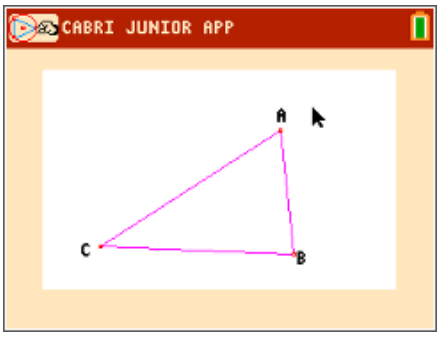
Tech Tip: Before beginning the activity, the Cabri™ Jr files ISOSTRI1.8xv and ISOSTRI2.8xv need to be transferred to the students' calculators via handheld-to-handheld transfer or transferred from the computer to the calculator via TI-Connect™ CE software.

Problem 1 – Size and Location of Sides and Angles

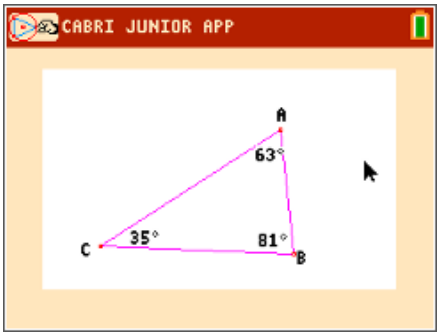
Opening a new Cabri™ Jr. file, students should first construct a triangle using the **Triangle** tool.

Select the **Alph-Num** tool to label the vertices *A*, *B*, and *C* as shown.

Note: Press enter to start entering the label, and then press enter again to end the label.

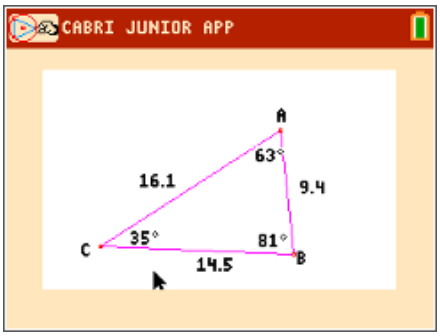


Students will measure the three interior angles of the triangle using the **Measure > Angle** tool. To measure an angle, press enter on each of three points that define the angle, with the vertex of the angle as the second point chosen.



Direct students to measure the three side lengths using the **Measure > D. & Length** tool.

Note: To measure a side of the triangle, you must click on the endpoints of the segment. If you click on the side itself, the tool will return the perimeter of the triangle.

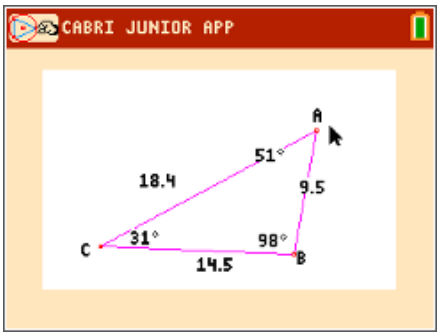


Students will now drag a vertex of the triangle to change the angle measures and side lengths.

Note: The measurements do not move with the line segments and angles they measure.

Encourage students to make a conjecture about the sizes and locations of the angles and sides in a triangle.

Students can answer the four questions on the worksheet based on their observations, concluding that the largest angle is opposite the longest side, and the smallest angle is opposite the shortest side.



1. Where is the largest angle of the triangle located relative to the longest side?

Answer: opposite the longest side

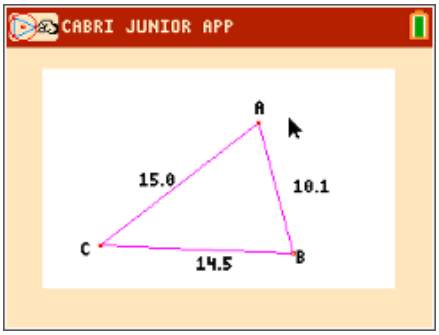
2. Where is the smallest angle of the triangle located relative to the shortest side?

Answer: opposite the shortest side

Have students save this file as *TRIANGLE* by pressing [y=] and selecting **Save as...**

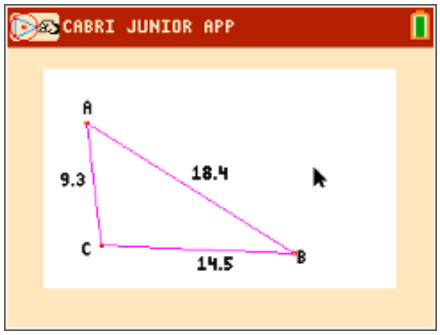
3. List the angles in order from smallest to largest.

a.



Answer: *C*, *A*, *B*

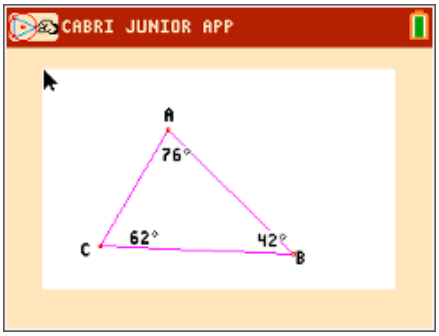
b.



Answer: *B*, *A*, *C*

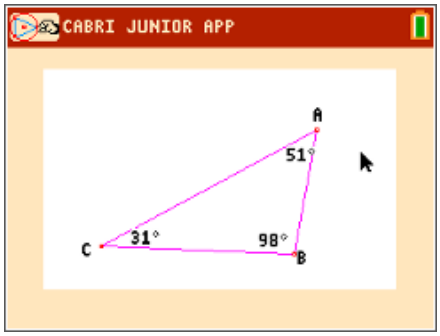
4. List the sides in order from shortest to longest.

a.



