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## Performance Descriptors for Lines and Transversal Unit

### ■ **Distinguished**

The student demonstrates exceptional and exemplary performance with distinctive and sophisticated application of knowledge and skills that exceeds the standard in **geometry**. The student applies definitions, theorems and postulates to explore angles formed by lines and parallel lines cut by transversals, and justify solutions in a clear, concise manner.

### ■ **Above Mastery**

The student demonstrates competent and proficient performance and shows a thorough and effective application of knowledge and skills that exceeds the standard in **geometry**. The student applies definitions, theorems, and postulates to determine measures of angles formed lines and parallel lines cut by transversals and justifies solutions.

### ■ **Mastery**

The student demonstrates fundamental course or grade level knowledge and skills by showing consistent and accurate academic performance that meets the standard in **geometry**. The student finds measures of angles found by lines and parallel lines cut by transversals using definitions, theorems and postulates.

### ■ **Partial Mastery**

The student demonstrates basic but inconsistent performance of fundamental knowledge and skills characterized by errors and/or omissions in **geometry**. Performance needs further development. Given definitions, theorems, and postulates, the student inconsistently finds measures of angles found by lines and parallel lines cut by transversals.

### ■ **Novice**

The student demonstrates substantial need for the development of fundamental knowledge and skills, characterized by fragmented and incomplete performance in **geometry**. Performance needs considerable development. The student recognizes lines and parallel lines cut by a transversal. Given appropriate definitions, theorems, and postulates, a student attempts to determine the measure of angles found by lines and parallel lines cut by a transversal.

## Parallel and Non-Parallel Lines

**Renee Warner & Michael Mendicino**  
**Buckhannon-Upshur High School**

### **Content Standards and Objectives:**

G.3.6 Explore the relationship between angles formed by two lines cut by a transversal when lines are and are not parallel, and use the results to develop methods to show parallelism.

### **Primary Learning Objectives:**

To introduce vocabulary related to parallel and non-parallel lines.

### **Materials:**

Masking Tape  
Notebook  
Worksheet

### **Vocabulary:**

Transversal  
Corresponding angles  
Alternate Interior Angles  
Same-Side Interior Angles  
Alternate Exterior Angles  
Same-Side Exterior angles  
Vertical angles

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### **Procedures/Activities**

#### ***Step 1: Duration: Five minutes***

Have students put down masking tape in non-parallel lines with a transversal on the floor of the classroom or a space outside of the classroom. Have eight (8) students place themselves at the eight (8) angles of intersection.

#### ***Step 2: Duration: Five to Ten Minutes***

Discuss student perceptions of the following vocabulary using the students in the intersections of the tape on the floor:

Transversal  
Corresponding Angles  
Alternate Interior Angles  
Same-Side Interior Angles  
Alternate Exterior Angles  
Same-Side Exterior Angles  
Vertical Angles

***Step 3: Duration: Five to Ten Minutes***

Give formal definitions of vocabulary

***Step 4: Duration: Ten to Fifteen minutes***

To check for understanding of these vocabulary words, have the students complete the vocabulary worksheet attached. Have them work individually first, then share-pair their answers so the groups can come to a consensus about the angle classifications.

