

Chapter 3 Unit Plan: Angles and Lines

This geometry unit plan was created for my methods in teaching math class and taught to my peer and professor. It is based on chapter 3 of *The University of Chicago School Mathematics Project, Geometry* which was about angles and lines. The students learned about angle measure, parallel lines, perpendicular lines, and associated theorems. There was a focus on showing angle congruence and an introduction to proof writing using a two-column set up. The main Indiana state standard related to this unit is,

“G.PL.3: Prove and apply theorems about lines and angles, including the following: vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent, alternate exterior angles are congruent, and corresponding angles are congruent; when a transversal crosses parallel lines, same side interior angles are supplementary; and points on a perpendicular bisector of a line segment are exactly those equidistant from the endpoints of the segment.”

The summative assessment associated with this unit was a chapter test covering vocabulary, measuring angles, proving theorems using a two-column format, and applying theorems about angles and lines to find missing angles. Throughout the unit, I used formative assessments including homework, exit tickets, and in class activities.

Sources

Coxford, A. F., Usiskin, Z., & Hirschhorn, D. (1993). *Geometry*. Glenview, IL: ScottForesman.

Indiana Academic Standards Mathematics: Geometry. (2017, October 2). Retrieved December 07, 2017, from <https://www.doe.in.gov/sites/default/files/standards/mathematics/geometry-standards.pdf>

Chapter 3 Test (50 pts.)

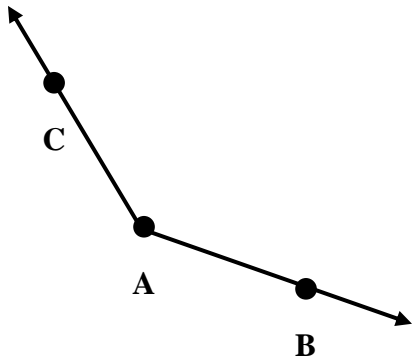
Name: _____ Date: _____ Class Period: _____

Matching (2pts. each): Match all terms to their definitions.

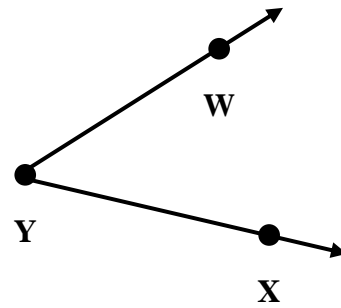
- | | |
|-------------------------|--|
| A. Acute Angle | 1. _____ Measure of angle is 180° |
| B. Obtuse Angle | 2. _____ Measure of angle is 90° |
| C. Right Angle | 3. _____ Sum of angle measures is 180° |
| D. Straight Angle | 4. _____ Measure of angle is 0° |
| E. Zero Angle | 5. _____ Measure of angle is less than 90° |
| F. Complementary Angles | 6. _____ Sum of angle measures is 90° |
| G. Supplementary Angles | 7. _____ Measure of angle is greater than 90° |

Measuring (3pts. each): Name and measure each angle using a protractor.

8. Name: _____
Measure: _____



9. Name: _____
Measure: _____



Proofs: Prove the following theorems using the two-column setup. Draw a picture if needed.

10. Vertical Angle Theorem (6 pts.): If two angles are vertical angles, then they have equal measure.

Statements	Reasons

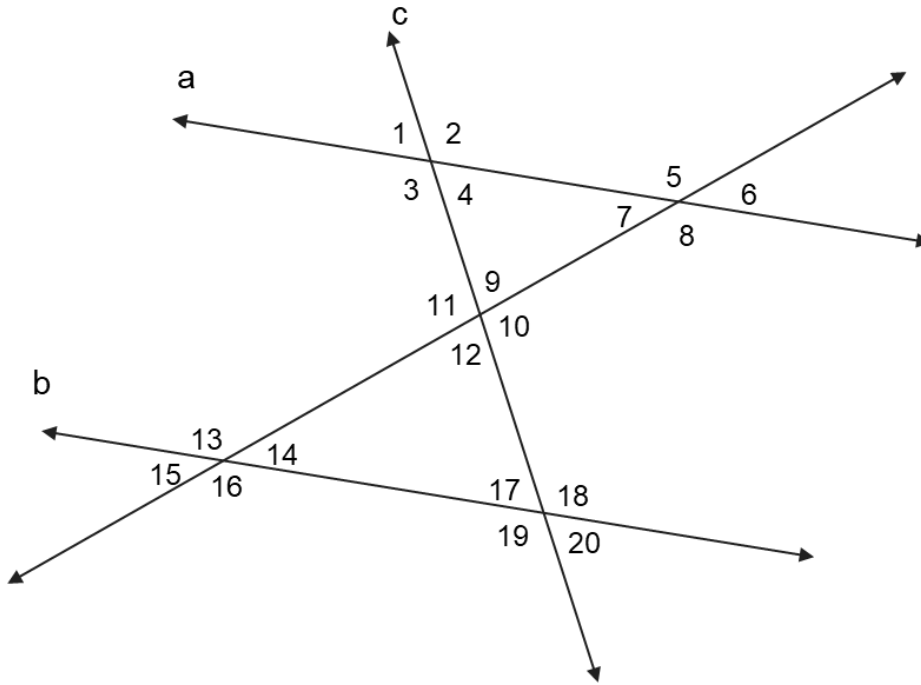
11. Alternate Interior Angles

Theorem (6 pts.): When two parallel lines are cut by a transversal, alternate interior angles are equal.

