**Understanding By Design Unit Template**

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| **Title of Unit** | Geometry Ch. 11 – Measuring Length and Area | **Grade Level** | 9th and 10th |
| **Curriculum Area** | Mathematics | **Time Frame** | 11 – 14 Days |
| **Developed By** | Nathaniel Nauman |
| **Identify Desired Results (Stage 1)** |
| **Content Standards** |
| G.2.2.2.1 – Estimate area, perimeter, or circumference of an irregular figure.G.2.2.2.2 – Find the measurement of a missing length, given the perimeter, circumference, or area.G.2.2.2.3 – Find the side lengths of a polygon with a given perimeter to maximize the area of the polygon.G.2.2.2.4 - Develop and/or use strategies to estimate the area of a compound/composite figure.G.2.2.2.5 – Find the area of a sector of a circle.G.2.2.4.1 – Use area models to find probability. |
| **Understandings** | **Essential Questions** |
| **Overarching Understanding** |  |
| Students will understand …* how to calculate the area and perimeter of squares, rectangles, parallelograms, and triangles
* why the area and perimeter of each of these shapes are calculated the way that they are calculated
* how to calculate the area of trapezoids, rhombuses, and kites
* why the area of each of these shapes are calculated the way that they are calculated
* how to calculate the ratios of the area and perimeter of similar figures
* why the ratios of the area and perimeter of similar figures is valuable
* how the area and perimeter of similar figures can be calculated by using ratios
* how to calculate the circumference of a circle and why this information is valuable
* how to calculate the arc length of a circle and why this information is valuable
* how to calculate the area of a circle
* how to calculate the area of a sector in a circle
* why the area of a circle and the area of a sector in a circle are calculated the way that they are calculated
* how to calculate geometric probabilities
* why a probability can be calculated from various geometric measures
 | What is the area of a square, rectangle, parallelogram, and triangle? How are these areas calculated? How can this knowledge be applied in the real world?What is the area of a trapezoid, rhombus, and kite? How are these areas calculated? How can this knowledge be applied in the real world?What is the ratio of the area and perimeter of similar figures? How are these values calculated? How can this knowledge be applied in the real world?What is the circumference and arc length of a circle?  How are they calculated?  How can this knowledge be applied in the real world?What is the area of a circle and a sector in a circle?  How are these areas calculated?  How can this information be applied in the real world?What is a geometric probability? How is a probability calculated when given lengths or areas? How can this knowledge be applied in the real world? |
| **Related Misconceptions** |
| * why the area of a triangle is calculated by $\frac{1}{2}bh$
* why the area of a trapezoid is calculated by $\frac{1}{2}h(b\_{1}+b\_{2})$
* why the area of a rhombuses and kites are calculated by $\frac{1}{2}d\_{1}d\_{2}$
* what $d\_{1}$ and $d\_{2}$ are in the rhombus and kite area formulas
* why the ratio of areas cannot be directly compared to the ratio of sides
* which formula is used for calculating the arc length of a circle and which is used for calculating the area of a sector of a circle
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| **Knowledge**Students will know… | **Skills**Students will be able to… |
| * the area formulas for a square, rectangle, parallelogram, and triangle
* the area formulas for trapezoid, rhombus, and kite
* how to identify similar figures
* the way to calculate the ratio of the areas and perimeters of similar figures
* the formula for the circumference of a circle
* the formula for the arc length of a circle
* the area formula for the area of a circle
* the area formula for the area of a sector in a circle
* how to calculate a probability when given a geometric length or area, including the process for calculating this probability
 | * calculate the area and perimeter of a square, rectangle, parallelogram or triangle when given the base and height of an object
* calculate the base or height of a square, rectangle, parallelogram or triangle when given the perimeter or area
* calculate the area of a trapezoid, rhombus, and kite when given the bases and height or the diagonals of an object, respectively
* calculate the bases or height of a trapezoid, or the diagonals of a rhombus or a kite when given the area of the object
* calculate the ratios of the area and perimeter of similar figures
* calculate the side of a polygon when given the perimeter or area of two similar polygons, and the side of the other polygon
* calculate the circumference of a circle when given its radius or diameter
* calculate the radius or diameter of a circle when given its circumference
* calculate the arc length on a circle when given the radius or diameter of a circle and the measure of the arc
* calculate the area of a circle when given the diameter or radius, or vice versa
* calculate the area of a sector in a circle when given the diameter or radius and the measure of the arc on the circle, or the diameter or radius when given the area of a sector
* calculate the geometric probability when given the required lengths
* calculate the geometric probability when given the required areas
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| **Assessment Evidence (Stage 2)** |
| **Performance Task Description** |
| **Goal** | To demonstrate understanding of various geometric shapes and their properties by landscaping a backyard made of areas consisting of the basic geometric shapes studied throughout the unit. Then to calculate the area and cost of installing this yard. |
| **Role** | A landscaper who wants to design a landscape for a backyard that includes a deck, a lawn area, a fountain, and a flower or garden area (and additional items if desired) that will win on the diy network's television show called Turf War. |
| **Audience** | A landscaper who gave the students the geometry of a yard that was made for the previous Turf War by his competitor and won because of how the geometries of and spacing between the displayed lawn, deck and fountain created an excellent feel for the yard. |
