What's Your Angle?/Which Line Is It Anyway?

Behaviorism Model
Vocabulary Acquisition – Chapter 11, pp. 209–234
Grade 4 – Math

1. **MATERIALS/PREPLANNING**
   - **Materials**
     - Individual whiteboards & markers (1 each per student)
     - Rulers for drawing (1 per student)
     - *Sir Cumference* book
     - Blank white paper for drawing
     - Pencils and colored pencils for drawing
   - **Vocabulary**
     - <u>Right</u> angle
     - <u>Acute</u> angle
     - <u>Obtuse</u> angle
     - <u>Parallel</u> lines
     - <u>Perpendicular</u> lines
   - **Literature**
     - *Sir Cumference and the Great Knight of Angleland* by Cindy Neuschwander

2. **OBJECTIVE**
   - **Objectives**
     - **Students Will Understand**
       - That the names of types of angles and lines contain clues about their identity or meaning.
     - **Students Will Know**
       - The prefixes and roots of three types of angles (right, acute, obtuse) and two types of lines (perpendicular and parallel).
     - **Students Will Be Able To**
       - Identify each of the three types of angles and two types of lines with accuracy.
       - Draw and label each type of angle and line with accuracy.
   - **State the Cognitive Taxonomy and/(Affective/ Psychomotor) Level**
     - **Cognitive**
       - **Knowledge**
       - **Comprehension**
       - **Application**
       - **Analysis**
       - **Synthesis**
       - **Evaluation**
     - **Affective**
       - **Receiving**
   - **Standards**
     - **Geometry (CA's Common Core Content Standards for Mathematics, 2012)**
       - **Draw and identify lines and angles, and classify shapes by properties of their lines and angles**
         - 4.G.1. Draw points, lines, line segments, rays, angles (right, acute, obtuse), and perpendicular and parallel lines. Identify these in two-dimensional figures.
     - **Reading (R/LA Framework for CA Public Schools, 2007)**

- **1.0 Word Analysis, Fluency, and Systematic Vocabulary Development**
  - 1.2 Apply knowledge of word origins, derivations, synonyms, antonyms, and idioms to determine the meaning of words and phrases.
  - 1.6 Distinguish and interpret words with multiple meanings.

3. ASSESSMENT
- **Describe clearly how you would assess student performance in this lesson.**
  - **Progress monitoring/guided practice (informal):** This would be done at various times throughout the lesson, as students will have opportunities to demonstrate their understanding of the vocabulary through discussion of their invented spellings and hypothesized meanings. They will also be able to show their understanding of the math concepts by writing on their individual whiteboards. Mistake-making is acceptable, even helpful, at this stage in the process. Therefore, grades for accuracy will not be given.
    - This type of assessment is required for the direct instruction model, which hinges upon modeling, practice, and feedback. Teachers must be able to guide students through the practice phases of the lesson, and then to provide feedback during and after the practice so that students can accurately follow the model provided by the teacher.
  - **Pretest (formal):** This diagnostic assessment will evaluate students' existing knowledge specifically (of the vocabulary terms) and generally (of their ability to piece together accurate spellings based on common morphology). A grade will not be recorded for this assessment.
    - This assessment is an integral part of the vocabulary acquisition model. The few words chosen for the test encompass the basic concepts of the lesson. Therefore it is necessary to include this assessment in order to correctly follow the theoretical model.
  - **Evaluation/posttest (formal):** This is the last step in the lesson format, and assesses the state of students' knowledge after they have received the lesson. A score will be given (through the following **checklist**, with 1 point given for each Y) based on accuracy of the answers; some questions are objective while others are subjective. The Yes/No answer system accounts for each.

Term	Spelled Correctly? (Y/N)	Explained roots? (Y/N)	Drew accurate example? (Y/N)	Named real-world application? (Y/N)
Acute				
Right				
Obtuse				
Parallel				
Perpendicular				

  - This assessment is also crucial to the vocabulary acquisition model, as it is the prescribed fifth step in the process. It measures the level of mastery students have achieved with the new vocabulary and concepts. It is appropriately given after students have had several opportunities to learn and work with the new terms.
  - **Independent practice (informal):** This assignment will be graded for completion and for accuracy, but it will serve as an opportunity for students to apply their knowledge, to make mistakes, and to revise their thinking. It will also demonstrate their ability to think creatively, and will be graded using the following **rubric**.