Statements	Reasons

12. **Angle Pile Up (18 pts.):** From given information, find measure of all other angles. Justify all of your answers.

- Line a is parallel to line b
- $m\angle 2 = 126^\circ$
- $m\angle 12 = 80^\circ$
- $m\angle 13 = 134^\circ$



School of Education Essential Components of Lesson

Topic: Angles **Class:** Geometry (MATH 4700) **Timeframe:** 40min **Date:** Day 1

Enduring Understanding (Big Idea): There are several ways we can talk about angles and how they relate to each other.

Essential Question/s: How do we talk about and describe angles?

Key Vocabulary: Angle, side, vertex, measure, interior, exterior, measure

I. CONTENT STANDARDS: (this is for whole unit)

G.PL.3: Prove and apply theorems about lines and angles, including the following: vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent, alternate exterior angles are congruent, and corresponding angles are congruent; when a transversal crosses parallel lines, same side interior angles are supplementary; and points on a perpendicular bisector of a line segment are exactly those equidistant from the endpoints of the segment.

II. INSTRUCTIONAL OBJECTIVES: Students will be able to...

- 1) Define an angle and identify the parts
- 2) Measure an angle
- 3) Apply the Angle Measure Postulate

III. ASSESSMENT:

- 1) Exit ticket and homework
- 2) Exit ticket and homework
- 3) In class examples and homework

IV. MATERIALS AND INSTRUCTIONAL TOOLS:

Protractor, smart board

Textbook: The University of Chicago School Mathematics Project, Geometry

V. DIFFERENTIATED INSTRUCTIONAL STRATEGIES:

Use various colors to tie concepts together

Have students come to the board to answer questions or have them do a turn and talk depending on class size.

Offer challenge problem with homework assignment.

VI. STUDENT ACCOMMODATIONS:

Follow all IEP guidelines

Offer students who need it fill in the blank copies of the notes as well as post notes online to class website for students to refer to later.

VII. DESCRIPTION of LEARNING ACTIVITIES:

	# of minutes	Activities	Assessment/ Evidence	Resources
Intro: Motivation & Transition	5	Probably seen angles and some of this before Today is learning some technical names and rules about angles		
Teach/Practice	20	Lesson (see power point) Go through the power point and fill in the written notes attached. Ask questions along the way, either have someone come up to the board or do a turn and talk then share answers with class.		Book
Application *	5	Practice Problems		Book
Closure	10	<u>Exit Ticket:</u> 1) Definition of angle 2) Draw an Angle 3) Label and name it properly 4) Measure it (?) <u>Homework:</u> p.109-111 #1,3,6,11,14,16,18 Challenge Problem: p.112 #24	Exit ticket handed in at end of class Homework handed in next class	

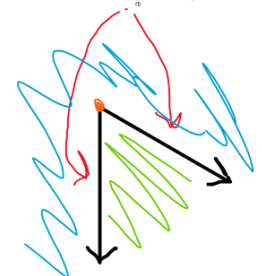
Day 1

HOW DO WE TALK ABOUT AND DESCRIBE ANGLES? (3.1)

DEFINITIONS

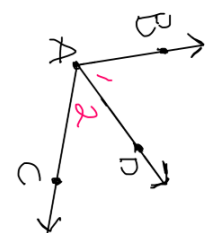
- An **angle** is the union of two rays that have the same endpoint
- The **sides** of an angle are the two rays
- The **vertex** is the shared endpoint

Note: An angle divides a plane into two sets, the **interior** (congruent) set and the **exterior** (congruent) set



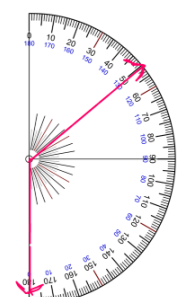
LABELING ANGLES (NOTATION)

- If looking at a single angle
 - $\angle A$
- Looking at multiple angles
 - $\angle BAC$ and $\angle CAD$
- Also can be labeled with numbers
 - $\angle 1$ and $\angle 2$



HOW TO MEASURE ANGLES

- The **measure** is the "openness" of an angle
 - Use unit degrees ($^\circ$)
- Using a protractor**
 - Put center of protractor on vertex
 - Align 1 side with bottom of protractor
 - Measure give where angle crosses arc of protractor

