**Lesson Title:** Amusement Park

**Unit Title:** Geometric Evaluation

**Teacher Candidate:** Randi Tuggle & Sarah Delaplaine

**Subject, Grade Level, and Date:** Mathematics, Grade 7, on 7/13/2018

**Placement of Lesson in Sequence and Lesson Rationale**

 This is the 3rd activity in the Geometry unit. Students have previously worked with area, perimeter, volume, and surface area. This prior knowledge will allow students to generate a model amusement park bringing in each previous component we have worked on.

**Central Focus and Purpose**

The unit we are working on is Geometry. This unit focuses on developing an understanding and applying the knowledge of shapes, perimeter, area, and the relations of points, surfaces, and solids. The lesson that we are working on today will teach students how to manipulate and arrange shapes using area and perimeter in order to design an amusement park layout. The purpose of this lesson is to help students develop a better feel and overall understanding of geometry by allowing them to manipulate shapes in creating their own park that will allow for the most visitors to each amusement park ride that they create. The overarching conceptual understanding of this lesson is area. The mathematical procedures that will be used are the use of shapes, area, perimeter, addition, subtraction, multiplication. Students will also be using skills in relation to graphing/gridding along with measurement and labeling. Students will engage in mathematical thinking during partner, group, and whole class discourse, explaining and justifying their reasons for placing rides the way that they did in order to maximize the number of visitors to each ride.

Questions that will be used to guide student explanations of their designs:

1. Is there more than one way to design this park?

2. What are the variables for solving this problem? Why

3. What equations might you need for this design? Why? Will the shapes you use and their size change the amount of visitors to the rides? Why or why not?

4. Is more information needed?

5. How would the size of the foot paths change your placement of rides?

6. How can you space your rides in order to maximize visitors to each ride? Why?

7. How can you justify your design?

8. Where would you place four food stands in order to continue to maximize foot traffic?

**CCSS.MATH Content and Practice Standards**

**7.G.B.4** Know the formula for the area and circumference of a circle and use them to solve problems, give an informal derivation of the relationship between the circumference and area of a circle.

**7.G.B.6** Solve real-world and mathematical problems involving perimeter, area of two and three dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms.

**MP 4** Mathematical Modeling

**Prior Content Knowledge and Pre-Assessment**

 Students already know how to find the area and perimeter of circles, triangles, and quadrilaterals. Students know how to find the volume and surface area of spheres, cubes, and prisms.

**Learning Target(s) and Plan for Clarifying Intending Learning**

**Conceptual Understanding** I can use my understanding of area to solve real-world problems.

**Procedural Fluency** I can solve real-world problems by applying my knowledge of area and perimeter formulas.

**Math Thinking** I can explain my rationale for placement of rides in my amusement park to maximize the amount of visitors to each ride.

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| **Strategy for using assessments to guide student learning** |
|  The formative assessment cycle would be for students to propose ideas and discuss their solutions in table groups. Students will share in their groups and with the teacher as the teacher is monitoring those groups. Then students will share the ideas to the classroom in an oral report with posters. The teacher will lead classroom discussion to review what was learned and revisit common misconceptions.  |
| **Success Criteria** (criteria for interpreting student success of the learning target) | **Plan for providing feedback and students’ monitoring of their own learning** |
| Reflection assignment at the end of their presentation, complete with geometrical reasoning for why the placement of the food stands work and how they are effective. Projects will include original writing, drawings, diagrams and tables. The assignment is worth 30 points plus an addition 5 for completion of reflection. Rubric aligns with learning targets. |  Teacher will use students to facilitate interaction relative to the learning targets. Students will also receive written feedback for their presentations using the rubric as a guide but providing individual comments in varying sections. |

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| **Academic Language Demands** |
| **Language Function** | **Vocabulary & Symbols** | **Secondary Language Demand** |
| * Students will **explain** why they placed their rides as they did.
* Students will **explain** why their map and placing of rides allowed for the most visitors to each ride.