Score	4	3	2	1
Creativity	Student creates features on map that are different from story and chooses a distinct feature for each term.	Student borrows minimally from the features found in the story, but chooses a distinct feature for each term.	Student borrows heavily from the features in the story and chosen features include little variety.	Student does not include any original ideas and does not use variety when designing features.
Accuracy	Student applies and spells each term accurately	Student applies and spells most terms accurately when	Student applies and spells few terms accurately	Student does not apply or spell terms accurately

	when designing features on their map	designing features on their map	when designing features on their map	when designing features on their map
Completeness	Student includes each term and five distinct features in creating a complete map	Student includes each term and distinct features, but map contains unused space	Student includes most terms and a feature for each, and map contains unused space	Student includes few terms and features, and uses minimal space on map

- This is one of the closing portions of the direct instruction model, as it allows students to attempt their new skill independently under the supervision of the teacher.

4. LESSON OPENING/PURPOSE
- **Clearly state to students how this lesson will benefit students.**
  My version: This lesson will help students recognize and use morphological clues to **identify** and to **produce** different types of angles and lines. It will enable them to **relate** mathematical concepts to specific word roots; this will allow them to recognize the same roots in other curricular areas and facilitate the construction of deeper conceptual understanding about language.
  Student version: In today's lesson, we will look at different types of angles, which we have been studying for a few days now, and lines, which are a new concept for us. We will learn the special names for these angles and lines, and the clues that the words give us. This will help us **remember** their names much more easily, but it will also help us **understand** other words in the same word families.

5. MOTIVATION FOR LEARNING
- **Identify the type of motivation (i.e., intrinsic/extrinsic) that is appropriate for this theoretical model.**
  - Because of the activities chosen and designed for this lesson, students will be intrinsically motivated to acquire the vocabulary and complete the tasks at a high level. However, because of the emphasis on teacher modeling, practice, and production, students will also be extrinsically motivated by earning a high score and performing skills/completing tasks at a level that earns their teacher's approval. No additional rewards are offered for high-quality work, but the students will find satisfaction in doing their best creative work and having it displayed around the classroom.
- **Describe exactly what you will do to in this lesson to support motivation to learn.**
  - In order to support students' intrinsic motivation to learn, I will emphasize "the joy of language" (Estes, Mintz, & Gunter, 2011, p. 215) that comes with discovering and acquiring new vocabulary. I will also emphasize creativity as they engage in independent practice. The opportunity to create original artwork that contains applications for their new vocabulary and connects to an enjoyable math-themed story will enrich their learning and sustain their motivation to learn.

6. LESSON BODY

Step 1   Review/Make Connections to Previously Learned Material
An advance organizer that includes recently learned information about angles and lines will be presented. This will refresh students' memories regarding the topic and prepare them to acquire new knowledge. (A copy of the advance organizer is attached at the end of the lesson plan.) Students will only see the first slide, which addresses prior knowledge, before the pretest. As the organizer unfolds, each new vocabulary word will be revealed as part of the organizer.

Step 2   State Objectives for the Lesson
- **Students Will Understand:** Today our goal is to learn the names of different types of angles and lines, and to remember them with the help of certain clues. These clues can be found in the names themselves.

- **Students Will Know:** We will find out how to describe those clues that we find in the words. Learning this will help us to figure out other kinds of unfamiliar words that we will read in the future.
- **Students Will Do:** After we talk about these different types of angles and lines, we will be able to recognize them – pick them out of a crowd – and even to create them ourselves.