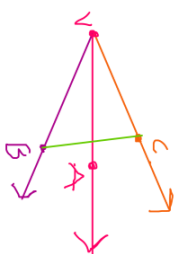


ANGLE MEASURE POSTULATE - UNIQUE MEASURE ASSUMPTION

- Every angle has a unique measure from 0° - 180°


ANGLE MEASURE POSTULATE - TWO SIDES OF A LINE ASSUMPTION

- Given any ray \overrightarrow{VA} and any number x between 0 and 180, there are **unique** rays \overrightarrow{VC} and \overrightarrow{VB} such that BC intersects line \overleftrightarrow{VA} and $m\angle BVA = m\angle CVA = x$



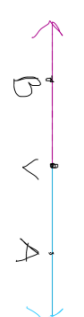
ANGLE MEASURE POSTULATE - ZERO ANGLE ASSUMPTION

- If \overrightarrow{VA} and \overrightarrow{VB} are opposite rays then $m\angle AVB = 180^\circ$



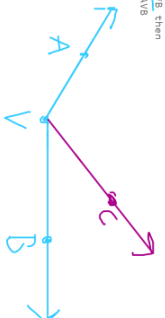
ANGLE MEASURE POSTULATE - STRAIGHT ANGLE ASSUMPTION

- If \overrightarrow{VA} and \overrightarrow{VB} are opposite rays (form a line) then $m\angle AVB = 180^\circ$



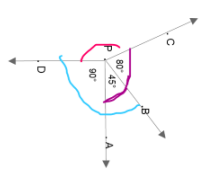
ANGLE MEASURE POSTULATE - ANGLE ADDITION PROPERTY

- If \overrightarrow{VC} is in the interior of $\angle AVB$ then $m\angle AVC + m\angle CVB = m\angle AVB$




APPLYING THE ANGLE MEASURE POSTULATE

- What is $m\angle AEC$? = 125
- What is $m\angle BPD$? = 135
- What is $m\angle CPD$? = 145



APPLYING THE ANGLE MEASURE POSTULATE

- If $m\angle CVA = 43^\circ$ what is $m\angle BVC$?



EXIT TICKET

- Draw an angle
- Name it
- Measure it with a protractor
- Identify sides, vertex, interior, and exterior
- State one part of the Angle Measure Postulate

School of Education Essential Components of Lesson

Topic: Angles **Class:** Geometry (MATH 4700) **Timeframe:** 40min **Date:** Day 2
Enduring Understanding (Big Idea): There are several different types of angles categorized by measure.
Essential Question/s: What are different types of angles.
Key Vocabulary: Zero, straight, right, acute, obtuse, complementary, supplementary, adjacent, linear pair, vertical angles.

I. CONTENT STANDARDS: (this is for whole unit)

G.PL.3: Prove and apply theorems about lines and angles, including the following: vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent, alternate exterior angles are congruent, and corresponding angles are congruent; when a transversal crosses parallel lines, same side interior angles are supplementary; and points on a perpendicular bisector of a line segment are exactly those equidistant from the endpoints of the segment.

II. INSTRUCTIONAL OBJECTIVES: Students will be able to...

- 1) Define vocabulary above.
- 2) Know and apply linear pair theorem.
- 3) Know and apply vertical angle theorem.

III. ASSESSMENT:

- 1) Exit ticket and homework
- 2) In class example and homework
- 3) In class example and homework

IV. MATERIALS AND INSTRUCTIONAL TOOLS:

Smart board
Textbook: The University of Chicago School Mathematics Project, Geometry

V. DIFFERENTIATED INSTRUCTIONAL STRATEGIES:

Use various colors to tie concepts together
Have students come to the board to answer questions or have them do a turn and talk depending on class size
Offer extra challenge question with homework assignment.

VI. STUDENT ACCOMMODATIONS:

Follow all IEP guidelines
Offer students who need it fill in the blank copies of the notes as well as post notes online to class website for students to refer to later.

VII. DESCRIPTION of LEARNING ACTIVITIES:				
	# of minutes	Activities	Assessment/ Evidence	Resources
Intro: Motivation & Transition	7	Recall: 1. What is an angle? 2. How do we name an angle? 3. How do we measure an angle? 4. What is a straight angle? 5. What is a zero angle?	Have students answer individually then check as a class	
Teach/Practice	15	Lesson (see power point) Go through the power point and fill in the written notes attached. Ask questions along the way, either have someone come up to the board or do a turn and talk then share answers with class.		Book
Application *	11	Example on 2 nd to last slide. Fill in given information, ask students to work on own then fill in		Book
Closure	7	<u>Exit Ticket:</u> 1. Draw a pair of... a. Vertical angles b. Complementary angles c. Supplementary angles 2. What is an obtuse angle? <u>Homework:</u> p.117 #1,4-12 even, 15 <u>Challenge Problem:</u> p.119 #25 or 26	Exit ticket handed in at end of class Homework handed in next class	

Day 2

WHAT ARE DIFFERENT TYPES OF ANGLES? (3.2)

TYPES OF ANGLES BY MEASURE

- * **Zero** → Measure equals 0°
- * **Straight** → Measure equals 180°
- * **Right** → Measure equals 90°
- * **Acute** → Measure less than 90°
- * **Obtuse** → Measure greater than 90°

ADJACENT ANGLES

- * Two angles are **adjacent** if they share a common side

$\angle 1$ is adj to $\angle 2$

LINEAR PAIRS-THEOREM

- * If two angles form a linear pair, then they are supplementary.

