Pre-Service Teacher: [redacted] Date October 13, 2009

Course: SED 410 Teacher: Dr. LaFerla Topic: Parallel and Perpendicular Lines Review

Standards: **NCTM**: Students will analyze properties and determine attributes of two-dimensional objects. Students will establish the validity of geometric conjectures using deduction, prove theorems, and critique arguments made by others; Students will explore relationships among classes of two-dimensional geometric objects, make and test conjectures about them and solve problems involving them. **GSE**: (Geometry 10.9) solves problems on and off the coordinate plane involving distance, midpoint, perpendicular and parallel lines or slope. **RIBTS:** 2.2, 2.7, 3.3, 5.5

Objectives	Students will name the angle pairs created by parallel lines and transversals; Students will use algebra to find angle measurements; Students will use graphing calculators to make deductions about geometric figures.
Instructional Materials/ resources	Graphing calculators, overhead projector, graph paper, rulers, white board, dry erase markers, yard stick, handouts for stations
Instructional activities and tasks	• Agenda ▪ Activity Explanation & Vocabulary Review ▪ Stations ▪ Explanation ▪ Summary ▪ Review Handout • Activity Explanation (20 min) ▪ As students arrive in the morning, teacher will model the activity at each of the six stations before the morning announcements. Instructions for the stations are as follows: Students are to work in groups no greater than four (desks will be arranged into six stations prior to start of class). Each group will be allotted 6 minutes per station, making the total activity time 36 minutes. Groups will record answers on a single sheet of graph paper and the class will review all the stations as a group. One person from each group will be assigned the job of presenter, another person will be assigned the job of recorder. Since class size is 24 but attendance averages in high teens, teacher may opt to eliminate one station and increase time per station. Teacher will be mobile and answering questions throughout activity. ▪ Prior to activity, teacher will lead a brief vocabulary review: o What are supplementary angles? What are vertical angles? What does it mean for two angles to be complementary? What is a transversal? What is parallel? What is perpendicular? If a transversal crosses two parallel lines, what can be said of the alternate interior angles? What about consecutive interior angles?

	• Stations (40min) ▪ Station 1 ▪ Graphing Calculators. Given a slope and a point, determine the equation of the line and enter into graphing calculator. Given two points, determine equation of line and enter into graphing calculator. ▪ Station 2 ▪ Word problem. Two trains on linear paths, students will determine whether or not trains will cross paths. ▪ Station 3 ▪ Vocabulary exercise. Students will be given graphs and vocabulary terms and asked to match equivalent terms ▪ Station 4 ▪ Graphing calculators. Students will be asked to graph two sets of parallel and perpendicular lines and identify the resulting figure as a rectangle. ▪ Station 5 ▪ Algebra. Given an equation for a line, students will find the equation of the line through point (x, y) and perpendicular to given line. ▪ Station 6 ▪ Real world application. Students will be asked to list as many professions as they can that use parallel and perpendicular lines • Explanation (20 min) • Students rearrange desks into rows. Using overhead projector, teacher will lead review of each station. A volunteer from each group will provide explanation for given station. Entire class will participate in calculator review, with teacher leading on overhead projector. • Summary (5min) • Teacher will once again reinforce vocabulary. Strategies for solving problems involving parallel and perpendicular lines will be discussed. (How do we show two lines are perpendicular? How do we prove two lines are not parallel?) • Why Bother? • Why do we care about parallel and perpendicular lines? • Students generate examples, teacher assists and offers suggestions • Review Handout (5 min) • Homework for the weekend will be to study for the upcoming unit test using the review handout. Teacher will provide review handout that includes vocabulary, representative problems from the unit and an answer key
Assessment activities	Station work collected from each group; Teacher assesses student explanations after station exercise

Learner factors	Audio learners –Discussion of vocabulary, discussion of problem solving strategy Visual learners –Graphing calculators, vocabulary station, overhead projection Kinesthetic learners-hands on station activities
Environment factors	Class arranged into six stations, four desks per station. Students work in groups of four. Teacher mobile, observing and assisting
Reflection	\Were students able to make sense of each station without the help of the teacher? Were students able to teach each other how to solve problems? Do the students have an adequate grasp of the concepts introduced in the unit?

Reflection	Difficult part was that some of the stations were easier than others. Next time I would try raise the level of difficulty on some on the easier stations so students are not finishing early and waiting for the time to go up. Also the rotation of stations got mixed up towards the end and did not flow as smoothly as it could of. All in all, it went well and the students enjoyed the stations.

