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| **TEAM Lesson Plan Template** |
| Teacher: Dr. Amanda Niedzialomski |
| Subject/Grade: Geometry, High School |
| Lesson Title: Lines |
| **STANDARDS** | **Identify what you intend to teach.** State, Common Core, ACT College Readiness Standards and/or State Competencies; Enduring Understandings and Essential Questions. |
| SMP3. Construct viable arguments and critique the reasoning of others.SMP5. Use appropriate tools strategically. **G.CO.C.9** Prove theorems about lines and angles. |
| **OBJECTIVE(s)/Sub-Objectives** | **Connect prior learning to new learning.** Clear, Specific, Observable, Demanding, High Quality, Measurable, Aligned to Standard(s), and Integrated with other subjects, build on prior student knowledgeStudent-Friendly (I Can Statement) |
| I can interpret images of geometric figures.I can draw conclusions about lines and angles from geometric figures.  |
| **MATERIALS AND RESOURCES**  | **Content-related:** Clearly supports lesson objective(s); rigorous & relevant; Incorporates multimedia & resources beyond the textbook.  |
| **Activities & Materials** \_x\_ Laptop/Computer and projector or whiteboard/markers to display diagrams and questions; Pencils and paper for students; Optional: GeoGebra <https://www.geogebra.org/> and computer(s) for students to manipulate figures. **What if the technology is not working?****Routine for distributing materials** |
| **ACCOMMODATIONS/ADAPTATIONS** | **Learning styles and interests.** Anticipate learning difficulties, regularly incorporate student interests & cultural heritage; differentiate instructional methods. |
| **Modifications/Plans for Diverse Learners *(NOTE: Clearly identify where you will use each of these in your lesson; do not just check the box!)*****Differentiation****----- Content ----- Process -----Product ----- Tiered Assignments ----- Flexible Grouping****----- Learning Centers \_\_\_\_ Other \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_****Accommodations****\_\_\_ Preferential Seating \_\_\_ Extended Time \_\_\_ Small Group \_\_\_ Peer Tutoring** **\_\_\_ Modified Assignments \_\_\_ Other** **Early Finishers:** |

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| **MOTIVATING STUDENTS/ANTICIPATORY SET** | **“Hook”: Engage students’ attention and focus on learning.** Personally meaningful and relevant. |
| ***How will you get students attention before beginning the lesson? Will you tell a story? Show a video? How will you relate what you are doing to students’ lives or make them interested in learning about the day’s concepts?*** |
| **INSTRUCTIONAL PROCEDURES** | **Step-by-Step Procedures-Lesson Sequence: Basic to Complex.** Lesson includes visuals, modeling, logical sequencing and segmenting (beginning, middle, ending); essential information; concise communication; grouping strategies; differentiated instructional strategies to provide intervention & extension; seamless routines; varied instructional strategies; key concepts & ideas highlighted regularly. |
| ***Introductio*n*.***We have seen postulates for lines (including parallel lines) and angles and theorems such as the Supplement Theorem, Complement Theorem, Vertical Angles Theorem, Alternate interior Angles Theorem, Consecutive Interior Angles Theorem, and Alternate Exterior Angles Theorem.  We have also seen geometric proofs. Today we will analyze some geometric diagrams to see what we can ( and cannot ) conclude from them. **Motivating Students** \_x\_ Review \_x\_ Verbal Reinforcement **Presenting Instructional Content** \_x\_ Lecture/Notes \_x\_ Discussion \_x\_ Guided Practice \_x\_ Discovery Learning The lesson is a mixture of brief lecture interspersed with small group and whole group discussion of geometric diagrams. ***Instructional strategies:*****Modeling and Guided Practice *–*** Arrange students in groups of 3 (or 4). Appoint a reporter and a recorder in each group. Let students know that they will look at a picture, discuss it within their group, and then they will share their thoughts with the whole group. 1. Display the image from lines.pdf. Ask students what information is given and what seems true about the image that is not given information. Have them discuss these questions as a small group. After some time, have groups share their answers with each other. Discuss that an image used in a problem is often just one example of a whole family of images that display the same given information.
2. Have the students work as small groups again to draw another image in which the given information is still true, but perhaps some of the information that appeared true in the original image has changed.  ( *Examples: The triangle appears to be isosceles, which need not be true from the given information; the line through the base of the triangle and the line through the apex of the triangle appear to be parallel, but none of the given information requires this – the line through the apex could be drawn with a different slope.* ) After some time, have groups share their answers with each other.
3. At this point, it is probably natural to talk about the usefulness of variables to help communicate thoughts about this image.  Discuss options.  One is to label the vertices and refer to angles and lines and line segments with them ( $∠ABC $ or $\overleftrightarrow{AC}$ for example).  Alternatively (or in addition), the angles can be given names, as can the lines or line segments.
4. Display the image from lines\_labeled.pdf. In this plan, the angles have been numbered and the line through the base and the apex have been named with letters; a different decision can be made through class discussion, but the class as whole should use the same system so that communication as a class is possible. Display the image labeled as the class decides.
5. Pose the following True-False statements to the class and have them work as groups to find the answers. ( It may be necessary to re-phrase the questions to use the labeling as decided by the class in step D).