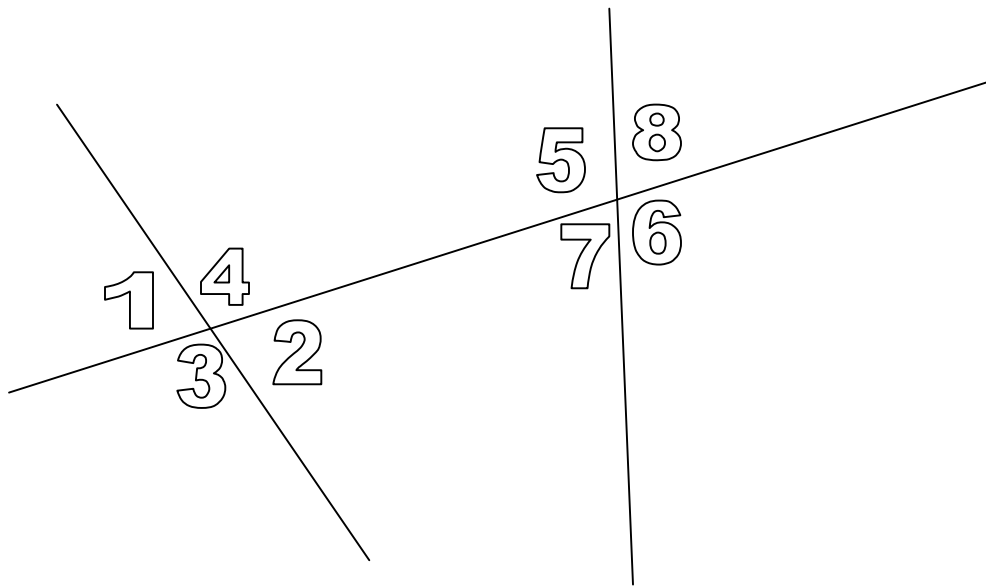
***Step 5: Five Minutes***

Check answers.

***Attachments:***

Worksheet for Step 4.

**Worksheet – Vocabulary Applications**



Name the angle pairs using the vocabulary from this lesson and from your prior knowledge:

1.  $\angle 5$  and  $\angle 2$  \_\_\_\_\_
2.  $\angle 3$  and  $\angle 7$  \_\_\_\_\_
3.  $\angle 7$  and  $\angle 8$  \_\_\_\_\_
4.  $\angle 4$  and  $\angle 5$  \_\_\_\_\_
5.  $\angle 1$  and  $\angle 6$  \_\_\_\_\_
6.  $\angle 4$  and  $\angle 8$  \_\_\_\_\_
7.  $\angle 3$  and  $\angle 6$  \_\_\_\_\_
8.  $\angle 4$  and  $\angle 7$  \_\_\_\_\_
9.  $\angle 2$  and  $\angle 6$  \_\_\_\_\_
10.  $\angle 1$  and  $\angle 3$  \_\_\_\_\_

## Special Angles on Parallel Lines Lesson written by Julie Warsinskey

### Content Standards and Objectives:

**G.3.6 explore the relationship between angles formed by two lines cut by a transversal when lines are and are not parallel, and use the results to develop methods to show parallelism.**

### Lesson Objectives:

1. Define vocabulary related to parallel lines.
2. Discover which angles are congruent when two parallel lines are cut by a transversal.

### Materials:

Patty paper

Notebook paper

Protractor

Ruler

Investigation: Which Angles are Congruent? (Adapted from Discovering Geometry)

Lesson 2.6 Special Angles on Parallel Lines Geometer's Sketchpad Lesson (Adapted from Discovering Geometry)

Pre-Algebra With Pizzazz Worksheet page 124

### Vocabulary:

Parallel Lines

Transversal

Corresponding Angles

Alternate Interior Angles

Alternate Exterior Angles

Same-side Interior Angles

Vertical Angles

### Procedures :

- 5-minute check reviewing angles formed by two lines cut by a transversal
- Go over and collect homework from previous day
- Review vocabulary from previous day as it pertains to lines cut by a transversal
- Give students Investigation: Which Angles are Congruent. Students may or may not work with a partner, but each should do the work.
- Review Investigation results, and elaborate on the congruence relationships between the angles.
- Optional: Go to computer lab and complete Lesson 2.6 Special Angles on Parallel Lines.

### Assignment (Lesson Assessment):

Pre-Algebra With Pizzazz Worksheet page 124

## Investigation: Which Angles are Congruent?

Name \_\_\_\_\_ Date \_\_\_\_\_  
Period \_\_\_\_\_

### Setup

1. Using the lines on your notebook paper as a guide, draw a pair of parallel lines.

2. Label the lines  $k$  and  $l$ .

3. Draw a transversal that intersects the parallel lines.

Label the transversal  $m$ .