Step 3   **Present New Material**

1. Pretest knowledge of words critical to content.
- Pretest students on the words *acute, right, obtuse, perpendicular,* and *parallel* (*right* will be a word they know how to spell, but its plethora of meanings, specific math application, and variety of spellings make it worth discussing.)
- Recite the words orally, asking students to **listen** carefully and to make their best attempt to spell and define each word accurately.
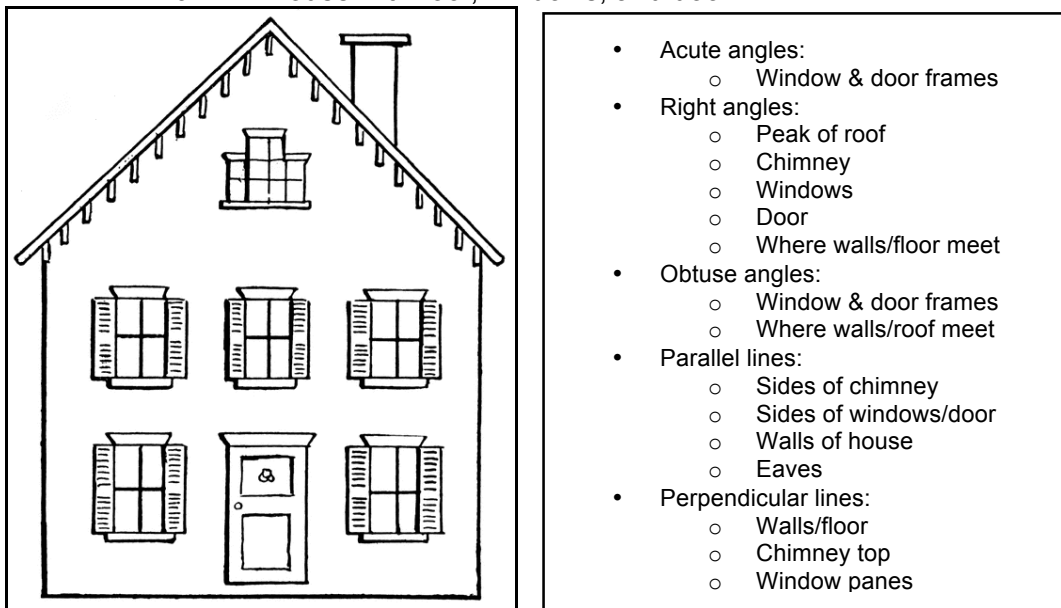
2. Elaborate on and discuss invented spellings and hypothesized meanings.
- Ask students to share what they think the beginnings and endings of each word mean. Explain that *acute* has nothing to do with *cute*. Also ask them to brainstorm words with a beginning similar to *parallel* (likely choices would be *parachute*, *paranormal*, and *parasite*). Explain how the prefix *para-* can have different meanings; we need to use word clues to find out which meaning it takes in each word.

3. Explore patterns of meaning.
- Provide definitions of prefixes and roots.
    - *Acute* comes from Latin word that means "to sharpen" or "needle."
    - *Right* has many uses, but in this case it comes from Latin word for "ruled" (think of a ruler for measurement, not of a country or kingdom), and means movement in a straight line.
    - *Obtuse* comes from Latin word for "to beat against"; in Middle English it meant "blunt." *Ob-* means "in the way; against."
    - *Parallel* comes from Greek words for "alongside"/"beside" and "one another"
    - *Perpendicular* comes from Latin words for "through" and "to hang"; in Middle English it meant "at right angles" (there is a connection!)
- Explain differences between acute, right, and obtuse angles (include picture of each).
    - *Acute* angles are the smallest kinds of angles; they are less than 90 degrees.
        - *How does it relate to the root?* The point at the middle of the angle is the sharpest of any angle.
        - *Mnemonic*: "a cute little angle"
    - *Right* angles are always 90 degrees; they always form a perfect corner.
        - *How does it relate to the root?* The lines that form right angles are always straight, as if drawn with a ruler.
        - *Mnemonic*: "right in the middle between acute and obtuse angles"
    - *Obtuse* angles are the biggest of these 3 angles; they are between 90 and 180 degrees ($90° <$ obtuse $< 180°$).
        - *How does it relate to the root?* The point at the middle is not sharp; it is blunt.
        - *Mnemonic*: "Obtuse angles are big, and always in the way"
- Ask students to identify examples of each type of angle.
    - Use PPT slides to show angles; students will write answers on their whiteboards.
- Explain differences between parallel and perpendicular lines (include pictures of each).
    - *Parallel* lines run alongside one another and never cross; think of them as the two sides of the freeway, which never cross but stay right next to each other.
        - *Mnemonic*: The double l's in *parallel* look like parallel lines.
    - *Perpendicular* lines cross each other at right angles; think of them as city streets, which have lots of crosses and intersections.
- Ask students to **identify** examples of each type of line.