$m\angle 3 = 180^\circ$
 $m\angle 1 + m\angle 2 = \angle 3$
 $m\angle 1 + m\angle 2 = 180^\circ$

VERTICAL ANGLES-THEOREM

- * Vertical angles are equal

$m\angle 1 + m\angle 2 = 180^\circ$
 $m\angle 3 + m\angle 2 = 180^\circ$
 $m\angle 1 + m\angle 2 = m\angle 3 + m\angle 2$
 $m\angle 1 = m\angle 3$

RECALL

- * What is an angle?
- * How do we name an angle?
- * How do we measure an angle?
- * What is a straight angle?
- * What is a zero angle?

ANGLE RELATIONS

- * Two angles are **complementary** if $m\angle 1 + m\angle 2 = 90^\circ$
- * Two angles are **supplementary** if $m\angle 1 + m\angle 2 = 180^\circ$

LINEAR PAIRS

- * Two angles form a **linear pair** if they are adjacent and the non shared sides form a straight line

VERTICAL ANGLES

- * Two angles are **vertical angles** if they are non-adjacent angles formed by two intersecting lines

EXAMPLES

- * $m\angle ECB = 126^\circ$
- * $m\angle IAD = 36^\circ$
- * $m\angle ABH = 55^\circ$

* What other angles can we find the measure of?

FINAL CHECK

- * Draw a pair of
 - o Vertical angles
 - o Complementary angles
 - o Supplementary angles
- * What is an obtuse angle?

School of Education Essential Components of Lesson

Topic: Angles **Class:** Geometry (MATH 4700) **Timeframe:** 40min **Date:** Day 3
Enduring Understanding (Big Idea): We manipulate angles in several ways to solve a problem
Essential Question/s: How can we use angles in problem solving?
Key Vocabulary: NA

I. CONTENT STANDARDS:

For Whole Unit

G.PL.3: Prove and apply theorems about lines and angles, including the following: vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent, alternate exterior angles are congruent, and corresponding angles are congruent; when a transversal crosses parallel lines, same side interior angles are supplementary; and points on a perpendicular bisector of a line segment are exactly those equidistant from the endpoints of the segment.

For This Activity

PS.1: Make sense of problems and persevere in solving them.

II. INSTRUCTIONAL OBJECTIVES: Students will be able to...

1) Manipulate angles to solve a problem

III. ASSESSMENT:

1) Progress on the activity

IV. MATERIALS AND INSTRUCTIONAL TOOLS (including safety issues and technology):

Projector, student computers

V. DIFFERENTIATED INSTRUCTIONAL STRATEGIES:

Students get to work at their own pace

VI. STUDENT ACCOMMODATIONS:

Follow all IEP guidelines

VII. DESCRIPTION of LEARNING ACTIVITIES:

	Clock Time or # of minutes	Activities	Assessment/ Evidence	Resources
Intro: Motivation & Transition	5	Project essential question for day Talk about how today we will be doing an activity involving problem solving and angles		
Teach/Practice	5	Have students go to student.desmos.com Enter class code After first 2 slides of activity, pause to check for understanding in how the activity works		Desmos activity
Application *	25	Students work through activity Pause on error correction slide Pause on another angle slide Keep class together on make your own challenge slides		Desmos activity
Closure	5	Exit Ticket: 1. What was the hardest part of today's activity? 2. What did you enjoy the most? Thoughts on the activity		

School of Education Essential Components of Lesson

Topic: Angles **Class:** Geometry (MATH 4700) **Timeframe:** 40min **Date:** Day 4

Enduring Understanding (Big Idea): We can use definitions, postulates, and theorems to prove our statements.

Essential Question/s: How can we prove what we know?

Key Vocabulary: Proof

I. CONTENT STANDARDS: (this is for whole unit)

G.PL.3: Prove and apply theorems about lines and angles, including the following: vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent, alternate exterior angles are congruent, and corresponding angles are congruent; when a transversal crosses parallel lines, same side interior angles are supplementary; and points on a perpendicular bisector of a line segment are exactly those equidistant from the endpoints of the segment.

II. INSTRUCTIONAL OBJECTIVES: Students will be able to...

- 1) Define proof.
- 2) Justify statements
- 3) Write proof using 2 columns set up

III. ASSESSMENT:

- 1) Exit ticket
- 2) Homework
- 3) In class examples and homework

IV. MATERIALS AND INSTRUCTIONAL TOOLS:

Smart board

Textbook: The University of Chicago School Mathematics Project, Geometry

V. DIFFERENTIATED INSTRUCTIONAL STRATEGIES:

Have students come to the board to answer questions or have them do a turn and talk depending on class size

Offer extra challenge question with homework assignment

VI. STUDENT ACCOMMODATIONS:

Follow all IEP guidelines

Offer students who need it fill in the blank copies of the notes as well as post notes online to class website for students to refer to later.