4. Label the angles with numbers 1-8 as shown at the right.

### Investigate

Measure each angle with a protractor and fill in the table below.

Angle Number	Angle Measure
1	
2	
3	
4	
5	
6	
7	
8	

### Questions

#### **Corresponding Angles Conjecture (CA Conjecture)**

1. List the pairs of **corresponding angles** and their measures. \_\_\_\_\_

If two parallel lines are cut by a transversal, then **corresponding angles** are \_\_\_\_\_

Draw an example in the space below.

#### **Alternate Interior Angles Conjecture (AIA Conjecture)**

2. List the pairs of **alternate interior angles** and their measures \_\_\_\_\_

If two parallel lines are cut by a transversal, then **alternate interior angles** are \_\_\_\_\_

Draw an example in the space below.

#### **Alternate Exterior Angles Conjecture (AEA Conjecture)**

3. List the pairs of **alternate exterior angles** and their measures. \_\_\_\_\_

If two parallel lines are cut by a transversal, then **alternate exterior angles** are \_\_\_\_\_

Draw an example in the space below.

**Same-Side Interior Angles Conjecture (SSIA Conjecture)**

4. List the pairs of **same-side interior angles** and their measures. \_\_\_\_\_

If two parallel lines are cut by a transversal, then **same-side interior angles** are \_\_\_\_\_

Draw an example in the space below.

**Vertical Angles Property**

5. List the pairs of vertical angles and their measures. \_\_\_\_\_  
\_\_\_\_\_

If two lines intersect, then **vertical angles** are \_\_\_\_\_  
\_\_\_\_\_

Draw an example in the space below.

**Extension**

1. Place a piece of patty paper over the set of angles 1, 2, 3, and 4. Copy the two intersecting lines  $m$  and  $l$  and the four angles onto the patty paper.

2. Slide the patty paper down to the intersections of lines  $m$  and  $k$ , and compare angles 1 through 4 with each of the corresponding angles 5 through 8.

3. What is the relationship between corresponding angles? \_\_\_\_\_  
\_\_\_\_\_

4. What is the relationship between alternate interior angles? \_\_\_\_\_  
\_\_\_\_\_

5. What is the relationship between alternate exterior angles? \_\_\_\_\_  
\_\_\_\_\_



## Parallel Lines Cut By A Transversal Activity Lesson written by Linda Jackson

This is a non-technological approach to supplementing the lessons done on the computer and hand held device, as well as an assessment to assess vocabulary and concept.

### Learning styles accommodated:

Kinesthetic  
Visual  
Linguistic  
Intra-personal  
Auditory

### Content Standards and Objectives:

G3.6 explore the relationship between angles formed when two parallel lines are cut by a transversal.

### Vocabulary and concepts that are being reinforced:

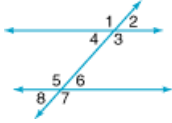
Transversal  
Corresponding angles  
Alternate interior angles  
Alternate exterior angles  
Same - side interior angles  
Same - side exterior angles  
Vertical angles  
Straight angles  
Conjecture

### Materials needed

Patty paper  
Straight edge  
Protractor  
Worksheet (provided)  
Pencil

Directions:

1. Construct 2 parallel lines in the space below, (it should be larger than the construction shown) and construct a transversal through the parallel lines.



2. Place a piece of patty paper or tracing paper on top of original construction and copy the figure. Make sure to label all the angles.
3. Slide the tracing down to the second set of angles, make a conjecture i.e. what do you notice about the angles?

List all the angles that are equal to angle a.

Write next to that angle whether it is:

Corresponding, alternate interior, alternate exterior or vertical.

List all angles that are equal to angle b.

Write next to that angle whether it is:

Corresponding, alternate interior, alternate exterior or vertical.