o   Use PPT slides to show lines; students will write answers on their whiteboards.
- Look at photographs that contain examples of angles and lines. Ask students to **identify** the angles and lines in each photo. Individual students could come up to the board and **circle** an angle or a line with a color designated for each type. This will help students to **distinguish** between each angle and line when they are arranged near each other.
  o   Ex: house with roof, windows, and door

- Acute angles:
  o   Window & door frames
- Right angles:
  o   Peak of roof
  o   Chimney
  o   Windows
  o   Door
  o   Where walls/floor meet
- Obtuse angles:
  o   Window & door frames
  o   Where walls/roof meet
- Parallel lines:
  o   Sides of chimney
  o   Sides of windows/door
  o   Walls of house
  o   Eaves
- Perpendicular lines:
  o   Walls/floor
  o   Chimney top
  o   Window panes

4. Read and study.
- Students will **listen** as the teacher reads aloud the book *Sir Cumference and the Great Knight of Angleland: A Math Adventure* by Cindy Neuschwander. It contains clever but direct references to the types of angles and lines that the students are learning about in this lesson. The illustrations also help contextualize the words, and provide students with a visual **application** of the vocabulary.
  o   http://www.amazon.com/Cumference-Great-Knight-Angleland-Adventure/dp/157091169X

5. Evaluate and posttest.
- In order to determine the depth of each student's understanding, the test will ask students to:
  o   spell each term correctly and **list** its definition in the context of math
  o   **explain** the meaning of each term's root(s) and how it relates the term's meaning in the context of math
  o   **draw** a math-related example of each term
  o   **name** one way each type of angle or line can be seen in the real world (e.g., a window pane, a freeway, a mountain, etc.)
- The posttest will be scored and recorded for points in the gradebook.

Step 4   Guide Practice, Assess Performance, and Provide Corrective Feedback
- **Questioning** – Students will answer these questions by writing/drawing the answer on their whiteboards and holding them up when asked.
  o   *Which kind of angle has a measurement of 90 degrees?* (right angle)
  o   *What do you call an angle that is smaller than 90 degrees?* (acute angle)
  o   *What do you call an angle that is bigger than 90 degrees, but smaller than 180 degrees?* (obtuse angle)
  o   *Which kinds of lines run alongside each other and never cross?* (parallel lines)
  o   *Which kinds of lines cross each other at 90-degree angles?* (perpendicular lines)

- **Correcting Errors** – Remind students of the clues hidden within each term if they confuse the meanings. For example, if they mix up *acute* and *obtuse*, remind them of the mnemonic "<u>a cute</u> little angle"; if they mix up *parallel* and *perpendicular*, ask them to think of what *para-* means.
  - By having students raise their whiteboards with their responses, the teacher can see and make note of which students do not understand, and students who have answered inaccurately can do so discreetly. They can receive immediate feedback, as the teacher will reiterate or clarify each answer after it is given.

Step 5   Assign Independent Practices, Assess Performance, and Provide Corrective Feedback
- Inspired by the story of Sir Cumference, students will **design** their own "Angleland," drawing a topographical map that includes features based on each type of angle and line. This activity will provide the students with an opportunity to visually demonstrate their understanding of the terms. After **creating** their drawings and chosen geographical features, students can **defend** their choices by referring to the learned vocabulary. This can come in the form of a paragraph written to **explain** the ways in which their map accurately represents the vocabulary terms.
  - It also links to visual arts and social studies (**Standard 4.1.5**), especially if the current social studies unit involves mapmaking or geography.

