<u>Chapter 3 – Parallel and Perpendicular Lines</u>

3.1 Pairs of lines and angles

- 3.1.1 In what ways can lines intersect or not intersect?
- 3.1.1 Uniqueness of parallel and perpendicular lines through a given point
- 3.1.2 Corresponding, alternate interior, alternate exterior, consecutive interior

3.2 Parallel lines and transversals

- 3.2.1 If the lines are parallel then use angle relationships to solve for unknowns
- 3.2.2 Prove angle relationships using other angle relationships

3.3 Proofs with parallel lines

- 3.3.1 Converse of the previous section: if we know the angles are congruent…
- 3.3.2 Compass and straight edge construction using corresponding angles
- 3.3.3 Transitive property applied to three parallel lines

3.4 Proofs with perpendicular lines

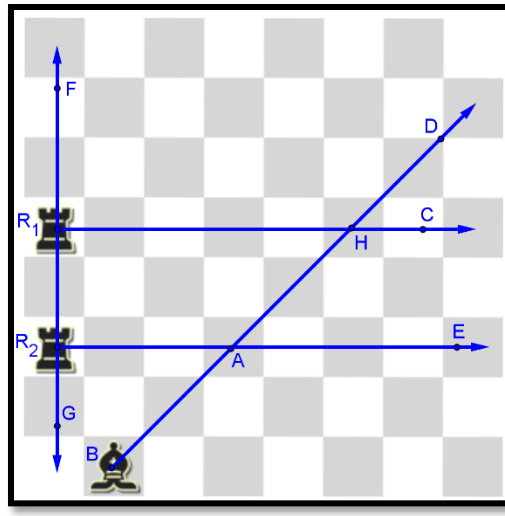
- 3.4.1 Perpendicular lines as definition of distance between point and line
- 3.4.2 Compass and straight edge constructions (generic and bisector)
- 3.4.3 Transitive property applied to perpendicular line to parallels

3.5 Equations of parallel and perpendicular lines

- 3.5.1 Splitting segments into specific ratios
- 3.5.2 Slope relationships between parallel and perpendicular lines
- 3.5.3 Further discussion of distance between point and line (along perpendicular)

Practice Performance Task – 3.1
Chess

New chess players must first learn how the different pieces on the board move. The following simplified diagrams are common when teaching new players. Use these diagrams to answer the questions that follow.



1. For each of the following pairs of angles, name the two lines and transversal that form the pair and the name of their relationship.

   $\angle DHC$ and $\angle HAE$ $\qquad$ $\angle CR_1R_2$ and $\angle ER_2R_1$

   $\angle R_2AH$ and R_1HA $\qquad$ $\angle EAB$ and $\angle DHR_1$

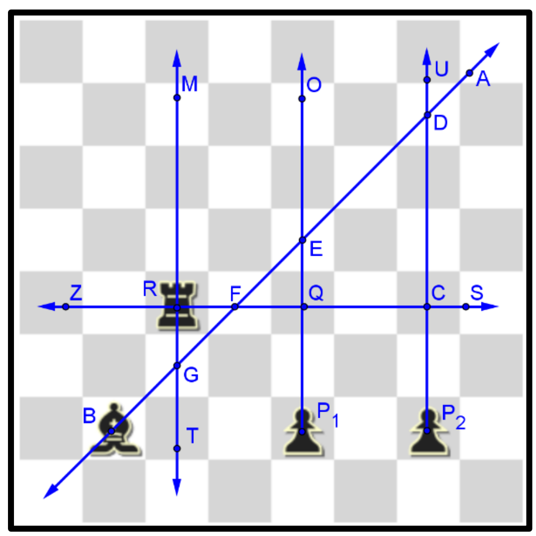
2. How does the above diagram illustrate both the Parallel Postulate and Perpendicular Postulate? Your explanation should use complete sentences and directly reference the given diagram.

3. Geometry has tons of theorems and postulates. I want to write my own geometry book (for the fame and fortune) and want to introduce the following theorem.

   Transitive Property of Corresponding Angles

   If $\angle 1$ and $\angle 2$ are corresponding angles and $\angle 1$ and $\angle 3$ are corresponding angles, then $\angle 2$ and $\angle 3$ must be corresponding angles.

   Explain why my theorem is either correct (and will make me famous) or is incorrect (and will be incredibly embarrassing). Use the diagram to the right to provide examples to support your conclusion.