1. If angle 5 is congruent to angle 7, then line m and line n are parallel. (T)2. If angle 7 is congruent to angle 9, then line m and line n are parallel. (F)3. If angle 1 and angle 7 are complementary, then line m and line n are parallel. (F)4. If angle 2 and angle 4 are complementary, then line m and line n are parallel. (T)Students can consider all the statements at once and work with their groups on discuss and then the class comes together to discuss.  After some time, have groups share their answers with each other. Did we find any counterexamples?  If so, what angle measures do the examples have?  Do we think any of these statements are true?  If so, can we prove the statement?  (Writing formal proofs for the statements students think are true can be part of the group work, or homework.)  If students have errors or cannot agree about something, constructing examples in GeoGebra is very helpful.  This can be done in the groups if technology is available, or led by the teacher (with student suggestions) at the front of the class. It is important for the discussion to involve justifications. Why is the answer True? (provide a proof / cite theorems) Why is the answer false? ( give a counterexample ). It may be necessary to let reporters draw pictures for the whole group, perhaps on a white board at the front of the room, or perhaps on a small whiteboard that the reporter can hold up. 1. Display the image from lines2\_angles.pdf. Ask students the following questions. Have them discuss withing their small groups, and then discuss their answers as a whole group.

1. What information is the given information in this image?2. What seems to be true about this image that is not given information?3. Can we redraw this image in an equivalent but different way?  (All given information still true.)4. How can we label this image in a way that will help us communicate? 1. Students should have a labeled diagram now. Ask themWhat can you prove with this given information?  Give an example a statement they can prove, like a pair of vertical angles have the same measure, so we know a second angle that measures 150 degrees.  Then have the groups experiment.  What theorems and postulates are we using?  How can we justify our claims?  Can I write a proof for what I think is true?  After groups have worked on the problem, the class discusses together.  What do we agree is true?  Do we have any disagreement?  What can we formally prove?  Monitor student work and ask throughout about what theorems/postulates support specific steps/claims.
2. Display the image from lines2\_congruent angles.pdf and repeat questions from steps F and G for this image.
3. And one more important question for this one: What additional questions could we pose?  What do you wonder about this image?  This is really open-ended, with no real right/wrong answers.  One thing I wonder: under what conditions will the angle formed by the two line segments that intersect the parallel lines be a right angle (like it appears in the image to be)

 **Check for Understanding (CFU) –** ***What am I doing for students that progress at different rates?*** ***What do I do if they get it?*** ***What do I do if they don’t get it?***  |
| **QUESTIONING/THINKING/PROBLEM SOLVING (embedded throughout)** | **Balanced mix of question types.** Utilizes Blooms Taxonomy/Webb’s Depth of Knowledge; high frequency; purposeful & coherent; require active responses; balance based on volunteers/non-volunteers, ability, & gender; lead to further inquiry & self-directed learning.  **Implement four types of thinking (Analytical, Practical, Creative, & Research-based) & Teach/Reinforce problem-solving types**. Provide opportunities for students to generate ideas & alternatives; analyze, evaluate & explain information from multiple perspectives& viewpoints. |
| **Questioning** Abbreviations refer to the image that the question is associated with. (L) lines, (LL) lines labeled, (L2) lines2\_angles, and (CA) lines2\_congruent angles. **Knowledge:****Comprehension:** * (L) What information is the given information in this image? ( *right angle* )
* (L2) What information is the given information in this image? ( *measures of two angles, lines are parallel* )
* (CA) What information is the given information in this image? ( pair of congruent angles*, lines are parallel*

**Application:**True-False statements: * (LL) If angle 5 is congruent to angle 7, then line m and line n are parallel. (*T*)
* (LL) If angle 7 is congruent to angle 9, then line m and line n are parallel. (*F*)
* (LL) If angle 1 and angle 7 are complementary, then line m and line n are parallel. (*F*)
* (LL) If angle 2 and angle 4 are complementary, then line m and line n are parallel. (*T*)

**Analysis:** * (L) What seems to be true about this image that is not given information? (*One thing that seems to be true about the image is that two of the lines appear to be parallel, but are not marked as parallel.* )
* (LL) Produce a counterexample.
* (L2) Which theorems and postulates are we using?
* (L2) How can we justify our claims? Write a proof for what you claim is true.