5. Based on this activity make a conjecture about the 4 types of angles:

In parallel lines cut by a transversal, alternate interior angles are \_\_\_\_\_

In parallel lines cut by a transversal, alternate exterior angles are \_\_\_\_\_

In parallel lines cut by a transversal, corresponding angles are \_\_\_\_\_

In parallel lines cut by a transversal, vertical angles are \_\_\_\_\_

6. Using what you know about supplementary angles and what you learned from this activity measure one angle and find the value of the remaining angles.

Angle a =

Angle b =

Angle c =

Angle d =

Angle e =

Angle f =

Angle g =

Angle h =

7. Repeat steps 1 through 6, constructing the transversal in a different location.

List all the angles that are equal to angle a.

Write next to that angle whether it is:

Corresponding, alternate interior, alternate exterior or vertical.

List all angles that are equal to angle b.

Write next to that angle whether it is:

Corresponding, alternate interior, alternate exterior or vertical.

Angle a =

Angle b =

Angle c =

Angle d =

Angle e =

Angle f =

Angle g =

Angle h =

Has your conjecture from step 5 been confirmed or not? Explain.

Hand Held Palm Pilot Pictures Computer Lesson  
Written by Charley Lindley and Teresa Anderson

**Objectives: G.3** Explore the relationships between angles formed by 2 lines cut by a transversal when lines are and are not parallel and use results to develop methods to show parallelism.

**Vocabulary:**

parallel lines  
transversal  
corresponding angles  
alternate interior angles  
alternate exterior angles  
same side interior angles  
vertical angles

**Materials:**

Class Set: Handheld computers (Palm Zire)  
\* May be adapted with disposable cameras or Polaroid cameras  
Synchronization Port  
Computer / Printer  
Colored Pencils

**Procedures:**

1. Review vocabulary
2. Give typed instructions for handheld computers. Read through and emphasize safety and appropriate use.
3. Exchange pictures of parallel lines with transversals.
4. Send partners to take pictures around school of parallel lines with transversals.
5. Beam pictures to teacher and / or synchronize student handhelds to computer.
6. Print pictures.
7. Homework: Color code sets of:  
corresponding angles  
alternate interior angles  
alternate exterior angles  
same side interior angles  
vertical angles

**Evaluation:**

- Printed pictures with correct color coding and labeling
- Observation of cooperative work among the students and appropriate use of technology

**Individual Differences / Modifications:**

Read instructions aloud.

Show examples of printed picture with color-coding and labeling.

Have vocabulary posted in classroom for spelling and definition purposes.

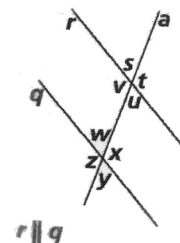
## **Handheld Computer Picture Instructions**

1. Turn on computer. Button on top right.
2. Slide front of computer up to expose camera lens and button.
3. Aim handheld at item for picture and hold very steady.
4. Push button (button front and center)
5. To view picture at any point, slide computer down to close and use stylus (pen looking thing located in the handheld).
6. Tap label of any photo you want to see.
7. To return to photo menu, tap the photo
8. Synchronize to the desktop computer or beam to the teacher for printing.

### Parallel Lines Cut By Transversal Test

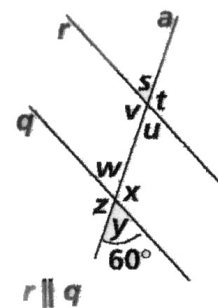
**Directions:** Use the figure shown. Circle the term that names the angles.

1.  $\angle u$  and  $\angle t$     **A.** Corresponding    **B.** Exterior    **C.** Supplementary
2.  $\angle u$  and  $\angle y$     **A.** Supplementary    **B.** Corresponding    **C.** Alternate Interior
3.  $\angle t$  and  $\angle z$     **A.** Corresponding    **B.** Supplementary    **C.** Alternate Exterior
4.  $\angle s$  and  $\angle w$     **A.** Exterior    **B.** Corresponding    **C.** Interior
5.  $\angle w$  and  $\angle u$     **A.** Supplementary    **B.** Corresponding    **C.** Alternate Interior
6.  $\angle v$  and  $\angle x$     **A.** Exterior    **B.** Supplementary    **C.** Alternate Interior
7.  $\angle v$  and  $\angle w$  and  $\angle u$  and  $\angle x$     **A.** Supplementary    **B.** Interior    **C.** Corresponding
8.  $\angle s$  and  $\angle t$  and  $\angle y$  and  $\angle z$     **A.** Exterior    **B.** Corresponding    **C.** Alternate Interior

