Lesson Plan (Math)

Grade/ Grade Band: 9th grade Geometry	**Topic/Title: 6-6 Kites and Trapezoids**

Brief Class Description (contextual information including number of students, subject, level, IEP/ELL/GT or other special considerations):
Mod 1B: This classroom environment is very relaxed. There are 30 students in the class, and there are many friends at tables which makes for productive noise. They feel comfortable joking around and having fun. There is one student who has had behavior problems with other teachers in the past, but he is said to have started new medication that will help this.
Mod 3B: This period of students is less confident and needs more guidance than the other class. There are 25 students in this class. There is a group of boys who can get loud, but with nonverbal and verbal communication they will settle.

Brief Lesson Description (Overview/Abstract): Students will discover properties of trapezoids and kites using patty paper, and then apply the properties of each by solving for unknowns. As an extension, students will use white boards to apply the properties to coordinate geometry, and then close the lesson by filling out the charts they have used all unit.

Objective(s): I can use properties of kites and trapezoids in order to solve problems.

Prior Student Knowledge:	**Possible Preconceptions/Misconceptions:**
Students have learned the properties and conditions of quadrilaterals with two sets of parallel sides. They have previously been introduced to kites and trapezoids as quadrilaterals but have not learned the properties of each.	Students may become confused about the properties of parallelograms vs kites and trapezoids. (i.e. a student may say that opposite sides must be congruent, but this is not the case for kites.)
Common Core Standards: **HSG-GPE.B.05** - Prove the slope criteria for parallel and perpendicular lines and use them to solve geometric problems (e.g., find the equation of a line parallel or perpendicular to a given line that passes through a given point). **HSG-SRT.B.05** - Use congruence and similarity criteria for triangles to solve problems and to prove relationships in geometric figures.	**Standards for Mathematical Practices:** Attend to Precision. Look for and express regularity in repeated reasoning. **NCTM:** Analyze properties and determine attributes of two- and three-dimensional objects. Explore relationships (including congruence and similarity) among classes of two- and three-dimensional geometric objects, make and test conjectures about them, and solve problems involving them.

Required materials:	**Safety considerations:**	**Technology Integration/Needs:**
Explore paper Patty paper Fill in notes Application handout White boards/markers/erasers Unit chart PowerPoint	**N/A**	Projector

ENGAGE:
(15 minutes)(75 minutes left)
Task: Students will work on a drill that reviews how to use slope to classify a quadrilateral. Then, students will be shown examples of kites (including a real one with superman on it) and work with their table groups to do a round robin with what they know about kites and trapezoids. Students will take 30 seconds to write one thing they know about kites or trapezoids, and then the paper will be passed clockwise. Each student will take 30 seconds to write one different thing they know. Then when all the students have something written on each other's papers (4 students to a table) a table will be cold called by spinner to share.

Instruction: *Teacher instruction* Student Answers
"Your drill is on the board!"
"What type of quadrilateral is this?"
Case 1: correct.
"This is a rhombus because all the sides are equal distances and that is the definition of a rhombus. It is not a rectangle or a square because the slope of side AB is the reciprocal of side AD but perpendicular lines have opposite reciprocals so it is not a right angle."
Case 2: incorrect.
"It is a rhombus because it looks like one."
"Awesome! Now today we will be talking about the last two quadrilaterals of the unit, kites and trapezoids. On the board are examples of kites, and I have on right here that I bought for 3 dollars at Walmart because I got excited about this lesson. Look it has Superman on it!"
"Please take out a sheet of paper, and we are going to do a round robin with the things we already know about kites and trapezoids GEOMETRICALLY. So you will take 30 seconds to write one thing you know about either quadrilateral, and then your paper will be passed clockwise and the next person will take 30 seconds to write something else. Are there any questions?"
Alright table [blank], what are some things you said about kites and trapezoids?"

Transition: "Let's take a closer look at kites and trapezoids!"

Instructional Strategies:
Round Robin

EXPLORE/EXPLAIN Cycle(s)
EXPLORE:
(15 minutes)(60 minutes left)
Task: Students will be given a handout and patty paper to write down the definitions they turn and talked about, and to use the patty paper to discover at least 2 properties about both trapezoids and kites. They will have 10 minutes to do this with their table teams. After 10 minutes, a spinner will be used to cold call tables and each table will share one property about either kites or trapezoids that they found.