VII. DESCRIPTION of LEARNING ACTIVITIES:				
	# of minutes	Activities	Assessment/ Evidence	Resources
Intro: Motivation & Transition	10	<u>Recall:</u> 1) What are complementary angles? 2) What are supplementary angles? 3) What is a linear pair? 4) What are vertical angles?		
Teach/Practice	10	Lesson (see power point) Go through the power point and fill in the written notes attached. Ask questions along the way, either have someone come up to the board or do a turn and talk then share answers with class.		Book
Application *	10	Prove linear pair theorem and vertical angle theorem, ask students for ideas on how to prove it.		Book
Closure	10	<u>Exit Ticket:</u> 5) What is a proof? 6) Why do we want to justify statements? <u>Homework:</u> p.123-124 #5,7,11-15 <u>Challenge Problem:</u> look up another geometry theorem and proof. Write 1 paragraph about some things you recognize and if you understand the argument.	Exit ticket handed in at end of class Homework handed in next class	

Day 4

HOW CAN WE PROVE WHAT WE KNOW? (3.3)

RECALL

- ★ What are complementary angles?
- ★ What are supplementary angles?
- ★ What is a linear pair?
- ★ What are vertical angles?

JUSTIFYING STATEMENTS

- ★ If $m\angle 1 = 74^\circ$, then $\angle 1$ is acute. *BC def of acute angle*
- ★ If $m\angle 1 = 74^\circ$, then $m\angle 2 = 106^\circ$
form linear pair \rightarrow add up to 180
- ★ $m\angle 1 = m\angle 3$
vertical angles are congruent

PROOFS

- ★ A **proof** is the sequence of justified conclusions to show a statement is true.
- ★ We will be using a two column proof setup

Statements	Reasons

EXAMPLE - VERTICAL ANGLE THEOREM

★ If two angles are vertical angles, then they have equal measure.

Statements	Reasons
$\angle 1$ & $\angle 3$ are vert. angles	Def. Given
$\angle 1$ & $\angle 2$ linear pair	} Def of linear pair
$\angle 2$ & $\angle 3$ linear pair	
$m\angle 1 + m\angle 2 = 180$	Linear Pair Theorem
$m\angle 2 + m\angle 3 = 180$	} Property of equality
$m\angle 1 + m\angle 2 = m\angle 2 + m\angle 3$	
$m\angle 1 = m\angle 3$	Sub. (add)

THINGS TO REMEMBER

- ★ We can only use postulates, theorems, and definitions we have stated, proved, or defined so far.
- ★ There is a list starting on p. 801

FINAL CHECK

- ★ What is a proof?
- ★ Why do we want to prove our statements?

School of Education Essential Components of Lesson

Topic: Angles and Lines **Class:** Geometry (MATH 4700) **Timeframe:** 40min **Date:** Day 5
Enduring Understanding (Big Idea): There are theorems related to parallel and intersecting lines.
Essential Question/s: What angles are formed by intersecting lines?
Key Vocabulary: Transversal, corresponding angles, alternate exterior, alternate interior, parallel

I. CONTENT STANDARDS: (this is for whole unit)

G.PL.3: Prove and apply theorems about lines and angles, including the following: vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent, alternate exterior angles are congruent, and corresponding angles are congruent; when a transversal crosses parallel lines, same side interior angles are supplementary; and points on a perpendicular bisector of a line segment are exactly those equidistant from the endpoints of the segment.

II. INSTRUCTIONAL OBJECTIVES: Students will be able to...

- 1) Define transversal, corresponding angles, alternate exterior, alternate interior, parallel
- 2) Know and apply corresponding angle postulate
- 3) Know, prove, and apply alternate interior angle theorem
- 4) Know, prove, and apply alternate exterior angle theorem

III. ASSESSMENT:

- 1) Exit ticket and homework
- 2) Exit ticket, in class example, homework
- 3) In class example and homework

IV. MATERIALS AND INSTRUCTIONAL TOOLS:

Smart board
Textbook: The University of Chicago School Mathematics Project, Geometry

V. DIFFERENTIATED INSTRUCTIONAL STRATEGIES:

Use various colors to tie concepts together
Have students come to the board to answer questions or have them do a turn and talk depending on class size
Offer extra challenge question with homework assignment.

VI. STUDENT ACCOMMODATIONS:

Follow all IEP guidelines
Offer students who need it fill in the blank copies of the notes as well as post notes online to class website for students to refer to later.

