Lesson Title	Geometric Basketball Court
Length of Lesson	1 day
Created By	Kylie Nash
Subject	Math
Grade Level	10^{th} – 12^{th} (Geometry)
State Standards	9^{th} -12^{th} Geometry 4a.
DOK Level	DOK 2
DOK Application	Compare, Make Predictions, Identify Patterns, Collect, Calculate, Understand
National Standards	9^{th}- 12^{th} Geometry
Graduate Research Element	None

Student Learning Goal:

State Standards for 9^{th} – 12^{th} Geometry: Geometry 4a.
(a) Solve real-world problems involving formulas for perimeter, area, distance, and rate.

National Standards for 9^{th} -12^{th} Geometry Standard:

- 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;

Students will collect data measurements on basketball court dimensions. Collect measurements on the various geometric shapes associated with the design of a basketball court. Identify patterns and shapes. Make predictions about symmetry of the court dimensions. Students will be able to practice and use appropriate equations to solve problems, physical techniques to collect, calculate and analyze data for measurement and critical analysis between relationships among geometric shapes.

Materials Needed (supplies, hand-outs, resources):
Notepaper, protractors, writing utensils, calculators, colored pencils, markers, and rulers.

Lesson Performance Task/Assessment:
Students will be able to collect measurement data on dimensions of a basketball court, such as perimeter, area, diameter, circumference, then identify polygon shapes used in the model and understand symmetry of the design. Students will be able to use appropriate equations to calculate different measurements in order to make predictions about symmetric properties.

Lesson Relevance to Performance Task and Students:
Allowing students to actually collect measurement data on real worlds applications will help strengthen math skills and engineering design concepts to students as well as how math, specifically geometry can be applied to real world applications. It will provide a

physical component to the concepts related to designing the layout various structures such as football fields, soccer fields. Students will learn concepts related to calculating perimeter, area, and other dimensions of polygons. Identify dimensions of symmetry. Students will be able to measure a physical object and make calculations based on the data they have collected. These lessons and performance tasks will strengthen the students, interest, knowledge and understanding of mathematical concepts of angle measurement and polygon shape design through the use of hands on activities to synthesize and interpret concepts learned in the classroom.

Anticipatory Set/Capture Interest:
Students will be told that they are design engineers for a local well known company and they have been chosen to repaint and wax the entire high school basketball court before the next season starts. The design teams need to collect the dimensions of the court, including all polygons shapes that need painting. Discussing with the students about symmetry, costs, available resources, polygons and designs will help students think about how to save time on collecting measurement data. Students also need to determine how much paint of each color used as well as how much wax will be need to complete the project.

If it is possible the students should go into the gym and collect the dimensions. They will use tape measures to collect measurements. The student must draw the court and use geometric equations to find the dimensions and calculate the amount of paint and wax to use. The data collection should not take more than 20 minutes. Students should be told how many square feet a gallon of paint and wax will cover.

Guided Practice:
The instructor will give an introduction to equations used for calculating various dimensions of the court. The teachers and students will work through some examples for calculating different dimensions. The instructor will introduce concepts related to polygon shapes (sides, angles measurements, etc.). Then the instructor will pose questions concerning engineering design considerations for various structures, symmetry. In the classroom first, in the gym, the instructor will ask students to form small groups and told they have will have 20 minutes to collect data. Each group will draw their design including dimensions based on feet and inches. Once the students have finished collecting data the instructor will discuss how this application can be applied to other real world applications. The instructor will also lead the discussion of the cost and amount of materials needed to redo the court.

Equations: Perimeter: $P = 2L + 2W$
Area Rectangle: $A=LxW$
Circumference: $C=pi(d)$
Area of Circle: $A = pi(r^2)$

Independent Practice:
Students will learn about dimension equations, select teams and pick a recorder to keep track of calculations. Students will get experience measuring, converting as well as drawing to scale. Then the groups can present their structures to the class and discuss any shapes and angles in their structures including colors. The students can ask questions and answer questions that help tie real world applications to mathematical problems. Students will then make predictions on how these measurements are implemented in the NBA regulations. They can predict how much of an increase NBA court sizes are compared to high school courts sizes.

Remediation and/or Enrichment:
Remediation:
Shorten the length of the activity, by excluding the component calculating the paint and wax considerations measurements; focus the basic dimension equations set either finding the sum of the angles or calculating the angles, partner help throughout the activity, individual assistance, individual IEP.

Enrichment/Extension:
Add the concept of the height of the basketball goal in relation to the court dimensions and the calculated the distances from the two-point, three-point and free throw lines, by considering angle measurement.

Check(s) for Understanding:
Day One:
1. How difficult was it to calculate the different equations using the collected data? Did everyone get the same measurements? Why or Why not?

2. If there is a limitation on resources how would their designs have changed?

3. What role did symmetry play on the design task?

4. What parts of the activity did you feel was the most important to helped to design and find dimensions of the basketball court? Why?

5. What parts of the activity did you feel was the least important to helped to design and find dimensions of the basketball court? Why?

6. Do you have a better understanding and improved knowledge of how to measure polygons and manipulate associated equations?

7. Do you think that with the skills and knowledge learned through this exercise that you can apply these concepts of design can be applied other everyday tasks?

Discuss some real world applications (who, what, when, where and how) that would benefit from understanding and measuring angles of various structures.

Possible Alternate Subject Integrations:

Science/Chemistry – Calculating area, perimeter, and circumference is beneficial for the formulation of molecules, chemical etc. They can help determine what the substance is based on it measurement, solids, etc.

Physics/Astronomy - Calculating the perimeter of different regions of space and matter.

Geography- These equations can be used to determine land mass such as rivers and lakes.

Health- Calculate calories burned based on court dimensions or game quarters.

Teacher Notes:

Reference Sources:

1.http://lionsden.tec.selu.edu/~sgoodly/court.html
2. http://sde.state.ok.us/Curriculum/CurriculumDiv/Math/Data/BasketballCourt.pdf