Instruction:
"On this discovery handout I am giving you now, on one side there is trapezoids and on the other is kites. I would like you to write down what you think the definition of each is in it's respective box but leave room for formal definitions later. I will also be giving you patty paper so you can use it to figure out a couple properties for each one. Are there any questions? You will have 10 minutes to do this."
"Alright your 10 minutes is up! Table[blank] what is one property you found?"
Kite diagonals are perpendicular
Kite adjacent sides are congruent

Kite opposite angles are congruent
Trapezoid diagonals are congruent
Trapezoid opposite sides are congruent
Trapezoid opposite sides are parallel

Transition: "Those properties you all found were fantastic!"

Instructional Strategies:
Manipulative
Cold Call

EXPLAIN (STUDENT CENTERED):
(25 minutes)(35 minutes left)
Task: After students have shared the properties they found, they will receive a fill in the blanks handout with the theorems for properties of kites and trapezoids, including the trapezoid midsegment theorem. Students will work in their teams to figure out what will go in the blanks, and then they will share so the class has completed notes. Then we will go through the vocabulary that goes with trapezoids (base, leg, base angle, height) and redefine an isosceles trapezoid (the definition is in their exploration). Then students will use their reference handout to teach a partner about the trapezoid midsegment theorem.

Instruction:
"Thank you to those who shared! Please copy the definition of kites and trapezoids onto your discovery paper where I told you to leave room."
"Now being handed to you is a sheet with properties of kites and trapezoids, but some of them are blank! Work with your teams to try and figure out what goes in the blanks. Use context clues!"
"This next slide has some important vocabulary on it. The parallel sides of a trapezoid are called the bases, and the nonparallel sides are called ***legs****."*
"[student], on your discovery paper is the definition of an isosceles trapezoid. Will you read it out loud for the class please?"
"An isosceles trapezoid is a trapezoid with congruent legs (non parallel sides)."
"Thank you! Be warned: the properties on your handout are for isosceles trapezoids only!"
"Now flip your handout back over and at the bottom you will see a theorem for the trapezoid midsegment theorem. Read it to yourself and then teach it to a partner at your table."

Transition: "Use your reference sheet on the handout that I am giving you!"

Instructional Strategies:
Fill in the blank
Teach a partner

ELABORATE:
(25 minutes) (10 minutes remaining)
Task: Students will have 15 minutes to work on their handouts. Then one person from each table will get two white boards per table (one for each pair of students) and partners will take turns writing down their answers. I will also write down answers on a white board from my answer key. Then using a random number generator a problem number will be called (i.e. Kites side number 3) and students will write their *answer only*. Then I will show my answer and if students are confused I will ask other students what they did to solve/answer. Problems on this handout include missing sides/angles, solving for unknowns, and applying properties of kites and trapezoids. After the handout is finished, two examples involving

coordinate geometry will be projected and students must use the white boards to answer the questions.

Instruction:
"Work with your groups on this handout for 15 minutes, and then we will do white board work with it."
"I would like you to write the answer to the number I call out loud on your white board. Make sure you read the directions so you know what the problem is asking!"

Transition: "Let's summarize what we've learned!"

Instructional Strategies:
White Boards

COGNITIVE CLOSURE
(10 minutes)

Task: Students will participate in an Always, Sometimes, Never summary using thumbs up/middle/down. Then we will fill in the kites and trapezoids sections of the unit chart. Students will turn and talk about which properties to fill in for each column (trapezoid and kite), and specific directions will be given to talk about how certain properties in the rows could be altered to apply to trapezoids. Then a spinner will be used to cold call tables and each table will share the properties they would fill in for one type of quadrilateral.

Instruction:

"Always, sometimes, or never?"

"Please get out your quadrilateral chart we've been working on. Turn and Talk with your tables about what you think can be filled in and what you be altered slightly to be filled in."

"What do we think?"

Base angles of trapezoid are congruent.

Adjacent sides of kite are congruent.

Opposite sides (legs) of isosceles trapezoid are congruent.

One set of parallel sides in trapezoid.

One pair of opposite congruent angles in kite.

Instructional Strategies:

Thumbs up/middle/down

Turn and Talk

Cold Call

EVALUATE:

Diagnostic Assessment(s): Student definitions of kites and trapezoids will help gauge their understanding of vocabulary and differences in quadrilaterals (Two pairs of parallel sides vs One pair vs No pairs).

