Unit Title: Parallel/Perpendicular Lines

Grade Level: 9, 10, 11

Subject Area: Geometry

Duration/Length/Number of class periods: 6-8 days

Description: A transversal line intersecting a pair of lines forms many different pairs of angles, and the angle pairs have special relationships, especially if the lines are parallel or perpendicular. Angle measures for certain pairs are used to determine if the lines are parallel or perpendicular.
Equations of lines are used to determine if two lines are parallel or perpendicular based on the slopes of the equations of the lines.

Established Goals (National, State, Local):
9.3.3.1 (2007) Know and apply properties of parallel and perpendicular lines, including properties of angles formed by a transversal, to solve problems and logically justify results.

9.3.3.2 (2007) Know and apply properties of angles, including corresponding, exterior, interior, vertical, complementary and supplementary angles, to solve problems and logically justify results.

What Enduring Understandings are desired? We can know characteristics of lines based on angles formed by intersecting lines.

What Essential Questions will be considered? How do I *know* that lines are parallel or perpendicular?

Students will know / be able to: Students can demonstrate that lines are parallel or perpendicular base on the slopes of the equations of lines, and based on the measures of angles formed by a transversal line.
Lines are parallel if: alternate interior angles, corresponding, or alternate exterior angles are congruent, or same-side interior angles are supplementary.

Description *Units must include at least one of each formative, summative, introductory activity and learning activity. Check the appropriate box; one per row.*	Formative	Summative	Introductory Activity	Learning Activity	Student Technology Used	Teacher Technology Used	ISTE Standards
Day 1 Parallel line optical illusions http://brainden.com/line-illusions.htm Which lines *look* parallel? Are they parallel or not? What would you need to know in order to *prove* that the lines are parallel or not?			**x**		Ipad, Schoology	Ipad, Schoology	
Geogebra: Parallel Lines Cut By Transversal https://www.geogebra.org/m/tNsdcxTB Given that line AE is parallel to line FD, 1) write down the measures of a pair of corresponding, alternate interior, alternate exterior, and same-side interior angles. 2) Make a conjecture about each pair of angles (say something that you believe IS true instead of what is NOT true). 3) Move point A so your angle measures change. Are your conjectures still true? If not, change your statements. 4) Move point A one more time. Are your conjectures still true?			**x**	**x**	Ipad, Geogebra	Ipad, Geogebra	**3, 5**
Day 2 Digital map (GoogleMaps, e.g.) activity *Finding parallel/perpendicular/transversal lines on a map.* 1) Show map of St. Paul with parallel lines and alternate interior angles. https://drive.google.com/open?id=1_LEr7haJ6CYLO_3tzU7PKNqg1l1E91wI If the streets are parallel, what is the measure of the missing angle in the picture? How do you know they are parallel? Use a theorem or postulate to support your answer. 2) Using GoogleMaps, find another city in the world. Identify 2 streets that appear to be parallel that have a transversal street intersecting them. Take a picture of the map, draw the streets and label 2 *corresponding* angles. Either using a protractor or estimating an angle, write the measure of 1 angle. Explain what the measure of the 2nd angle must be if the streets are parallel, using a theorem or postulate to justify your answer.				**x**	Ipad, GoogleMaps	Ipad, Google Maps	

Find a 3rd angle and explain what its measure must be, using a theorem or postulate to justify your answer.							
Formative assessment: What's Your Angle? Quizizz assessment (to be created) 2 parallel lines are cut by a transversal. Name angle pairs and find missing angle measures, given that the lines are parallel. Use a theorem or postulate to support each answer.	x				Ipad, Quiziz z	Ipad, Quizizz	
<u>Day 3</u> Geogebra: Properties of lines and transversals https://www.geogebra.org/m/GAsg3kqP#material/wEjrdyE9 or https://www.geogebra.org/m/GAsg3kqP#material/yNj7CjrV - Non-parallel lines; test your statements from yesterday, are they true for non-parallel lines? - Which properties of angle pairs are ONLY true for parallel lines? - Which properties of angle pairs are true for NON-parallel lines? (You may use previous knowledge for this question)			x	x	Ipad, Geog ebra	Ipad, Geoge bra	**3, 5**
<u>Day 4</u> Formative assessment: Can you prove it? Are the lines parallel? EdPuzzle formative assessment (to be created) An interactive video showing lines and angle pairs. Questions about whether the lines are parallel, and which postulate supports the answer.	x				Ipad, EdPu zzle video	Ipad, EdPuz zle video	
<u>Day 5</u> Geogebra: Slopes of Parallel and Perpendicular Lines https://www.geogebra.org/m/JdPdzMsq Try 10 attempts at "Slopes of Parallel Lines" Try 10 attempts at "Slopes of Perpendicular Lines" Complete the following sentences: - "The slopes of parallel lines…" - The slopes of perpendicular lines…"				x	Ipad, Geog ebra	Ipad, Geoge bra	**3, 5**
Formative: Slopes of Parallel and Perpendicular Lines Kahoot! (to be created) Given a pair of equations, determine if they are parallel, perpendicular, skew or none of these. Write the slope (or equation) of a line that is parallel, perpendicular, or neither of these.	x				Ipad, Kaho ot!	Ipad, Kahoot !	
<u>Day 6</u> Summative: Optical illusions; prove which lines are parallel.		x			Ipad, Schoo logy	Ipad, School ogy	

Using images of lines that don't appear to be parallel, students need to use properties of parallel lines and angle measures to prove if they are or are not parallel. For example, https://drive.google.com/open?id=1ydQADQOfOGV7elL8cotpPW7h0Ag57MVU							

Materials, tools and resources

1) Parallel line optical illusions - http://brainden.com/line-illusions.htm

Are the lines parallel? How do you *know* that they are/aren't parallel? Can we use another part of the picture to show (indirectly) whether they are parallel?

2) Angles formed when a pair of lines is cut by a transversal.

3) Angles formed when parallel lines are cut by a transversal.

What is true about the measures of angle pairs when a transversal cuts a pair of parallel lines? Write down conjectures.

Which conjectures are true *only* when the lines are parallel?

Geogebra: Parallel Lines Cut By Transversal
https://www.geogebra.org/m/tNsdcxTB

Which conjectures are true whether the lines are parallel or not?

Geogebra: Properties of lines and transversals
https://www.geogebra.org/m/GAsg3kqP

Unit Plan Author (name, school and optional email address or hyperlink to teacher's web page)

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Additional credit given to