Review Handout: Parallel and Perpendicular Lines

Define the following key vocabulary terms:

Vertical Angles:

Complementary Angles:

Supplementary Angles:

Parallel Lines:

Perpendicular Lines:

Alternate Exterior Angles:

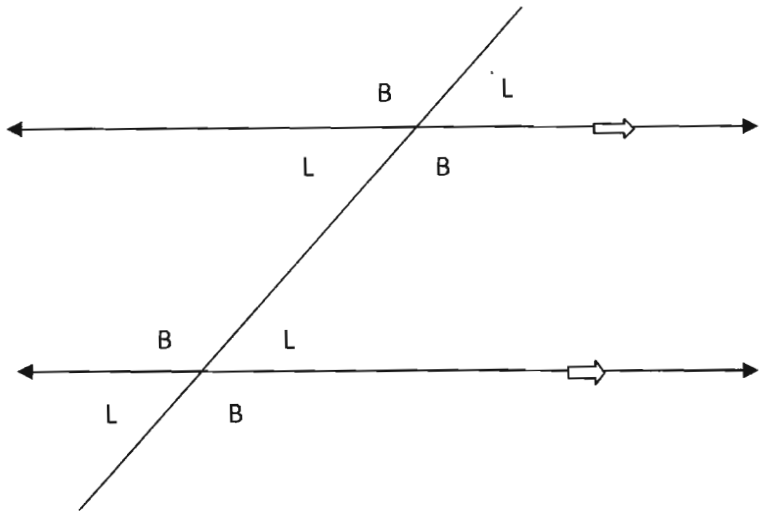
Alternate Interior Angles:

Corresponding Angles:

Slope-intercept form:

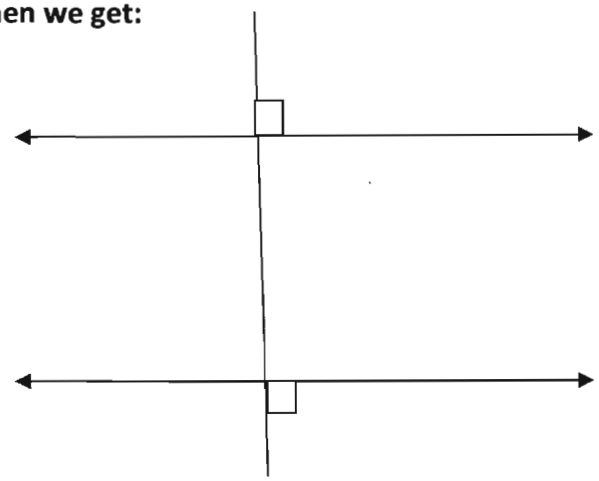
Transversal:

Remember, when a transversal crosses two parallel lines, only two kinds of angles are created. Let us call them B for Big and L for Little:



Now we know B + L = 180 and B and L are supplementary to one another.

If angle B and angle L are equal to one another then we get:



B = L

B + L = 180

If we substitute for B, look what happens...

B + B = 180

2B = 180

B = 90

L = 90

Therefore the lines must be perpendicular.

Now, solving problems involving parallel and perpendicular lines requires us to be able to do a little algebra. First, we must remember that the slope of a line is given by:

$$m = \frac{(y_2 - y_1)}{(x_2 - x_1)}$$

Next, remember the equation of a line in slope intercept form is:

$$y = mx + b$$

where m is the slope and b is the y-intercept.

Thirdly, remember that the slopes of perpendicular lines are negative reciprocals of each other. So, for example, if one slope is 2, the slope of a perpendicular line will be $\frac{-1}{2}$.

Knowing these three equations will help solve problems involving parallel and perpendicular lines. We can **prove** two lines parallel by showing that their slopes are equal. Similarly, we can **prove** two lines are perpendicular by showing that the slopes are negative reciprocals of each other.

Strategy

A few different types of problems are asked for this unit.

Example 1)

You are given two equations of form y= mx + b and asked are the lines parallel, perpendicular or neither. For this type of question, we can just look at the slopes (m) and decide if they are equal, negative reciprocals or neither.

y = 4x – 11

y = (¼)x + 6

The slopes here are 4 and ¼. Although they are reciprocals, they are both positive and so the lines are neither parallel nor perpendicular.

Example 2)

You are given that a line has a certain slope and goes through a certain line. For this type of problem we have to use the slope-intercept equation and plug in our point to solve for b.

Find an equation of the line that goes through point (2, 3) and has slope m = -4

First, we know:

y = mx + b

y = (-4)x + b [since m = -4]

Now we plug in our point (2, 3) and solve for b

3 = (-4)(2) + b

3 = -8 + b

11 = b

Finally, rewrite the equation and we are done:

y = (-4)x + 11

Example 3)

You are given two points and asked to find the equation of the line that goes through them.

Find the equation of the line that goes through (-3, 4) and (3,0)

First find the slope

$$m = \frac{0-4}{3-(-3)} = \frac{-4}{6} = \frac{-2}{3}$$

Now we are back to a situation where we have a slope (-2/3) and a point (In this case we have a slope and two points) Just pick a point (doesn't matter which one but the point with a zero will be easier) and solve the same as example 2.

$$Y = (\frac{-2}{3})x + b$$

$$0 = (\frac{-2}{3})(3) + b$$

$$0 = -2 + b$$

$$2 = b$$

Now rewrite and you are done:

$$Y = \frac{-2}{3}x + 2$$

Example 4)

Sometimes you are given a line going through a point that is parallel or perpendicular to a second line. These are confusing, but remember that we only care about the slope of the second line.

Find the equation of a line that goes through (4, 1) and is parallel to the line

$$y = \frac{-1}{2}x - 13$$

Remember, for the second line, all we look at is the slope $m = \frac{-1}{2}$ Since we are looking for a parallel line, we know that our line will have the same slope as the second line. Now we are back to having a slope $m = \frac{-1}{2}$ and a point (4, 1) and we solve exactly the same as example 2.