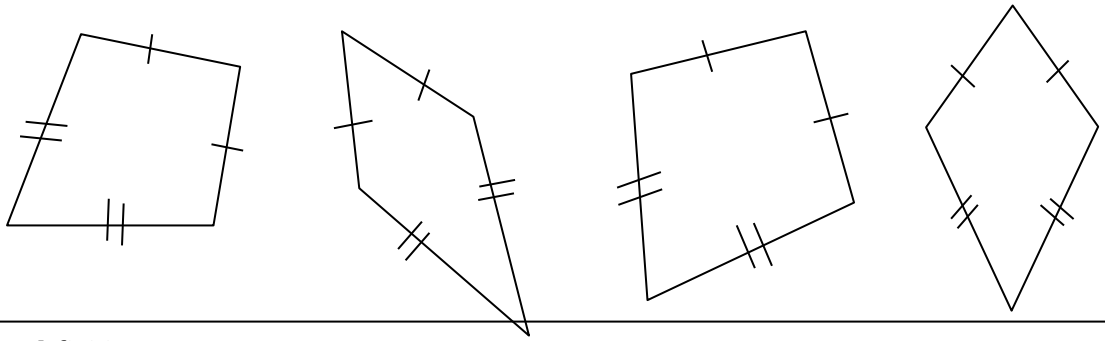
Formative Assessment(s): Cold calling student tables to share properties they discovered will help me assess what they already know and what they easily figured out, and then white board work will allow me to evaluate their understanding of how to apply what they've learned.

Summative Assessment(s): Chapter 7 Test 4/20/18

Timing/Pacing Adjustments (Slinky Time): Include a plan for how to adjust instruction if tasks take longer/shorter than anticipated:
If there is more time, more extension examples for coordinate geometry can be done by students to apply and extend their learning. (+5 mins) Students may also write their own word problem relating to something in their personal life revolving around trapezoids and kites. (+7 mins)
If there is less time, the white board work can be skipped and instead the answer key will be projected for students to check their answers. Then for a formative assessment I can ask students to raise their hands if they got all correct, most correct, and then some correct. (-5 mins)

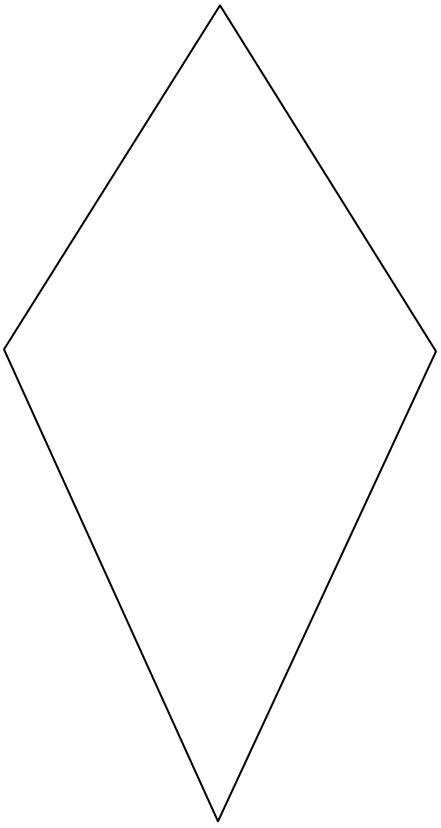
G4a KITE EXPLORATION

Based on the examples below, define kite.



Kite definition -

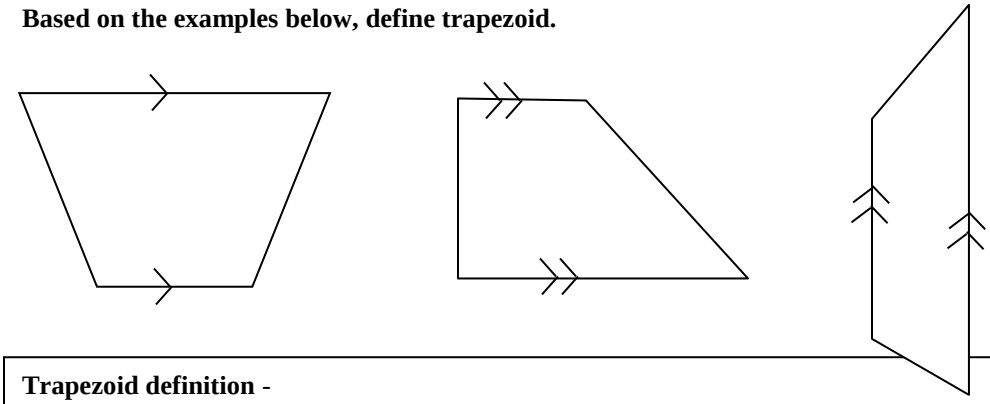
Trace the kite below on patty paper. Use your kite model to make some conjectures about kites. You should be able to discover at least 3 properties.