   | * Math terms: area, perimeter, formulas, perpendicular bisector
* Special Term: voronoi diagram

  | **Mathematical Precision:**Students must correctly label their units, representing numerical answers with correct accuracy.**Syntax:**Students must have geometric formulas expressing units clearly labeled using correct mathematical operations and symbols. Examples: A=BH, P=2L+2W**Discourse:** The problem will be posed and discussed as a large group, students will identify problem areas and variety of equations that will need to be utilize. Small groups will create reports and presentations to report for large groups orally.  |

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| **Language Support** (instructional and assessment strategies) |
| **Language Instruction** | **Guided Practice** | **Independent Practice** |
| During large group discussion, teacher will facilitate identifying the reasoning behind the assignment and identify problem areas. Teacher will also model an explanation for the explanatory areas of the worksheet. | Students will practice making explanations and justifications in small groups while creating their final designs/posters while the teacher walks around and guides each group.. Students will have an opportunity to share with the teacher and correct any mistakes/misconceptions before final presentations. | Students will present and explain their presentations to the class with their groups. Teacher may ask guided questions to check for understanding individually. Students will independently write a one-page summary on the justification of their placement of the food stands. |

**Differentiation, Cultural Responsiveness, and Accommodation for Individual Differences**

 To accommodate for differences in mathematical abilities, students will work in groups of four to engage in discourse on how to map out a pathway that best fits the restraints of the problem. The final justification summary will be individual to assess each student’s ability to understand the formulas and mapping process. I will be using our classroom aide for our English Language Learners, assisting them in any reading that they may need to do and helping to guide them through vocabulary. Students will be strategically placed in groups to ensure that there are higher level math students in each group. This will spread the level of knowledge throughout each group, making sure that lower level students have peers to guide them. The teacher will also serve as planned support. I will walk around the classroom, from group to group, helping each group and giving guidance where it is needed. Manipulative shapes will also be provided to engage tactile learners in the exploration.

**Materials – Instructional and Technological Needs** (attach worksheets used)

 Materials needed for this assignment are: posters, shape manipulatives, the amusement park planning worksheet (copy attached), rulers, grid paper, protractor/ruler (if needed/wanted).

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| **Instructional Plan** (detailed explanation for thing the lesson) |
| **Pacing** | **Teacher Activities** | **Student Activities** |
|  15 min.  |  **Engage - Whole Class**Start out the day by showing an engaging and interesting video on the construction and final product of a well known amusement park (Disneyland). *Hand out the amusement park worksheet while explaining to the students that they will be designing and creating their own amusement parks and that it may be helpful to take notes on the construction/justification of ride placement from the video.* Questions: Is there more than one way to design a park?What types of shapes might you need to design your own rides?What equations would you need to use to decide how much space the rides will take up, based on the shapes that you use? |  Students will watch the Disneyland video and take notes to help with their design and creation of their own amusement park. Students will begin to brainstorm their own amusement park. |
|  35 min in class(outside class time may be used if groups so choose).  |  **Explore - Groups***Explain while handing out amusement park worksheet*; your team/group has been hired to landscape a new amusement park with rides. You are provided a blank map with letters E through M, representing the nine rides you must include in your design.You must map out the most effective design in order to maximize the number of visitors to each ride. While students are working, ask questions to groups or whole class such as: What equations might you need for this design? Why?How would the size of the foot paths change your placement of rides?How can you space your rides in order to maximize visitors to each ride? Why?How can you justify your design? |  Show blueprint for amusement park on document camera (shown at bottom of this box). Ask, “ What are some of the problem areas that you see?”Example of some problem spots.Give students time to explore in their groups possible ways to design their park: where rides will be placed, how wide the foot paths will be, what shapes they will use for the rides (must use at least 4).  |
| 7 minutes per group  |  **Explain - Whole Class***After creating their amusement park, students will be generating and presenting a poster/powerpoint with their groups on their geometrical reasoning for why the pathways chosen and the ride placement allows for the most visitors to each ride.* The teacher will watch each presentation and score the presentation according to the rubric. Students will be scored as a group based on the clarity of their explanations and justifications. Questions that the teacher might ask following each presentation might include: Can you explain why you designed that ride with those particular shapes?Can you explain more on why you placed that ride in that spot? How will that increase visitors to that ride? Why did you make your foot paths that size? | Each group will present their amusement parks with a visual representation (poster/powerpoint). Each group presentation should include original drawings (hand drawn or computer generated), diagrams, tables, and equations used.Explanations should make sense and should justify their mathematical thinking.  |
| 25 minutes | **Elaborate - Individually**Explain to the students that they are now given the task of placing four food stands throughout their park in order to continue to maximize visitors not only to each ride, but to each food stand. Explain to students that they will be working individually to place the food stands in the amusement park that they created with their groups. They will follow by writing a one page explanation/justification for their placement to turn in to the teacher. Questions to be asked will include:What shape will your food stands be? How will this affect foot traffic, if at all?What equations would you need for those shapes?Where would you place four food stands in order to continue to maximize foot traffic?How can you justify your design? | Each student will work individually to place four food stands throughout their amusement park. Students will generate a one page summary on their explanation and justification for the placement of their food stands. This paper will be turned in to be graded.  |
| 20 minutes | **Evaluate - Whole Class** Students will engage in whole class discussion and talk about each design. They will talk about the effectiveness of the placement of rides, size and direction of foot paths, and how it might be altered to maximize visitors to each ride.Questions that the teacher will ask are:How might this design be altered to increase visitors to each ride?Why do you think the placement of that ride lowers visitors?What shapes did they use in their park? What equations were needed?Why do you think the size/direction of their footpaths increase or decrease visitors? | Students will engage in whole class discussion and talk about each design, addressing each question asked by the teacher.Students will be formatively assessed based on their engagement and activeness in the discussion. Explanations and justifications should be clear and make sense.  |