VII. DESCRIPTION of LEARNING ACTIVITIES:				
	# of minutes	Activities	Assessment/ Evidence	Resources
Intro: Motivation & Transition	5	<u>Recall:</u> 1. What is a proof? 2. What does the vertical angle theorem say?		
Teach/Practice	20	Lesson (see power point) Go through the power point and fill in the written notes attached. Ask students to share ideas and try to prove alternate interior and alternate exterior angle theorem. Turn and talk to neighbor then either have students share steps with class or have student come to board to prove (depending on class size)		Book
Application *	10	Example practice problem		Book
Closure	5	<u>Exit Ticket:</u> 7) What are parallel lines? 8) Draw two lines cut by a transversal. 9) Label corresponding angles and alternate interior angles. <u>Homework:</u> p.129-130 #1-5, 14-17 <u>Challenge Problem:</u> p.131 #26	Exit ticket handed in at end of class Homework handed in next class	

Day 5

WHAT ANGLES ARE FORMED BY INTERSECTING LINES? 3.4

SOME VOCAB

- When 2 lines are intersected by 3rd the 3rd line is called a **transversal**.
- Corresponding angles** have similar location in relation to the transversal.
→ 1&5, 2&6, 3&7, and 4&8

RECALL

- What is a proof?
- What does the vertical angle theorem say?

MORE VOCAB

- Alternate exterior**
→ 1&8 and 2&7
- Alternate interior**
→ 3&6 and 4&5

WHAT ABOUT PARALLEL LINES?

- Lines are **parallel** and if they are the "same" line and never intersect.
- Postulate**: if 2 parallel lines are cut by a transversal, corresponding angles are equal.

ALTERNATE INTERIOR ANGLES THEOREM

- When two parallel lines are cut by a transversal, alternate interior angles are equal.

Statements	Reasons
2 Parallel lines cut by a transversal	Given
$m\angle 1 = m\angle 5$ $m\angle 2 = m\angle 6$	2 Parallel lines cut by transversal → corresponding angles are equal
$m\angle 1 = m\angle 4$ $m\angle 2 = m\angle 3$	Vertical Angles
$m\angle 4 = m\angle 5$ $m\angle 3 = m\angle 6$	Substitution

ALTERNATE EXTERIOR ANGLES THEOREM

- When two parallel lines are cut by a transversal, alternate exterior angles are equal.

Statements	Reasons
2 parallel lines are cut by a transversal	Given
$m\angle 1 = m\angle 5$ $m\angle 2 = m\angle 6$	corresponding angles
$m\angle 5 = m\angle 8$ $m\angle 6 = m\angle 7$	Vertical Angles
$m\angle 1 = m\angle 8$ $m\angle 2 = m\angle 7$	Substitution

EXAMPLE

- Line a is parallel to line b
- $m\angle 2 = 126^\circ$
- $m\angle 12 = 88^\circ$
- $m\angle 13 = 134^\circ$

FINAL CHECK

- What are parallel lines? *are lines that don't intersect.*
- Draw two lines cut by a transversal.
- Label corresponding angles and alternate interior angles.

School of Education Essential Components of Lesson

Topic: Angles **Class:** Geometry (MATH 4700) **Timeframe:** 40min **Date:** Day 6
Enduring Understanding (Big Idea): Perpendicular lines have unique qualities and theorems associated with them.
Essential Question/s: What are perpendicular lines?
Key Vocabulary: Perpendicular, perpendicular bisector, angle bisector

I. CONTENT STANDARDS: (this is for whole unit)

G.PL.3: Prove and apply theorems about lines and angles, including the following: vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent, alternate exterior angles are congruent, and corresponding angles are congruent; when a transversal crosses parallel lines, same side interior angles are supplementary; and points on a perpendicular bisector of a line segment are exactly those equidistant from the endpoints of the segment.

II. INSTRUCTIONAL OBJECTIVES: Students will be able to...

- 1) Define perpendicular, perpendicular bisector, angle bisector
- 2) Know, prove, and apply two perpendiculars theorem
- 3) Know, prove, and apply parallel to perpendicular theorem
- 4) Construct a perpendicular bisector

III. ASSESSMENT:

- 1) Exit ticket and homework
- 2) In class example and homework
- 3) In class example and homework
- 4) Homework

IV. MATERIALS AND INSTRUCTIONAL TOOLS:

Smart board
Textbook: The University of Chicago School Mathematics Project, Geometry

V. DIFFERENTIATED INSTRUCTIONAL STRATEGIES:

Use various colors to tie concepts together
Have students come to the board to answer questions or have them do a turn and talk depending on class size

VI. STUDENT ACCOMMODATIONS:

Follow all IEP guidelines
Offer students who need it fill in the blank copies of the notes as well as post notes online to class website for students to refer to later.
Let students work in pairs for support from peers

