Math Objectives

- Students will identify pairs of alternate interior angles and same-side interior angles given two lines cut by a transversal.

- Students will recognize which pairs of alternate interior angles are congruent.

- Students will recognize which pairs of same-side interior angles are supplementary.

- Students will look for and make use of structure (CCSS Mathematical Practice).

- Students will look for and express regularity in repeated reasoning (CCSS Mathematical Practice).

Vocabulary

- parallel lines
- transversal
- alternate interior angles
- same-side interior angles
- supplementary angles
- congruent angles

About the Lesson

- This lesson involves students recognizing which pairs of alternate interior angles are congruent and which pairs of same-side interior angles are supplementary.

- As a result, students will:
  - Click on different segments to identify which segments form alternate interior angles and which segments form same-side interior angles.

Prerequisite Knowledge

- Before this activity is done, students must understand that when parallel lines are cut by a transversal, the alternate interior angles are congruent.

TI-Nspire™ Navigator™ System

- Use Screen Capture and Quick Poll to monitor students' understanding as they respond to the questions posed on the student activity worksheet.
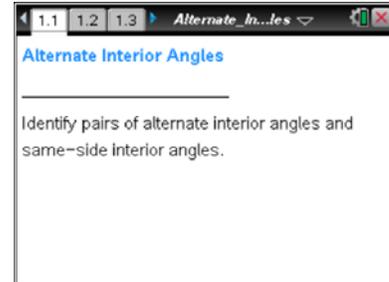
TI-Nspire™ Technology Skills:
- Download TI-Nspire document
- Open a document
- Move between pages
- Click to select segments

Tech Tips:
- Make sure the font size on your TI-Nspire handheld is set to Medium.
- You can hide the function entry line by pressing `ctrl` `G`.

Lesson Materials:
Student Activity
Alternate_Interior_Angles_ Student.pdf
Alternate_Interior_Angles_ Student.doc
TI-Nspire document
Alternate_Interior_Angles.tns

Visit www.mathnspired.com for lesson updates and tech tip videos.

Discussion Points and Possible Answers

Move to page 1.2.

1. Hover over the segments until you find segment *L*. Then click.
    a. What happens to the segment when you click on it?

        Answer: When you click on segment *L*, it flashes.
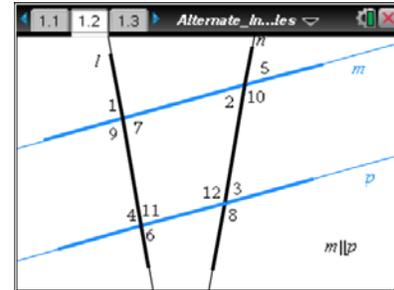
Press esc **to start over.**

    b. Click on segments *L* and *C*. What angle is formed by these segments?

        Answer: ∠7

> **Teacher Tip:** Be sure that students understand that these two segments
> form only one angle because they share only an endpoint. Note that *L* is
> used for the name of a segment, and *l* is the name of a line. Students
> should not confuse the two.

Press esc **to start over.**

2. Click on the segments that form ∠2 and ∠3.
    a. What special name do you give ∠2 and ∠3? Why do you think these angles were given this
        name?

        Answer: Alternate interior angles are used to describe the angles on alternate sides of the
        transversal but in between the parallel lines.

    b. Given *m* ∥ *p*, what do you know about the measures of ∠2 and ∠3? Justify your answer.

        Answer: When two parallel lines are cut by a transversal, alternate interior angles are congruent.
        Because *m* ∥ *p*, the angle measures will be the same.

TI-Nspire Navigator Opportunity: *Quick Poll*
See Note 1 at the end of this lesson.

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c. What do you notice about the flashing segments?

Answer: They form a "Z" or a zigzag.

> **Teacher Tip:** Many students have problems identifying alternate interior angles in complex figures. This activity is designed to help them do this. Note that this "Z" can be reflected or oriented in different ways.

3. Press [esc]. Find at least two more sets of segments that follow the pattern you discovered in part 2c.

a. What pairs of angles are determined by each set of segments?

Sample Answers: ∠9 and ∠ 11, ∠7 and ∠4, ∠10 and ∠12, ∠6 and ∠12

> **Teacher Tip:** Students may find the text highlighted instead of the segment on which they want to click. They can either tab to the segment or move the cursor farther down the segment.
> Students may want to name other pairs of angles that are formed by a "Z" but which are not given a number. Adding these to the list by increasing the number of named angles is an option. Students may also not name angles such as 6 and 12, but these are alternate interior angles even though they are not congruent. Pointing out these angles may help reinforce the need for the assumption that parallel lines cut by a transversal will produce congruent alternate interior angles.

b. What do you know about these pairs of angles?

