Name: Craig L. Johnson, Bland High School

1. Title of Lesson:

Practical Application and Creation of Angle Relationships in Everyday Street Maps and the Relationship of Angles Using Non-Parallel Lines Cut by a Transversal.

1. Context of Lesson:

The students are in a geometry class. The class period is 50 minutes long at my school and class size averages 13 students in a geometry course. The students will be of varying levels of skill along with inclusion students. The students will have already covered the introduction of angle relationships, determined if angle relationships are congruent or supplementary angles to each other, and have generated classroom definitions (what I call “House Rules”) instead of the textbook ones for the following terms when two parallel line are cut by a transversal: Corresponding Angles, Alternate Interior Angles, Alternate Exterior Angles, Same Side Interior, Same Side Exterior, and Vertical Angles. These two days of lessons are to reinforce the terms discussed at the introduction of the concepts. It is a chance for them to see a relation of angle relationships outside of illustrations on the board. It is also a chance for them to create their own street map of their local area to see angle relationship that could occur if looking at the town from overhead. The students will utilize angle relationships throughout the school year in algebraic calculations, deductive reasoning statements, and counter-examples, at least at my school we discussed these topics early in the school year. Also, students will see angle relationships applied when two lines cut by a transversal are not parallel. They will determine if congruency and supplementary status hold true and record their discovery in their notebooks and add to House Rules.

1. Learning Objectives and Assessment (Using the New Bloom’s Taxonomy given by Dan Mulligan in his presentation)

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| Learning Objective | Bloom | Assessment (Formative/Summative) |
| Review of Introductory Angle Relationships and whether they are congruent angles or supplementary angles (definition of corresponding, alternate interior, alternate exterior, same side interior, same side exterior, and vertical angles) | Remember, Understand | Formative Informal Evaluation based on responses of students. Clarification given if class response is not unanimous on responses. |
| Checklist 5 directions given on D.C. map. Before each group can progress, instructor will have a quick checklist to see if students have correct final destination. | Applying | Summative checklist given at the end of each question. The answer is correct or incorrect for each group with tally of number of tries taken. |
| Students will create a map and use local landmarks using angle relationships (school and home are given along with others) Student will also create clues to travel on their map and share with other groups (Overnight and day two project) | Create, Evaluate (when determining landmarks and clues given), and Apply | Summative evaluation of student created map with rubric provided. |

1. Related 2009 Virginia Standards of Learning:

G.2. (c): The student will use the relationships between angles formed by two lines cut by a transversal to solve real world problems involving angles formed when parallel lines are cut by a transversal.

1. Materials Needed:

Day One: Map of Washington, D.C., masking tape, labeled placards of D.C. landmarks, Directions for creating local maps, teacher checklist for group response, Grading Rubric of overnight and day 2 part of project, and poster board.

Day Two: Side walk chalk (various colors), yardsticks for straight edge, and tour sheets. If it is raining, tape or thumb tacks to hang posters to wall will be needed as well.

