

## About the Lesson

In this activity, students will explore the angles formed when parallel lines are cut by a transversal. The measurement tool helps them discover the relationships among the various angles in the figure. Students will draw parallel lines, draw a transversal, and explore angle relationships. As a result, students will:

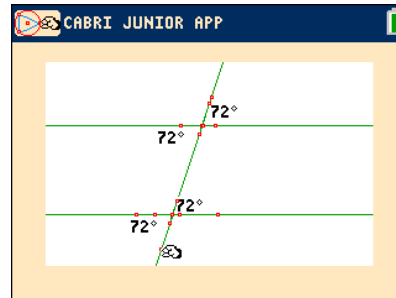
- Discover that pairs of alternate angles (interior and exterior) are congruent and same side angles (interior and exterior) are supplementary.
- Use dynamic geometry technology tools to construct two parallel lines cut by a transversal.

## Vocabulary

- congruent
- corresponding angle
- exterior angle
- interior angle
- parallel
- supplementary
- transversal

## Teacher Preparation and Notes

- This activity is designed to be used in a high-school geometry classroom. It can also be used with advanced middle school students.
- This activity is intended for students to work with each other in pairs while the teacher assists and guides the exploration. Use the following pages to present the material to the class and encourage discussion. Students will follow along using their calculators.
- Students should already be familiar with parallel lines as well as reading and naming angles.
- The CabriJr Application is needed to complete this activity.



### Tech Tips:

- This activity includes screen captures taken from the TI-84 Plus C Silver Edition. It is also appropriate for use with the TI-84 Plus family with the latest TI-84 Plus operating system (2.55MP) featuring MathPrint™ functionality. Slight variations to these directions given within may be required if using other calculator models.
- 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.

### Compatible Devices:

- TI-84 Plus Family
- TI-84 Plus C Silver Edition

### Associated Materials:

- ParallelLines\_Student.pdf
- ParallelLines\_Student.doc

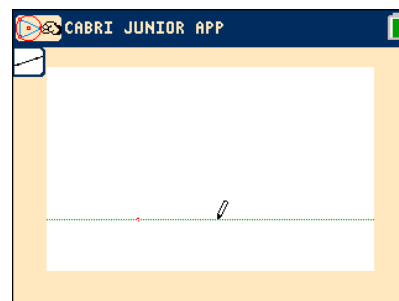
Have students press **[APPS]**, and move down to select the **Cabri Jr** application. Press **[ENTER]**, or any key, to begin using the application.

Then they should press **[Y=]** for the **[F1]** menu and select **New**. (If asked to **Save changes?** press **[ENTER]** to choose “No.”)

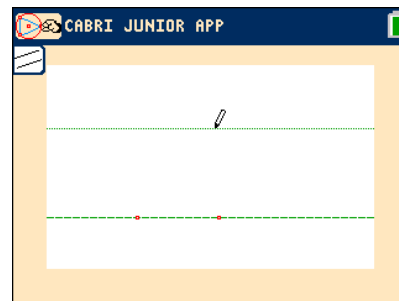


**Tech Tip:** If the axes are shown, press **[GRAPH]** for **[F5]**, and select **Hide/Show > Axes**. This will hide the axes.

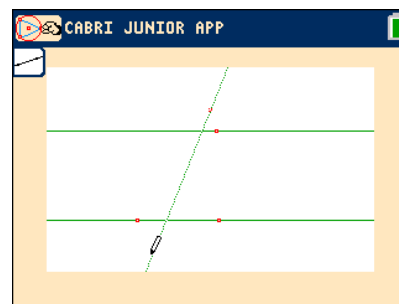
To begin have students create the first of the two parallel lines. To do this, students should press **[WINDOW]** for **[F2]**, and select **Line**. Have them move down and to the left and press **[ENTER]** to mark one point on the line. They should move to the right and press **[ENTER]** to mark the second point defining the line.



Then students are to create the second of the two parallel lines. To do this, have students press **[ZOOM]** for **[F3]**, and select **Parallel**. They should move the pencil until the line is blinking. Have students press **[ENTER]** and then press **[↑]** until the second line is in the desired location. Then, have students press **[ENTER]** to mark the point through which the parallel line is drawn.

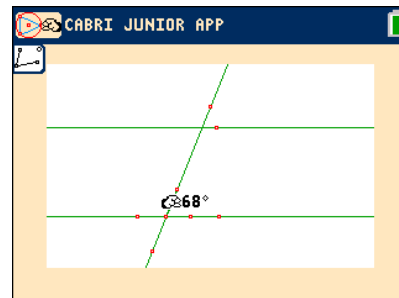


Now students will create the transversal that intersects the two parallel lines. To do this, have students press **[WINDOW]** for **[F2]** and select **Line**. They should move up and mark a point by pressing **[ENTER]**. Then, they should move down and left and press **[ENTER]** to mark the second point defining the transversal of the two parallel lines.