Step 6   Review Periodically – Build in review of lesson in future lessons
- The class will review these lessons by learning to sing a couple of songs by Rockin' the Standards, including *Parallel or Perpendicular* and *The Angles Song*. These songs include hand motions and contain plenty of clues for remembering the vocabulary and its meanings.
  - YouTube contains videos of some classes performing these songs, or they can be found on iTunes or Spotify.
- For students who need more practice distinguishing between the types of angles, there is a worksheet for identifying angles (attached at end of lesson).
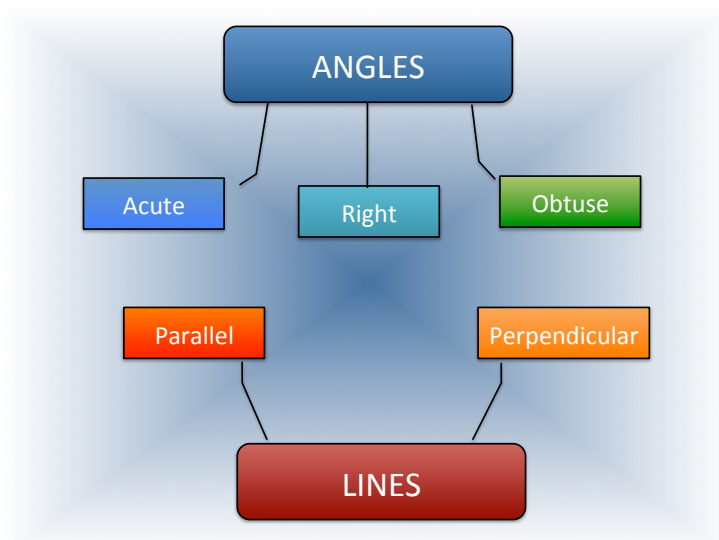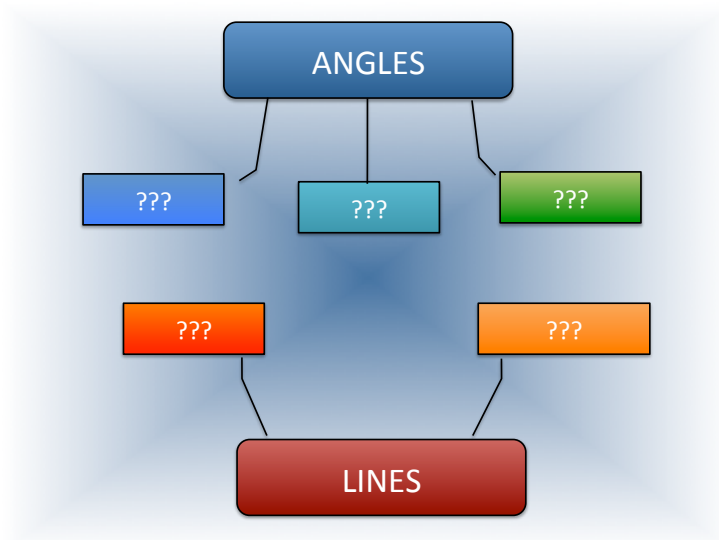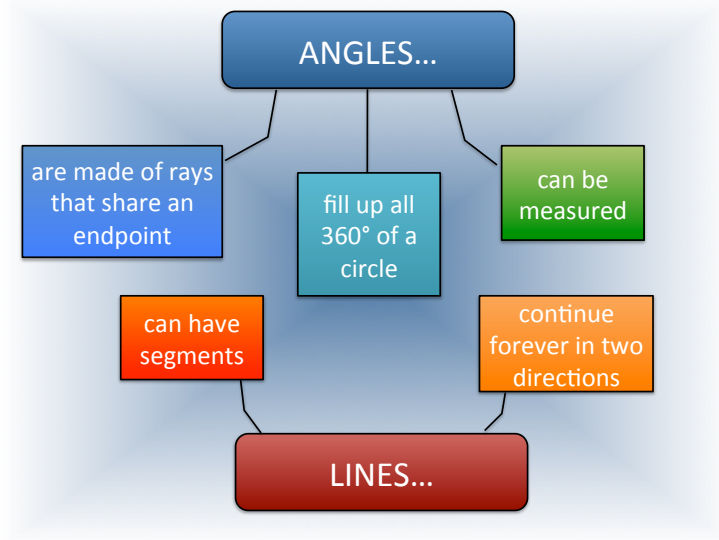
7. **Student Work Examples/Technology Support**
- **Attach samples of student work.**
  - Samples of independent practice are attached at the end of the lesson.
- **Add technology support (ex. www resources/interactive activities etc.)**
  - *YouTube videos/Spotify songs from Rockin' the Standards (http://www.youtube.com/watch?v=-VQ8xJ9qLWk&list=UUCrRtDwsmwzOhsLzn7cHRVA&edufilter=L-Hmzxw5LmLXyzgFh4WyAg&safe=active)*
    Lyrics to "Parallel or Perpendicular?" by Rockin' the Standards (to the tune of "Do your Ears Hang Low?")
    Do you see a parallel, lookin' like a double L
    Lines that never cross, never would as well
    But when two lines come together
    forming right angles, we yell, "Perpendicular"