1. Procedure:

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| **DAY ONE** | | |
| Time (Each class is 50 minutes long) | Mathematical Tasks to be Used, Teacher Thoughts/Actions/Questions | Anticipated Student Comments, Questions, Actions, and Strategies |
| First 10 minutes of class. Students will take 5 minutes to create the answer to their question. 5 minutes will be given for student responses to question and additional review if needed | BEFORE: Start of class warm-up question. This will be written on the board. The question is: Draw a pair of parallel lines cut by a transversal and mark two angles. Give the angle relationship of two angles; determine whether they are congruent or supplementary pair, and why they have this relationship. | Answers will vary base on student choice of angle pair relationship chosen. Teacher will expand explanation of student responses given and show on dry erase board or Smart board the student’s various responses until all angle relationship pairs are covered. Any questions may revolve around the area of why certain angle relationships are what they are. Answers should be based on classroom definitions created by the class. |
| 20 minutes: Five minutes to split into predetermined groups and move desks to edge of classroom. Fifteen minutes to create floor model of map and do Washington DC map tour activity. | DURING: Students will be given a map along with masking tape and placards to recreate map on the floor. SAY: “Each group must correctly recreate the map on the class floor. Once this is correct and I have seen it, you will be given a tour of directions to follow to find final destinations. When your group thinks you are in the correct destination, the team leader will raise their hand. I will come over to see if you are correct. If you are correct, I will say, ‘Good job. Proceed to tour 2 (so on until all five locations are found).’ If you are not correct I will respond, ‘Try again’ and I may allow you to spy or give you a clue from our definitions. I will mark your number of tries to get the right destination. The fewer tries you have, the better. It means that you understand the angle relationships well. Are there any questions?” I will have a clipboard and checklist and mark student responses and number of tries each group gives. | Answers are predetermined based on questions given with map (see file: ). Clarification and scaffolding clues may need to be given so that each group finds correct final destination. If students are really stuck, allow spy pass to be used to ask another group for help. Teacher is not giving responses, but allowing students to teach each other the ideas involved. Teacher will keep an ear to peer teaching to make sure appropriate mathematical concept was shown. |
| 20 minutes: For ten minutes, class will review tour clues as a whole. Students will be asked about non-parallel lines used. For remaining ten minutes, discussion of and clarification of overnight project will be given. If there is any time remaining, the class will work independently on project. | AFTER: A review as a whole of final locations on hand drawn map on dry erase or create on Smart board. SAY: “Was there anything unique about the lines used today that is not the same as the ones drawn the day before? Do the angle relationships apply with these new lines? Do they still have the supplementary or congruent properties? Why do you think this is?” Give students overnight project and grading rubric. Overnight assignment is individual creation. Rubric has an individual and group component to determine final score. (See assignment and rubric files) | Comments from students will range from one pair was parallel and one was not to the relationships apply, but they are different from our house rules definitions. None of the non-parallel lines have congruency or supplementary property anymore. Why do they think they don’t apply anymore may get various responses. Looking for a response similar to non-parallel lines are not similar and therefore will not have the same angle measurements needed for congruency or supplementary angles. For overnight project and presentation, students may ask what local landmarks can be used. Response will be any that they deem important. Teacher will answer clerical questions directly and higher order thinking questions when asked about directions to allow students time to analyze their own information and formulate responses to their own questions. |

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| **DAY TWO** | | |
| 10 minutes. Start of class activity will take 5 minutes with a 5 minute review of parallel and non parallel lines cut by a transversal. | BEFORE: A Pre-generated Map will be drawn on dry erase board. One pair of parallel and one pair of non parallel lines will be cut by transversals. (see illustrated file name )The questions given will be: 1. What is the relationship between angle 1 and angle 4? Are they congruent or not? Why or why not? 2. Is there any relationship between angle 2 and angle 7? If so, what is it and what holds true in it? 3. Give a pair of angles that are alternate exterior. What makes them alternate exterior and are they congruent? Why or why not? (See illustration given named ) | Discussion of similarities and differences of parallel lines and non-parallel lines cut by a transversal will be given. Responses will varying, but utilization of house rules definition of properties will be interjected with non-parallel stating no congruency or supplementary angle status. |
| 35 minutes. 5 minutes for each group to meet and discuss their project and what they did for the group score. 5 minutes to choose the questions your group will tour with. 10 minutes to draw and label their maps on the chalk or to prepare their display if it is raining. 15 minutes to take tour with group. | DURING: Students will use their overnight project to create their maps using sidewalk chalk or we will display their posters on the wall if it is raining. They will then tour each place in a round robin fashion and give a group response. Clues will be typed for maps on classroom computers so each clue given is legible (there are 3 in the room each connected to a flip switch circuit single printer, at least in my class) Teacher will say, “Your group is going to tour the other group’s maps and see if you can figure out where you are going. You will not be answering any map clues from your own group since you have reviewed each other’s work. I will be giving each group a record sheet so you can show me where you think you are going. Be sure to discuss your choices with your group members. Record only the response you all decide the location is. Be sure to put whose map you are looking at on the destination guess so that I will know which map you were looking at.. | Time may be needed to type responses. I will answer clerical questions for the recording sheet as they come up during the project. Teacher will also check periodically with groups to make sure recording is correct. |
| 5 minutes | AFTER: With time remaining in class, Quick review of angle relationships and reminder of assessment on angle relationships to be conducted the following day. | Students may groan, but remind them that acquiring the skill for angle relationships will make the succession of the school year quite easy to master. |

1. Meeting the Needs of All Students:

We have a student with an electric wheelchair. He will gain assistance from his group in construction of outside chalk drawing by supervising. Parking lot is outside of classroom and sidewalk chalk will be used to draw created papers on asphalt. Spy passes will be handy if students are struggling with self-created part of concept, if need arises. Teacher will be handy to answer questions. If a substitute is doing assignment, in house definitions of angle relationships will be utilized by students along with an answer key for D.C. tour day one.