**Synthesis:*** (CA) What additional questions could we pose?  What do you wonder about this image?  ( *This is really open-ended, with no real right/wrong answers.  One thing I wonder: under what conditions will the angle formed by the two line segments that intersect the parallel lines be a right angle (like it appears in the image to be)* )?

**Evaluation:** **Thinking*(NOTE: Clearly identify where you will use each of these in your lesson; do not just check the box!)***  \_\_ **Practical** –***Students use/apply/implement real life scenarios***\_\_ **Creative**– ***Students Create/design/imagine/suppose*** \_\_ **Analytical** – **Students analyze /compare contrast/evaluate/explain**  \_\_ **Research-based** – ***Students explore/review variety of ideas, models, solutions to a problem*** **\*What am I going to do to give Ss opportunity to?** **1. Generate variety of ideas:** **2. Analyze problems from multiple viewpoints:** **Problem Solving *Note: Teach 2 or more types of problem solving (NOTE: Clearly identify where you will use each of these in your lesson; do not just check the box!)***\_\_\_ **Abstraction (ex: Take 1 piece out – still make association) \_\_\_ Categorization** **\_\_\_ Drawing conclusions/Justifying Solutions \_\_\_ Predicting Outcomes (If; Then)** **\_\_\_ Observing and Experimenting \_\_\_ Improving Solutions (ex: Better Way)** **\_\_\_ Identifying Relevant/Irrelevant Information** **\_\_\_ Generating Ideas \_\_\_ Creating and Designing**  |

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| **GROUPING** | **Maximize student understanding & learning** Varied group composition (race, gender, ability, & age); clearly understood roles, responsibilities & group work expectations; accountability for group & individual work; student opportunities for goal setting, reflection & evaluation of learning. |
| * Students will work in heterogeneous groups of 3 or 4.
* Each group should have a recorder to write down the group’s thoughts and a reporter to share the small group’s thoughts with the whole class.
* Expectations are assigned with verbal instructions.
* Students will work with neighbors to ease transition to groups.
* Groups will discuss each image in the lesson. There is no formal written product for this activity.
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| **ASSESSMENT** | **Formative and/or summative assessment.** A variety of assessments, including rubrics, measure achievement of objectives and informs instruction.  |
| ***Assessments: aligned with state stds; measurement criteria; measure student performance in more than 2 ways (project, experiment, presentation, essay, short answer, multiple choice test) (NOTE: Clearly identify where you will use each of these in your lesson; do not just check the box!)*****\_\_\_ ThinkLink Probe \_\_\_ Study Island \_\_\_ Teacher Made Test \_\_\_ Unit/Chapter Test \_\_\_ Project \_\_\_ Quiz** **\_\_\_ Group Assignment \_\_\_ Study Guide \_\_\_ Oral Presentation \_\_\_ Graphic Organizer \_\_\_ Exit Ticket** **\_\_\_ Journal \_\_\_ Questions/Answers** **\_\_\_Teacher Observation *(thumbs up/thumbs down, etc.)*\_\_\_ Solution to Real World Problem** **\_\_\_ Other \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**  *\****Students should achieve \_\_\_\_\_% mastery of this objective: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** |
| **CLOSURE** | **Reflection/Wrap Up.** Summarizing, reminding, reflecting, restarting, connecting. |
| ***During the conclusion part of creating an effective lesson plan teachers must sum up the ideas learned from the lesson. A teacher should also relate this information to future and past coursework to provide students with a broad understanding of the ideas learned. It is important to allow students enough time to ask questions, assert assumptions, and summarize the lesson during this part of the lesson plan.**** ***Review/Summary: wrap up what has been learned and accomplished in the lesson (even if they are in the middle of an exercise, it is still important to summarize to the point where they are now). Ideally involve students in this synthesis.***
* ***Preview for next lesson: link what they did to day with where they are going next.***
* ***Upcoming assignments: remind them of any upcoming assignments.***

***Today we…. Turn to your partner and…. Let’s review our I Can statements……*** ***Here is your exit ticket for today…..*****Follow-up Activities/Extension *These may be designed to create a longer or more intense lesson. For example, if the class is able to cover the material in a lesson much faster than expected, extensions may prove helpful. Extensions may also be useful in various parts of a lesson where the teacher (and class) decides they should spend more time on a skill or topic.******Reflection: You must reflect on every lesson you teach.*** |

**NOTES:**

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