Practice Performance Task – 3.2
New Theorems

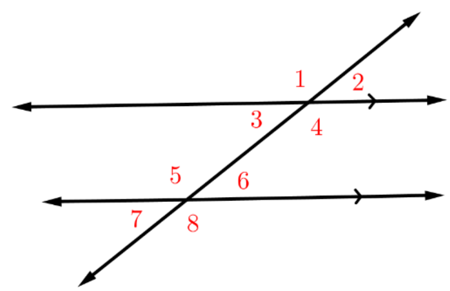
Chapter 3.2 introduces theorems concerning four angle relationships involving parallel lines crossed by a transversal: corresponding angles, alternate interior angles, alternate exterior angles, and consecutive interior angles. The questions below discuss angle relationships not discussed.

Suppose the new relationship is between two angles on alternate sides of the transversal. One of the angles must be interior while the other is exterior. Any pair of angles that match this description will be called Alternate Inside-Out Angles.

1. Draw a diagram that provides an example of alternate inside-out angles. Your diagram should include clear labeling and an explanation of why your angles are alternate inside-out angles.

2. In the diagram provided, circle two angles that are Alternate Inside-Out Angles. Assuming the lines are parallel, will the angles you circled be congruent or supplementary? Use the table below to prove the two circled angles are either congruent or supplementary.

Statements	Reasons



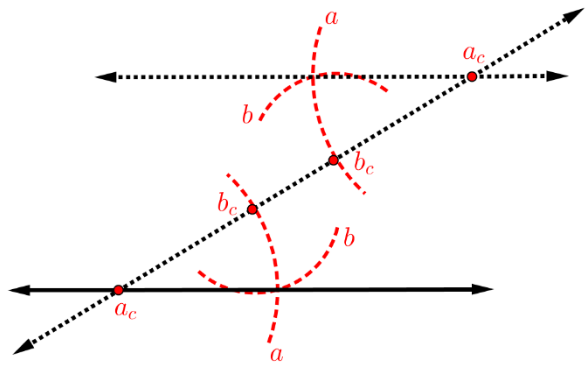
3. While I have never seen a geometry book that discusses alternate inside-out angles, I have seen many geometry textbooks that include a discussion of consecutive exterior angles.

   a. If two parallel lines are crossed by a transversal, then what must be true about consecutive exterior angles?

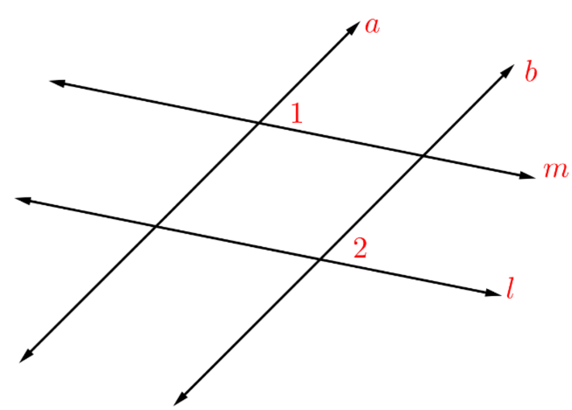
   b. If the two consecutive exterior angles are $(3x + 2.5)°$ and $(32x + 90)°$, then what is the measure of each angle. Make sure to show your work.

Practice Performance Task – 3.3
Constructions and Appearances

1. The construction of parallel lines that you were shown in class is not the only method for constructing parallel lines. Suppose a friend that attends a different school shows you the following construction in her textbook. Explain why this construction also assures the two lines will be parallel. Your explanation must be specific and use complete sentences. You may add labels to the diagram for clarity. (a_c means the center for arc a. Arcs with the same letter have the same radius.)



2. The diagram to the right shows what appears to be two pairs of parallel lines. There are no parallel marks shown so we must try to prove the lines are parallel. Suppose we are told $\angle 1 \cong \angle 2$. Explain why this is NOT enough information to prove either pair of lines is parallel.

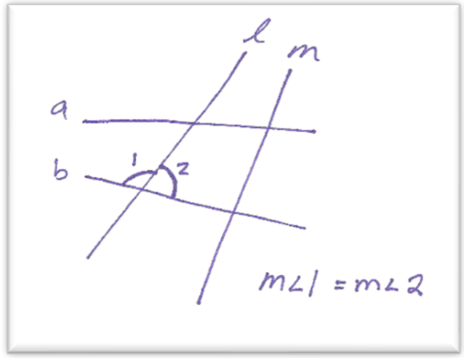


3. Many students are confused by the diagram for question 2 because the two pairs of lines look like they are parallel. Students then assume that if $\angle 1 \cong \angle 2$ then $a||b$ and $m||l$. Use the space below to redraw the diagram so that $\angle 1 \cong \angle 2$ but the two pairs of lines do NOT appear to be parallel.