1. What Could Go Wrong With This Lesson and What Will You Do About It?

Students may have had basic understanding of introductory lesson, but no real knowledge of concept application. Review may be needed on day one. Use classroom tiles and brick walls as a reference point. Draw examples of practice on board with two parallel lines cut by a transversal if necessary. Students will not generate day two maps. If need be, extend time period on day two expectation to be completed for a possible day three.

I: Connection to CTA:

I utilized Mr. Nussbaum’s concept of a small group project and his idea of a spy pass for students who may struggle with what to do. I liked these ideas. The project is a hands-on approach with visual and verbal teaching going on that could benefit different learning styles. The spy pass allowed students to work without stopping the whole class for one or a few students. I utilized Dan Mulligan’s D.C. map for angle relationships. I liked that it uses simplistic street design in the notion of geometry, a practical application that students can use in their lives. I noticed on my I-Pad’s map streets are laid out and angle relationships can be seen if you zoom in to the street level. If students use their cell phones or a GPS in this capacity they can see it along with traditional street maps in major metropolitan areas. Finally, I am utilizing Mr. Litner’s Open-Ended Questions to allow the students to create their own maps on a warm-up exercise and the class overnight assignment/project. Admittedly, two of the projects locations are given, the rest are to be decided upon by the student. By allowing creativity, the students are utilizing Bloom’s higher order learning areas along with the basic ones.

Craig L. Johnson JMU CTA Academy

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Draw a pair of parallel lines cut by a transversal and mark two angles. Give the angle relationship of two angles; determine whether they are congruent or supplementary pair, and why they have this relationship.

Write the question above only on the board. Answers will vary depending on what pair types they use. Refer to the angle relationship House Rules Poster on the wall if you need to see an illustration like the one asked above and the definitions for House Rules given.

Note: I realize each teacher will have their own version of the angle relationships definitions. To not limit it to my own, I allowed freedom of creative thought to be used by each individual teacher who may get ideas from this.

2Washington, D.C. Tour Questions

1. You begin your tour at the White House. You decide to go to the location at the corresponding angle to it. You then decide to visit the location that is a vertical angle to it. You decide to end this tour at the location that is considered the same-side interior angle to this location. Where are you?
2. You begin your tour at the FBI building. You decide to visit the location that is a vertical it. You decide to visit the place that is a corresponding angle to it. You decide to end this tour at the location that is the same side interior angle to this location. Where are you?
3. You begin at the Lincoln Memorial. You take a taxi to the location that is an alternate exterior angle to it. You then take a bus to the same side interior angle to it. You end the tour with the building that is the alternate interior angle to this building. Where would you be?
4. You begin your tour day at the Smithsonian Institute. You travel to the corresponding angle to it. You visit the same side exterior location to it. You end the tour day at the location that is the vertical angle to it. Where would you be?
5. You begin at Ford’s Theater. You take a cab to the location that is a corresponding angle to it. You then walk to the location that is a vertical angle to this location. You end the tour day with a location that is the corresponding angle to this. Where would you be?

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NOTE: This portion of page is for staff only. Top will be given to students only.

Answer Key: 1. Washington Monument; 2. Smithsonian Institute; 3. US Capitol; 4. National Zoo; 5. Vietnam War Memorial

3

**Touring Washing DC by the Angles**

**Directions:**

1. **Use the masking tape to create the road map of Washington DC that appears below. NOTE: Apply a scale to your model that approximates each road to be 5-6 feet long. NOTE: Pennsylvania Ave. is parallel to Constitution Ave.**
2. **Place each card that contains the name of a famous national monument at the indicated intersection.**
3. **Study the scale map created by your team. Compare your scale map to the map below.**

Developed By Dan Mulligan, Simply Achieve Inc.

Lincoln Memorial

FBI Building

Washington Monument

Vietnam War Memorial

National Zoo

US Capitol

Smithsonian Institute

White House

Ford’s Theater

US Treasury

Supreme Court

**Pennsylvania Ave.**

**Constitution Ave**

**14th Street NW**

**New York Ave.**

4

Teacher Checklist \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Period \_\_\_\_\_\_

**Touring DC by the Angles**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Group #** | **Location 1** | **Location 2** | **Location 3** | **Location 4** | **Location 5** |
| **1:\_\_\_\_\_\_\_\_\_** |  |  |  |  |  |
| **2: \_\_\_\_\_\_\_\_** |  |  |  |  |  |
| **3:\_\_\_\_\_\_\_\_\_** |  |  |  |  |  |
| **4:\_\_\_\_\_\_\_\_\_** |  |  |  |  |  |
| **5: \_\_\_\_\_\_\_\_** |  |  |  |  |  |

Record tally marks for number of destination tries. Put a check mark when location given is correct.