VII. DESCRIPTION of LEARNING ACTIVITIES:

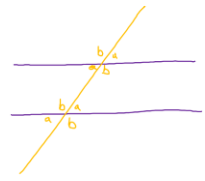
	# of minutes	Activities	Assessment/ Evidence	Resources
Intro: Motivation & Transition	5	<u>Recall:</u> 1) What are parallel lines? 2) Draw two parallel lines cut by a transversal. 3) Label all angles with same measure.		
Teach/Practice	15	Lesson (see power point) Go through the power point and fill in the written notes attached. Ask questions along the way, either have someone come up to the board or do a turn and talk then share answers with class.		Book
Application *	15	Prove two perpendiculars theorem and parallel to perpendicular theorem with partner then share with class		Book
Closure	5	<u>Exit Ticket:</u> (look at picture) 4) What are perpendicular lines? 5) What is an angle bisector? 6) What is $m\angle 1$ if l and m are perpendicular and n is an angle bisector? <u>Homework:</u> p.135-137 #2, 4-6, 11, 13, 14 Challenge Problem: p.139 #26	Exit ticket handed in at end of class Homework handed in next class	

Day 6

WHAT ARE PERPENDICULAR LINES? 3.5-3.6

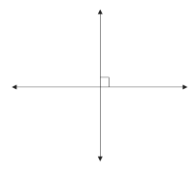
RECALL

- ★ What are parallel lines?
- ★ Draw two parallel lines cut by a transversal.
- ★ Label all angles with same measure.



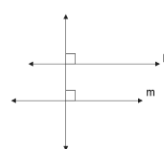
PARALLEL VS. PERPENDICULAR

- ★ Parallel lines never meet
- ★ Lines **perpendicular** if they intersect at a 90°



TWO PERPENDICULARS THEOREM

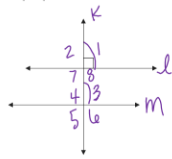
★ If two lines, l and m , are each perpendicular to the same line, then l is parallel to m .



Statements	Reasons
1. Lines l & m are \perp to same line	Given
2. all angles are right angles	2 def of \perp
3. all corresponding \angle 's, \angle 's, \angle 's are equal	3. see #2
4. lines l & m are parallel	4. corresponding \angle 's theorem

PARALLEL TO PERPENDICULAR THEOREM

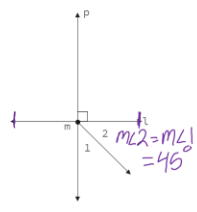
★ If a line is perpendicular to one of two parallel lines, then it is perpendicular to the other.



Statements	Reasons
1. A line is perpendicular to one of 2 parallel lines	Given
2. We know $k \perp l$, then $\angle 1 = 90^\circ$	def
3. If l and m are parallel then $\angle 1$ & $\angle 3$ are correspond.	3. def.
4. $\angle 1$ & $\angle 3$ are equal 90°	4. cor. \angle 's, \angle 's are equal
	it is perpendicular to the other (k)

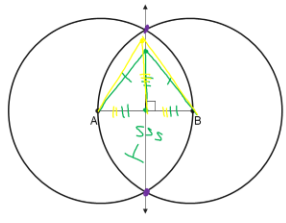
ANOTHER DEFINITION

- ★ A **perpendicular bisector**, p , intersects a line l at its midpoint, m , and p is perpendicular to l .
- ★ An **angle bisector**, divides an angle such that $m\angle 1 = m\angle 2$



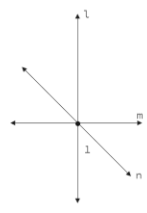
DRAWING PERPENDICULAR BISECTORS

- ★ Start with a segment \overline{AB}
- ★ Draw a circle with center A that contains B
- ★ Draw a circle with center B that contains A
- ★ Connect the intersections of the circles, that is the perpendicular bisector



FINAL CHECK

- ★ What are perpendicular lines?
- ★ What is an angle bisector?
- ★ What is $m\angle 1$ if l and m are perpendicular and n is an angle bisector?



School of Education Essential Components of Lesson

Topic: Angles and lines **Class:** Geometry (MATH 4700) **Timeframe:** 40min **Date:** Day 7
Enduring Understanding (Big Idea): We can use our theorems and definitions together to solve for angles.
Essential Question/s: How can we apply our definitions and theorems to solve for angles?
Key Vocabulary: No new vocabulary

I. CONTENT STANDARDS: (this is for whole unit)

G.PL.3: Prove and apply theorems about lines and angles, including the following: vertical angles are congruent; when a transversal crosses parallel lines, alternate interior angles are congruent, alternate exterior angles are congruent, and corresponding angles are congruent; when a transversal crosses parallel lines, same side interior angles are supplementary; and points on a perpendicular bisector of a line segment are exactly those equidistant from the endpoints of the segment.

II. INSTRUCTIONAL OBJECTIVES: Students will be able to...

1) Apply the definitions and theorems to solve for other angles.