**Rubric**

Rubric for assessment of project

**Representing and Explaining The Rationale for Your Amusement Park**

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| 1. All variables are defined and logical
 | Accurate Needs Work Missing 5 3 0 |
|  2. Explanations are thorough and  mathematically supported | Accurate Needs Work Missing 5 3 0 |
|  3. Mathematics are correct and  well-supported | Accurate Needs Work Missing 5 3 0 |
|  4. Projects are well formatted and clearly  explained and labeled | Accurate Needs Work Missing 5 3 0 |
|  5. Student justifies their decisions for their  park and why they feel it is the best  choice | Accurate Needs Work Missing 5 3 0 |
|  6. Formulas for geometry (area and  perimeter) are labelled and used correctly  | Accurate Needs Work Missing 5 3 0 |

\_\_\_\_\_\_ / 30 Points

* \_\_\_\_\_/ 5 for Reflection

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\_\_\_\_\_ / 35 Total Points

**Name\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Period\_\_\_\_\_**

**Amusement Park**

**Part 1**

Your team has been hired to help landscape a new amusement park. You are given a map of the large rides at the park and are asked to map out pathways through the park.

**Facts (restraints):**

* Each ride needs as much space as possible between the ride and the pathway
* Each ride needs a pathway all the way around it.
* The border on the map counts as a pathway.

**Objectives:**

Your team must

* Must map out the pathway that best fits the restraints listed above.

**To be turned in:**

Your team must create a typed presentation that you would make to the amusement park directors. In this presentation you will include:

* the restraints you are given,
* what assumptions you make,
* what your objectives are,
* the methods (such as mathematics, the process of elimination, trial and error, etc.) you used. Include step by step what you did and why so if a stranger were to pick up your work, they could come to the same conclusion as you did.
* what your conclusions are.

If you used any visual aides such as graphs, charts or drawings, make sure you include them. Be prepared to share your findings with the class.

*HINT:* Try using your geometry tools.

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**Amusement Park**

**Part 2**

The company loved the perpendicular bisector mappings of the park’s pathways. They now want you to place four fast food stands. Where would you place them to maximize your foot traffic? Why? What assumptions did you have to make?

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**Amusement Park**

**Reflection**

1. **What did you learn during this process?**
2. **Were there variables that you did not realize as you were contributing to the project?**
3. **How did you justify your design?**
4. **How did the equations connect to the mathematical concept of geometry?**

**1 Point for Completed Reflection**

**1 Point Per Question Explanation**

**\_\_\_\_\_ / 5 Total Points**