Practice Performance Task – 3.4
Terrible Diagrams

One of the best things about geometry is the intuitive reasoning students can use when analyzing diagrams. Unfortunately, many students forget that just because two lines look parallel or perpendicular, that does not mean they are. The following problems include some terrible drawn diagrams. Be careful and don't "eyeball" anything.

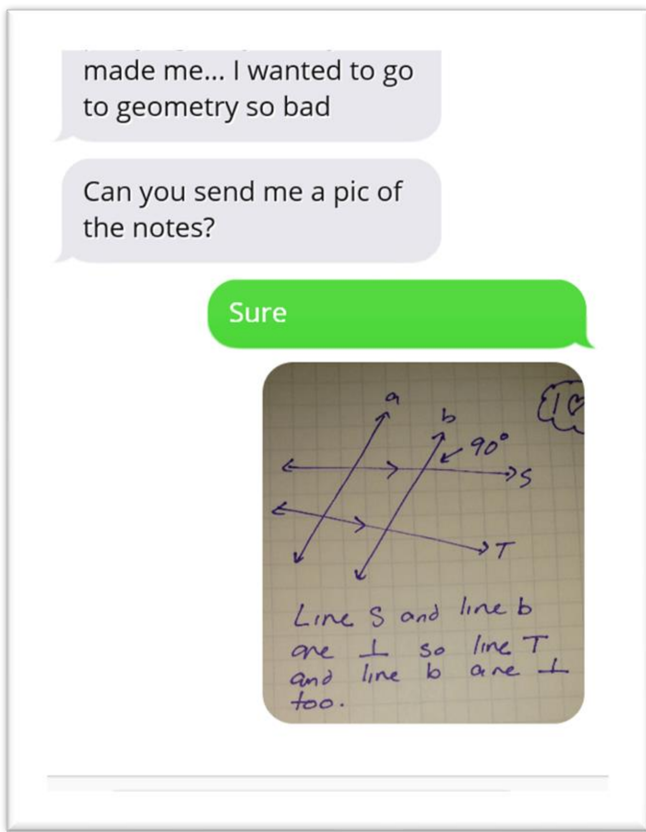
1. You are taking notes in a geometry class and you copy the diagram from the board into your notes. The diagram from your notes is shown to the right. The teacher then writes two sentences on the board. For each sentence, determine if there is enough information to prove it is true. If there is then explain why. Otherwise, explain why you cannot prove the statement is true.



   a. We know line l and line b are perpendicular.

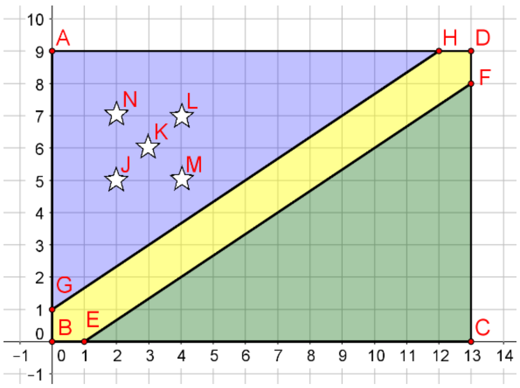
   b. We know line a and line b are parallel.

2. You missed class on Friday so you ask your friend to text you a picture of the notes from class. Your friend is not the greatest artist so you are not sure if he drew the diagrams correctly. Based only on the information given in the diagram, is the statement that follows valid? Your explanation must use complete sentences and cite specific theorems and postulates when necessary.



Practice Performance Task – 3.5
The Solomon Islands

The Solomon Islands is a small nation north-east of Australia. While the majority of people live on six major islands, The Solomon Islands consists of over 600 islands! The following problems will investigate the characteristics of the nation's flag.



1. The figure to the left shows an approximation of the flag of The Solomon Islands plotted on a coordinate plane. Find the equation that represents lines $\overline{GH}$ and $\overline{EF}$. Does this provide evidence that these two lines are parallel? Explain.

2. Prove $\overline{JL}$ and $\overline{NM}$ are perpendicular. Explain your reasoning and show your work.

3. Find the equation of the line that passes through the N, K and M stars. Is this line perpendicular to $\overline{GH}$? Explain how you made this determination.

4. Find the distance between the J star and $\overline{EF}$. Show your work.