Answer: Each is a pair of alternate interior angles. The angles formed by the transversals *l* and *n* and parallel lines *m* and *p* will be congruent (pair ∠9 and ∠11; pair ∠7 and ∠4; pair ∠10 and ∠12). The other angle pairs (such as ∠6 and ∠12) will not be congruent because the condition of parallel lines is not met.

4. Sherri highlighted segments *J*, *F*, and *T*. She concluded that ∠6 is congruent to ∠12. Do you agree? Why or why not?

    Answer: No. Angles 6 and 12 are not congruent because line *n* is not parallel to line *l*. Although angles 6 and 12 are alternate interior angles, they are not congruent unless they are created with parallel lines and a transversal.

5. Click on the segments that form ∠7 and ∠11.
    a. What special name do you give ∠7 and ∠11? Why do you think these angles were given this name?

        Answer: Same-side interior angles are angles on the same side of a transversal and both between the two parallel lines. These may also be called angles on the same side of a transversal.

    b. Given *m* ∥ *p*, what do you know about their angle measures? Base your answer on what you know about alternate interior angles.

        Answer: When two parallel lines are cut by a transversal, same-side interior angles are supplementary. Note that ∠9 and ∠11 are alternate interior angles formed by two parallel lines, *m* ∥ *p*. Thus, ∠9 is congruent to ∠11. But ∠9 and ∠7 are linear pairs and, therefore, are supplementary. If ∠11 is substituted for ∠9, then ∠11 and ∠7 are also supplementary.

6. Press ⎡esc⎤. Find at least two more sets of segments that follow the pattern you discovered in part 5b.
    a. What pairs of angles are determined by each set of segments?

        Answer: ∠9 and ∠4, ∠2 and ∠12, ∠10 and ∠3, ∠11 and ∠12, ∠2 and ∠7

    b. What do you know about these pairs of angles?

        Answer: The pairs are same-side interior angles. Because *m* ∥ *p*, pair ∠9 and ∠4, pair ∠2 and ∠12, and pair ∠10 and ∠3 have angle measures that will be supplementary, reasoning as in question 5.

> **Teacher Tip:** Students may identify *F*, *T*, and *L* as segments that form same-side interior angles. However, angles 11 and 12 and angles 2 and 7 are not supplementary because lines *n* and *l* are not parallel.

7. Identify a pair of numbered same-side interior angles that are not supplementary. Explain why.

    Answer: *F*, *T*, and *L* are segments that form same-side interior angles. However, angles 11 and 12 are not supplementary nor are angles 2 and 7 because lines *n* and *l* are not parallel.

Move to page 1.3.

8. Identify all of the numbered pairs of alternate interior angles that are congruent and the segments that form each pair.
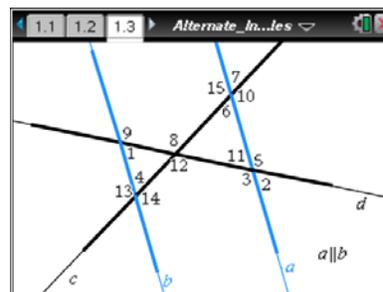
    Answer: Angles 9 and 3 formed by segments *E*, *F*, *G*, *B*.
    Angles 4 and 6 formed by segments *Q*, *J*, *H*, *C*.
    Angles 1 and 11 formed by segments *Q*, *F*, *G*, *C*.
    Angles 14 and 15 formed by segments *P*, *J*, *H*, *N*.

TI-Nspire Navigator Opportunity: *Screen Capture* or *Quick Poll*
See Note 2 at the end of this lesson.

> **Teacher Tip:** Angles 13 and 1 are also alternate interior angles but not formed by parallel lines. If students have trouble finding pairs, have them name the segments that form a *Z*.

9. Identify all of the numbered pairs of same-side interior angles that are supplementary.

    Answer: ∠1 and ∠3, ∠9 and ∠11, ∠6 and ∠14, ∠4 and ∠15

Wrap Up

Upon completion of the discussion, the teacher should ensure that students understand:

- Alternate interior angles form a "Z" when two lines are cut by a transversal.
- Same-side interior angles form a "C" when two lines are cut by a transversal.
- Alternate interior angles are congruent only when formed by parallel lines.
- Same-side interior angles are supplementary only when formed by parallel lines.

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Note 1

Question 2b, *Quick Poll*

Use a Quick Poll to assess student understanding about these angles.

- If $\angle 2$ measures 65°, what is the measure of $\angle 3$? (**Answer:** 65°)

Note 2

Question 9, *Quick Poll*

A Quick Poll can be given at this point to ensure students can recognize congruent angles.

- Which two angles are congruent alternate interior angles? (Identify all correct answers.)

    a. $\angle 6$ and $\angle 4$
    b. $\angle 14$ and $\angle 13$
    c. $\angle 11$ and $\angle 4$
    d. $\angle 11$ and $\angle 1$

    Answer: a and d