| **Situation** | Students will be given the geometry and required dimensions of the yard that won the Turf War by the landscaper competing in this show so that they can calculate the area of the redwood decking that was required, the area of the fountain that was required, and the minimum amount of sod that was needed for the lawn in the last Turf War. After calculating this information, students will be asked to generalize the geometries of this yard so that the feel of this yard can be achieved in any yard that the landscaper may compete in during the next Turf War. Finally, students will be asked to design their own ideas of a great yard that includes a fountain, a deck, a lawn area, and a flower or garden area (and any other items that they wish to include) and calculate the area of each of these items for the landscaper to see. [See link below for information about the show.]<http://www.diynetwork.com/turf-war/show/index.html> |
| **Product/Performance** | The area of the redwood decking that was required, the area of the fountain that was required, and the minimum amount of sod that was needed for the lawn in the last Turf War. Also the generalizations of the geometries of this yard so that the feel of this yard can be achieved in any yard that the landscaper may compete in during the next Turf War. Lastly the design of the student's own idea of a great yard that includes a fountain, a deck, a lawn area, and a flower or garden area (and any other items that they wish to include) and the calculations of the area of each of these items. All of these tasks will be graded by using a rubric. |
| **Standards** | G.2.2.2.2 - Find the measurement of a missing length, given the perimeter, circumference or area.G.2.2.2.4 - Develop and/or use strategies to estimate the area of a compound/composite figure.G.2.2.2.5 - Find the area of a sector of a circle. |
| **Other Evidence** |
| Focus questions, informal questioning during class, problems during the lesson, homework problems, quizzes, and a chapter test. |
| **Learning Plan (Stage 3)** |
| **Where are your students headed? Where have they been? How will you make sure the students know where they are going?** | Students will know what the plan is for the unit by the Key Learning Statement and Unit Essential Question at the beginning of the first day of class on this unit, and by the Lesson Objective statements provided at the beginning of each lesson.Key Learning Statement: Being able to measure length and calculate area has multiple applications. These applications include dividing land of various shapes, calculating space taken up by items in a room and maximizing storage of various objects.Unit Essential Question: How can knowledge about area and lengths be used?11.1: To be able to find the perimeters and areas of parallelograms and triangles, and to be able to find a missing length when given the perimeter or area of a parallelogram or triangle.11.2: To be able to find the areas of trapezoids, rhombuses and kites, and to be able to find a missing length when given the area of a trapezoid, rhombus or kite.11.3: To be able to find the perimeter, area or unknown side of similar figures.11.4: To be able to find the circumference of a circle and the arc length in a circle. Also if given the circumference, then to be able to find the radius or diameter of a circle, or to be able to find the radius or angle measure if given an arc length.11.5: To be able to find the area of a circle, or its radius if the area is provided. Also, to be able to find the area of a sector of a circle, or its degree measure or radius if the area of a sector is provided.11.7: To be able to use geometric lengths and areas to find the probability of an event. |
| **How will you hook students at the beginning of the unit?** | Hooked students by introducing the Key Learning Statement and Unit Essential Question to show what all being able to measure lengths and calculate areas can do for someone, and then moving into a general discussion about what area really is, and not just something like “length times width.” |
| **What events will help students experience and explore the big idea and questions in the unit? How will you equip them with needed skills and knowledge?** | The Key Learning Statement and Unit Essential Question at the beginning of the first day of class on this unit, and the Lesson Objective statements provided at the beginning of each lesson will go a long way to helping students to experience and explore the big ideas and questions in this unit. Various application problems scattered throughout the unit will also promote students to explore and experience everything that being able to calculate areas and finding missing measures can provide. |
| **How will you cause students to reflect and rethink? How will you guide them in rehearsing, revising, and refining their work?** | Whenever a student gets stuck on a problem, I intend to ask them “what do they think might work/ what they might do next”, “if this problem reminds them of a previous problem,” and similar questions that will help them to reflect and rethink about what they are learning and develop their mathematical skills.  |
| **How will you help students to exhibit and self-evaluate their growing skills, knowledge, and understanding throughout the unit?** | Students will be able to exhibit their growing skills, knowledge and understanding by solving harder problems in homework and/or solving problems with a greater degree of correctness, this method will also help students to self-evaluate their growing mathematical abilities. |
| **How will you tailor and otherwise personalize the learning plan to optimize the engagement and effectiveness of ALL students, without compromising the goals of the unit?** | Providing appropriate accommodations for students with physical and/or mental disabilities. Presenting material visually (slides, handouts, and writing on board), verbally (saying what I am doing on the board, and group/class discussions), and through means that assist tactile learners (activities, and note-taking). Modify lesson plan to take advantage of current events, student’s interests, questions, etc. |
| **How will you organize and sequence the learning activities to optimize the engagement and achievement of ALL students?** | The material will be outlined in a way so that previously learned material, both in this unit and before this unit, will be reviewed and used during various class activities. |

From: Wiggins, Grant and J. Mc Tighe. (1998). *Understanding by Design*, Association for Supervision and Curriculum Development

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