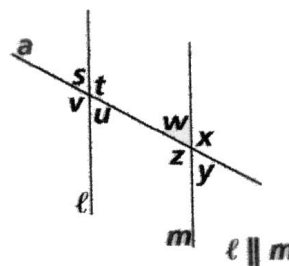


**Directions:** Find the measures of the angles in the figure below. Write your reason for each measure. Use the three theorems about parallel lines and what you know about supplementary and vertical angles.

	Measure	Reason
9.	$\angle z$ _____	_____
10.	$\angle x$ _____	_____
11.	$\angle w$ _____	_____
12.	$\angle u$ _____	_____
13.	$\angle v$ _____	_____
14.	$\angle t$ _____	_____
15.	$\angle s$ _____	_____



16.  $m\angle y$  \_\_\_\_\_
17.  $m\angle w$  \_\_\_\_\_
18.  $m\angle t$  \_\_\_\_\_
19.  $m\angle z$  \_\_\_\_\_
20.  $m\angle s$  \_\_\_\_\_
21.  $m\angle u$  \_\_\_\_\_
22.  $m\angle x$  \_\_\_\_\_
23.  $m\angle v$  \_\_\_\_\_

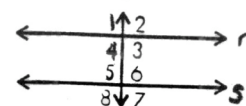


$$s = 6x + 4$$

$$y = 7x - 9$$

In the diagram,  $r$  is parallel to  $s$ ,  $m\angle 1 = (2x - 10)^\circ$  and  $m\angle 2 = (x + 40)^\circ$ . Find the measures of all eight angles.

- |                       |                       |
|-----------------------|-----------------------|
| 24. $m\angle 1$ _____ | 25. $m\angle 2$ _____ |
| 26. $m\angle 3$ _____ | 27. $m\angle 4$ _____ |
| 28. $m\angle 5$ _____ | 29. $m\angle 6$ _____ |
| 30. $m\angle 7$ _____ | 31. $m\angle 8$ _____ |



## Associated Web Sites / Links

### **Parallel Lines Conjectures Activity**

- May be used to introduce vocabulary and theorems  
<http://www.geom.uiuc.edu/~dwiggins/conj16.html>

### **The University of Tennessee Knoxville Math Archives**

- Lists many math concepts that can be accessed and printed for use in the classroom.  
<http://archives.math.UTK.edu/topics/geometry.html>

### **Glencoe Books**

- May be used in conjunction with the Glencoe geometry textbooks. This site is interactive with student participation.
- May be used as an assessment
  - Click on “Secondary Education”
  - Click on “Mathematics”
  - Click on “Online Study Tools”
  - Click on “WV”
  - Click on “Geometry”
  - Click on “Geometry: Concepts and Applications” then “2004 Edition” then “Self-Check Quizzes”
  - Click on “Chapter 4” the “Parallel Lines and Transversals”<http://www.glencoe.com>

### **Regents Examine Prep Center**

- Interactive site giving students practice with the angles and angle measures
  - May be used as an assessment
    - Click on “Math A”
    - Click on “4. Modeling/Multiple Representation”
    - Click on “Types of Angles (including Angles with Parallel Lines)”
    - Click on “L Angles with Parallel Lines”
    - Click on “P Practice with Angles and Parallel Lines”<http://www.regentsprep.org>

### **LessonPlansPage.com**

- This site offers lesson plans in many different areas to teachers completely free of charge.
- There are numerous math lessons on this page for many different grade levels and curriculum areas.

<http://www.lessonplanspage.com/MathParallelLinesCutByTransversalProperties910.htm>