Now students will measure angles and explore angle relationships.

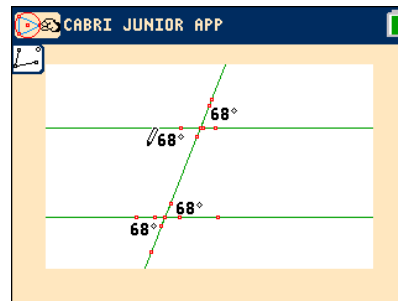
To do this, have students press **[GRAPH]** for **F5**. They should select **Measure**, then scroll right and down to select **Angle**. Students must select three points to identify the angle. Have them move the pencil until one of the lines is flashing and press **[ENTER]** to select a point on that line. Students should move the pencil until one of the parallel lines and the transversal are both flashing and then press **[ENTER]**.



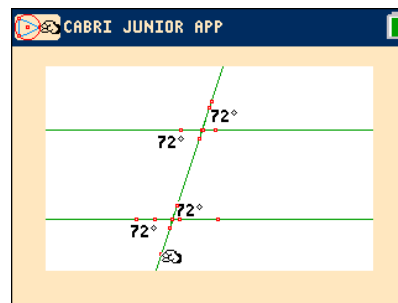
This will mark their intersection as the vertex of the angle. Have students move the pencil to the other line (which will form a side of the angle). Students should press **ENTER** when that line is flashing.

With the angle measuring tool active, students are to measure some of the other angles formed, such as the corresponding, alternate interior, and alternate exterior angles.

Move each measurement to a convenient location. Press **CLEAR** to turn off the hand.



To make conjectures about the different types of angle pairs, students are to move the pointer to one of the points on the transversal. Students can then press **ALPHA** to activate the *hand* and move the point. Students should record their observations at the bottom of page 1 on the worksheet or lead a class discussion.



1. Which angle pairs remain congruent as the position of the transversal changes?

**Answer:** corresponding and alternate interior angle pairs remain the same as the transversal changes.

2. Fill in the blank: When a transversal cuts through two parallel lines, the corresponding angles formed by the transversal are:
  - A. never congruent
  - B. sometimes congruent
  - C. always congruent

**Answer:** C

3. A student claims two lines in a plane are parallel. To support her claim, she draws a transversal line and shows that the interior angles formed by the transversal are congruent. Do you agree with her claim? If not, how could she modify her statement to make it correct?

**Sample Answer:** I disagree with the claim because it is not true in all cases. The student's claim is not precise enough because she did not specify which interior angles are congruent. The claim that two lines in a plane are parallel would be supported by the fact that the alternate interior angles formed by the transversal are congruent. However, it would not be supported by the fact that interior angles on the same side of the transversal are congruent. She could modify the claim by stating that

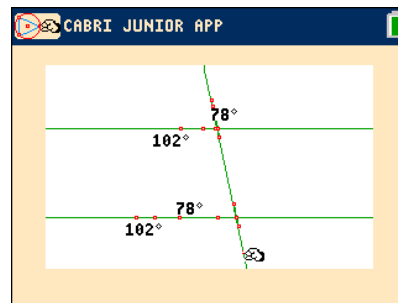
the alternate interior angles are congruent.

**Teacher Tip:** This is a good opportunity to encourage students to communicate precisely about the angles in the geometric construction. Students should be comfortable with the definitions of corresponding angles, alternate interior angles, and alternate exterior angles, and they should recognize the distinction between the terms “interior angles” and “alternate interior angles.”

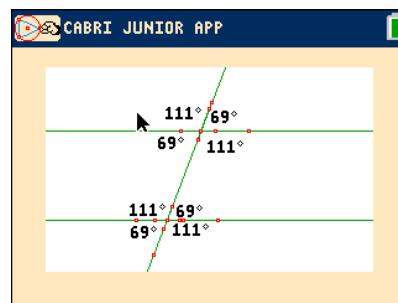
It is also a good opportunity to allow students to critique an argument by brainstorming counterexamples. Challenge students to think about a case where the interior angles formed by a transversal are congruent but the lines are not parallel.

## Extension

Students are to move the transversal until one of the angles has “crossed over” and observe that there are now consecutive interior angles that are supplementary.



Students should measure the remaining angles and observe the relationships among the angle measures.



To exit the Cabri Jr application, have students press  $\boxed{Y=}$  for the **F1** menu. Have students select **Quit** (or press  $\boxed{2nd} \boxed{[QUIT]}$ .)