PROPERTIES

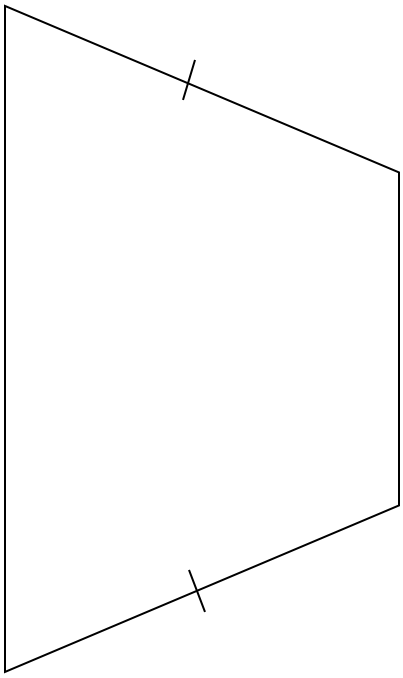
G4b TRAPEZOID EXPLORATION

Based on the examples below, define trapezoid.



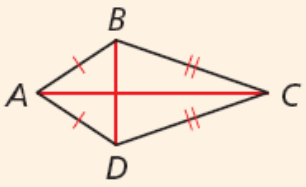
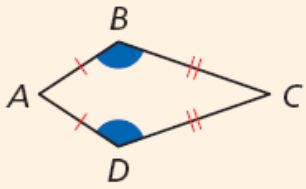
Trapezoid definition -

An isosceles trapezoid is a trapezoid with congruent legs (non parallel sides). Trace the isosceles trapezoid below on patty paper. Use your isosceles trapezoid model to make some conjectures about isosceles trapezoids. You should be able to discover at least 3 properties.

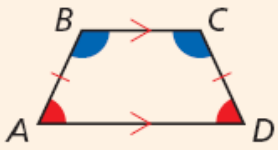
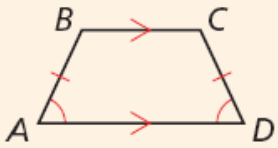
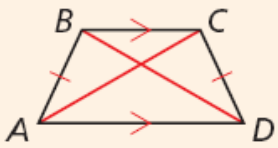


PROPERTIES

Theorems Properties of Kites

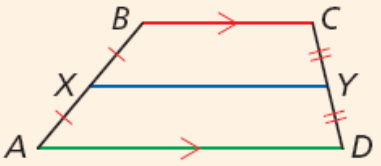
THEOREM	HYPOTHESIS	CONCLUSION
6-6-1 If a quadrilateral is a kite, then its diagonals are perpendicular. (kite → diags. ⊥)		$\overline{AC} \perp \overline{BD}$
6-6-2 If a quadrilateral is a kite, then exactly one pair of opposite angles are congruent. (kite → one pair opp. ∡s ≅)		$\angle B \cong \angle D$ $\angle A \ncong \angle C$

Theorems Isosceles Trapezoids

THEOREM	DIAGRAM	EXAMPLE
6-6-3 If a quadrilateral is an isosceles trapezoid, then each pair of base angles are congruent. (isosc. trap. → base ∡s ≅)		$\angle A \cong \angle D$ $\angle B \cong \angle C$
6-6-4 If a trapezoid has one pair of congruent base angles, then the trapezoid is isosceles. (trap. with pair base ∡s ≅ → isosc. trap.)		*ABCD* is isosceles.
6-6-5 A trapezoid is isosceles if and only if its diagonals are congruent. (isosc. trap. ↔ diags. ≅)		$\overline{AC} \cong \overline{DB} \leftrightarrow$ *ABCD* is isosceles.

Theorem 6-6-6 Trapezoid Midsegment Theorem

The midsegment of a trapezoid is parallel to each base, and its length is one half the sum of the lengths of the bases.



$\overline{XY} \parallel \overline{BC}, \overline{XY} \parallel \overline{AD}$

$XY = \frac{1}{2}(BC + AD)$