III. ASSESSMENT:

1) Angle pile up activity

IV. MATERIALS AND INSTRUCTIONAL TOOLS:

Protractor, activity worksheets

Textbook: The University of Chicago School Mathematics Project, Geometry

V. DIFFERENTIATED INSTRUCTIONAL STRATEGIES:

Students get to be as creative as they want when creating their own version of the activity

VI. STUDENT ACCOMMODATIONS:

Follow all IEP guidelines

Let students work in pairs if they choose to get support from peers

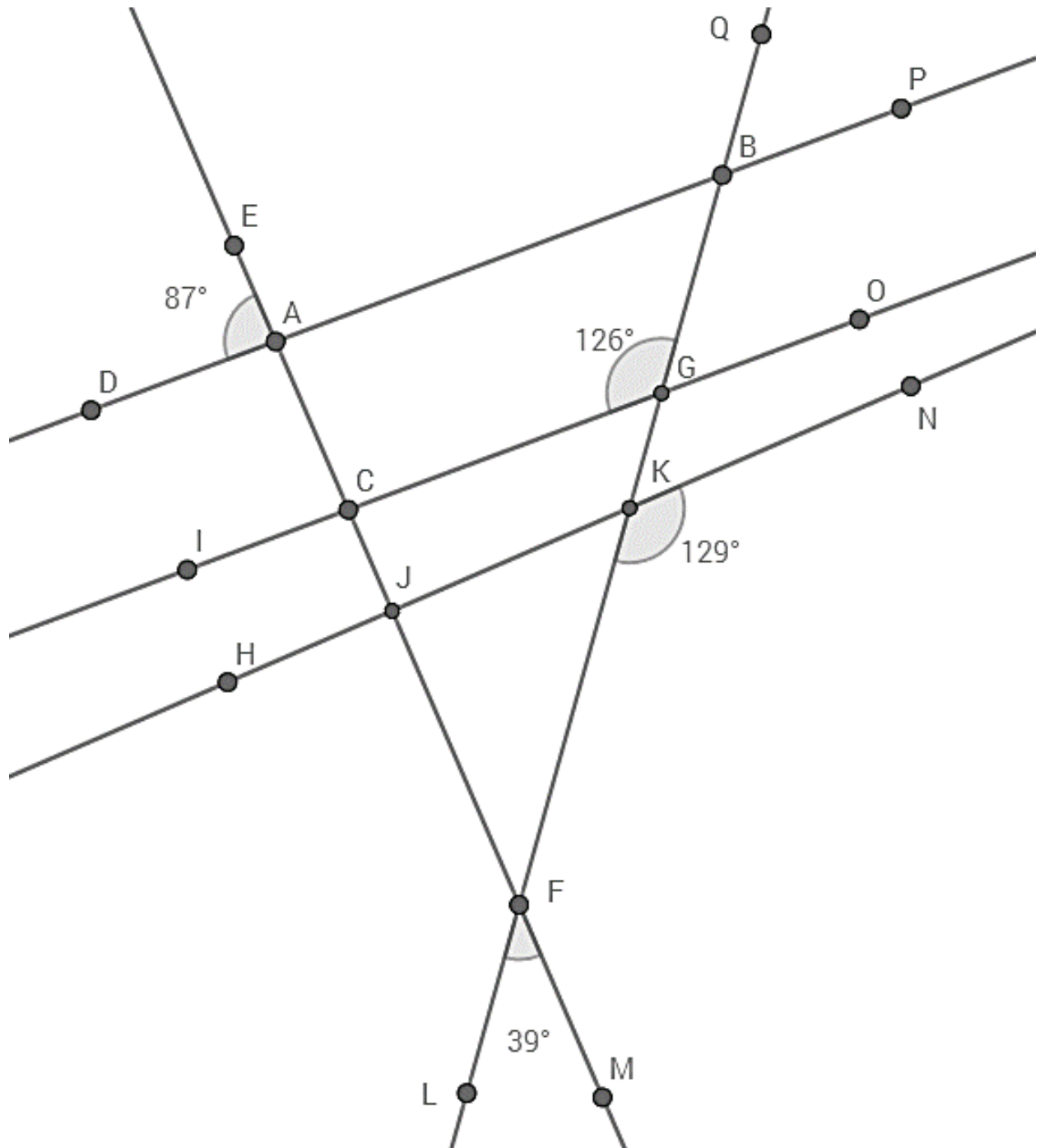
VII. DESCRIPTION of LEARNING ACTIVITIES:

	# of minutes	Activities	Assessment/ Evidence	Resources
Intro: Motivation & Transition	2	Today we are doing an activity to practice bringing together our definitions and theorems to solve for angles. We have done things like this in our notes before but today is a big one		
Teach/Practice	8	Go through instructions on slides and on worksheet		
Application *	20	Activity		
Closure	10	Go through what is on the test Ask if there are any questions <u>Homework</u> : study for test tomorrow		

Review Activity: Angle Pile Up (Part 1)

Please fill in all missing angles. Be sure to list all justifications for each angle measure you find.

Note: \overleftrightarrow{DP} is parallel to \overleftrightarrow{IO} and \overleftrightarrow{HN} is perpendicular to \overleftrightarrow{EM}



Review Activity: Angle Pile Up (Part 2)

Now create your own angle pile up activity. You can be as creative as you want but include...

- 1) At least 1 pair of parallel lines
- 2) At least 1 pair of perpendicular lines
- 3) At least 1 pair of vertical angles
- 4) At least 1 linear pair
- 5) Measure of any required angles, measured with a protractor