5

**Overnight Project- My Home Town Map**

Since we have used a map of a famous location to do angle relationships, I thought we would try to do one with our own hometown. You are to create a map similar to the one for Washington, D.C. Only instead of using landmarks like the US Capitol or Smithsonian Institute, you will be using the landmarks of our home. I only ask that you make your house and the school two of the buildings on your map. You may use as many lines as you like and as many local places as you like. You will draw and label your map on the poster board I will give to you.

Along with your map, you are to create a mini tour of questions like the DC map has. Create questions that are challenging and that may stump your classmates or even me. You may use as many angle relationships in your tour questions as you like.

I am looking to see that you are proficient in the creation and identification of angle relationships. As a challenge, the rubric has some high expectations for those who want to wow me and the class. Good Luck!!!!!

6

Day Two Warm-up (Start of Class) Question

Day 2 Warm Up Map Design: This is for your benefit to see. The dry erase constructed one will not have boxes around the numbers. Write the numbers without boxes if you are a substitute teacher for the day. Write the questions below the illustration on the board as well. Keep answers for your reference only. On the two horizontal lines, add a filled in double triangle to note parallel status.

6

2

8

1

4

5

7

3

1. What is the relationship between angle 1 and angle 4? Are they congruent or not? Why or why not?

2. Is there any relationship between angle 2 and angle 7? If so, what is it and what holds true in it?

3. Give a pair of angles that are alternate exterior. What makes them alternate exterior and are they congruent? Why or why not?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. corresponding angles. Yes, they are congruent the lines cut by the transversal are parallel.
2. they are same side exterior angles. Since they are parallel lines cut by a transversal they are a supplementary pair.
3. 2 and 8, 3 and 5, 7 and 4. They are on opposite sides of a transversal cutting two lines. 2 and 8 and 3 and 5 are congruent. 7 and 4 is not.

7

The Poster Tour/Chalk Map Tour of Our Home Town

Note for teachers/substitute teachers: If it is a pretty day and you have gotten permission from school administration to do this out in your school’s parking lot, do so. If it is raining, prepare to tape up the posters or pin them up in your room.

The below are the steps given to each student. Make copies if needed. Go through each step one at a time until complete.

**Tour of Our Home Town**

1. Get in your groups from the day before. You have 30 seconds.
2. Check Each of your groups work to make sure you all did your very best. ( 5 minutes)
3. Choose two questions from each of your maps to use for tour questions. (5 minutes)
4. One person from the group will go and type questions to be printed out. The other group members will do one of the following:
5. If it is not raining, you will go outside and construct each of your maps with sidewalk chalk.
6. If it is raining, display your posters in a group in the room. Ask for tape or thumb tacks to pin up along the wall. Then help other students move desks to center of class so the walking tour can occur. (10 minutes maximum)

5. Take the Tour. You and your fellow group members will tour with one Location Destination sheet. You will look at all the other group’s maps and see if you can discover where their tour is taking you. You will submit this at the end of the tour to the teacher. Be sure to write the name of the student’s map you are looking at when you give where you think the destinations are going. (15 minutes)

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Group Destination Choices: OUR HOME TOWN

Group # \_\_\_\_\_\_\_ Group Members: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

|  |  |  |
| --- | --- | --- |
| Map Viewed (Give student’s full name)  Destination 1:  Destination 2: | Map Viewed (Give student’s full name)  Destination 1:  Destination 2: | Map Viewed (Give student’s full name)  Destination 1:  Destination 2: |
| Map Viewed (Give student’s full name)  Destination 1:  Destination 2: | Map Viewed (Give student’s full name)  Destination 1:  Destination 2: | Map Viewed (Give student’s full name)  Destination 1:  Destination 2: |
| Map Viewed (Give student’s full name)  Destination 1:  Destination 2: | Map Viewed (Give student’s full name)  Destination 1:  Destination 2: | Map Viewed (Give student’s full name)  Destination 1:  Destination 2: |
| Map Viewed (Give student’s full name)  Destination 1:  Destination 2: | Map Viewed (Give student’s full name)  Destination 1:  Destination 2: | Map Viewed (Give student’s full name)  Destination 1:  Destination 2: |

**DO NOT DO YOUR OWN GROUP MAPS!!!!!!**

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