Advance Organizer

ANGLES...

- are made of rays that share an endpoint
- fill up all 360° of a circle
- can be measured
- can have segments
- continue forever in two directions

LINES...

ANGLES

- ???
- ???
- ???
- ???
- ???

LINES

ANGLES

- Acute
- Right
- Obtuse
- Parallel
- Perpendicular

LINES

Hidden Angles

Different angles are hidden in these pictures. Can you identify them?
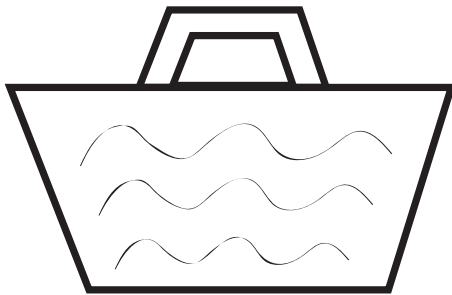
Review:
- *A right angle is the 90 degree angle between two perpendicular lines.*
- *An acute angle is an angle less than 90 degrees but more than 0.*
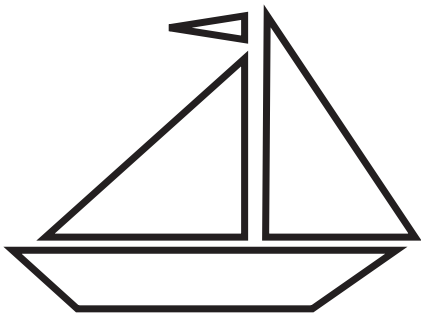- *An obtuse angle is an angle between 90 and 180 degree.*
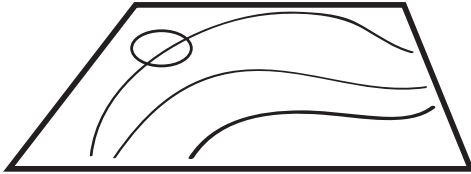
There are ____**no**____ right angles.
There are ____**two**____ acute angles.
There are ____**two**____ obtuse angles.
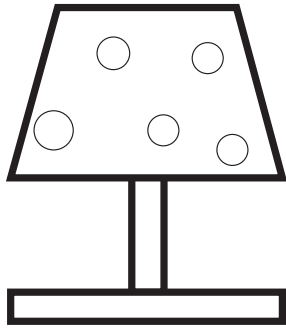
There are ____**eight**____ right angles.
There are ____**two**____ acute angles.
There are ____**two**____ obtuse angles.

There are ____**no**____ right angles.
There are ____**six**____ acute angles.
There are ____**six**____ obtuse angles.

There are ____**two**____ right angles.
There are ____**nine**____ acute angles.
There are ____**two**____ obtuse angles.