Answer: $\overline{AC}$, $\overline{AB}$, $\overline{BC}$

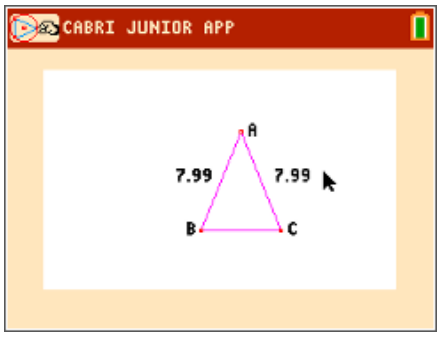
b.



Answer: $\overline{AB}$, $\overline{BC}$, $\overline{AC}$

Problem 2 – The Isosceles Triangle Theorem

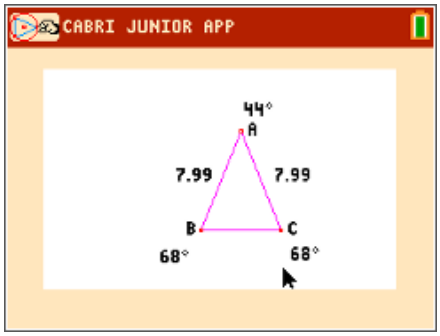
Have students open the file *ISOSTRI1* by pressing y=. An isosceles triangle has been constructed, and the congruent sides have side lengths displayed.



Students will measure all three angles using the **Measure > Angle** tool.

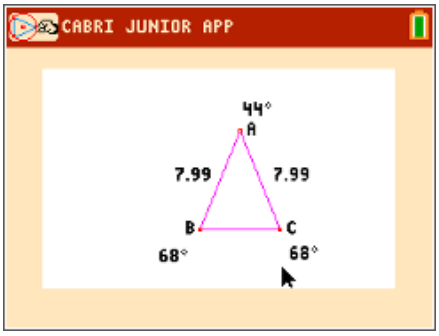
Direct students to drag a vertex of the triangle to explore what happens to the angle measures when two sides have equal lengths.

Students should conclude that a triangle with two congruent sides also has two congruent angles. This is known as the Isosceles Triangle Theorem.



5. At the right, make a sketch of your triangle with the side lengths and angle measures labeled.

Answer:

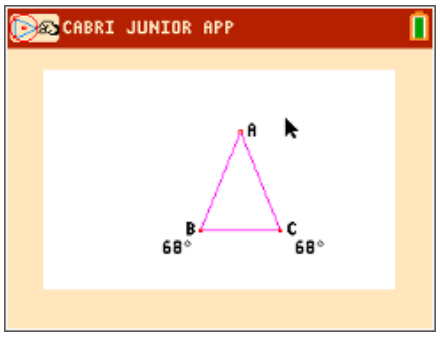


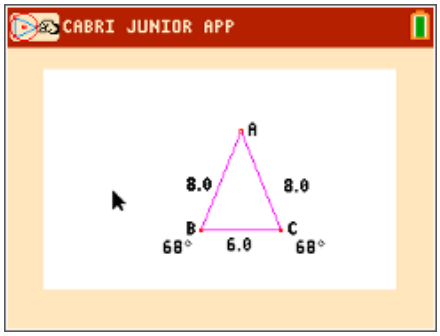
6. Complete this statement:

If two sides of a triangle are congruent, then _____.

Answer: …the angles opposite them are congruent.

The converse of the Isosceles Triangle Theorem may be explored in the file *ISOSTRI2*.





Students will measure all three sides using the **Measure > Length** tool, and then drag a vertex to explore.

On their worksheet, students should make the conclusion that a triangle with two congruent angles also has two congruent sides.

7. Complete this statement:

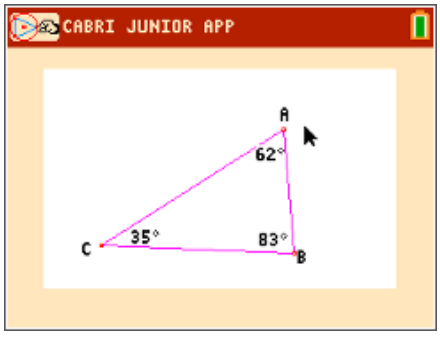
If two angles of a triangle are congruent, then _____.

Answer: …the two sides opposite them are congruent.

Problem 3 – Types of Angles in a Triangle

Have students to open the file *TRIANGLE* that they saved from Problem 1.

If desired, have them hide the side lengths using the **Hide/Show > Object** tool.



Students will drag a vertex and notice how many angles of each type can exist in a triangle. They should conclude that a triangle:

- Can have three acute angles.
- Cannot have three right angles.
- Cannot have three obtuse angles.

8. Drag a vertex of the triangle and classify the types of angles that exist (acute, right, obtuse).

Answers:

$\angle A$	$\angle B$	$\angle C$
acute	acute	acute
acute	acute	obtuse
acute	acute	right

9. Can a triangle have three acute angles? Make a sketch to support your answer.

Answer: Yes

10. Can a triangle have three right angles? Make a sketch to support your answer.

Answer: No

Teacher Tip: Challenge students to observe that a triangle can have, at most, one right or one obtuse angle and that a triangle cannot have both a right and obtuse angle.

11. Can a triangle have three obtuse angles? Make a sketch to support your answer.

Answer: No