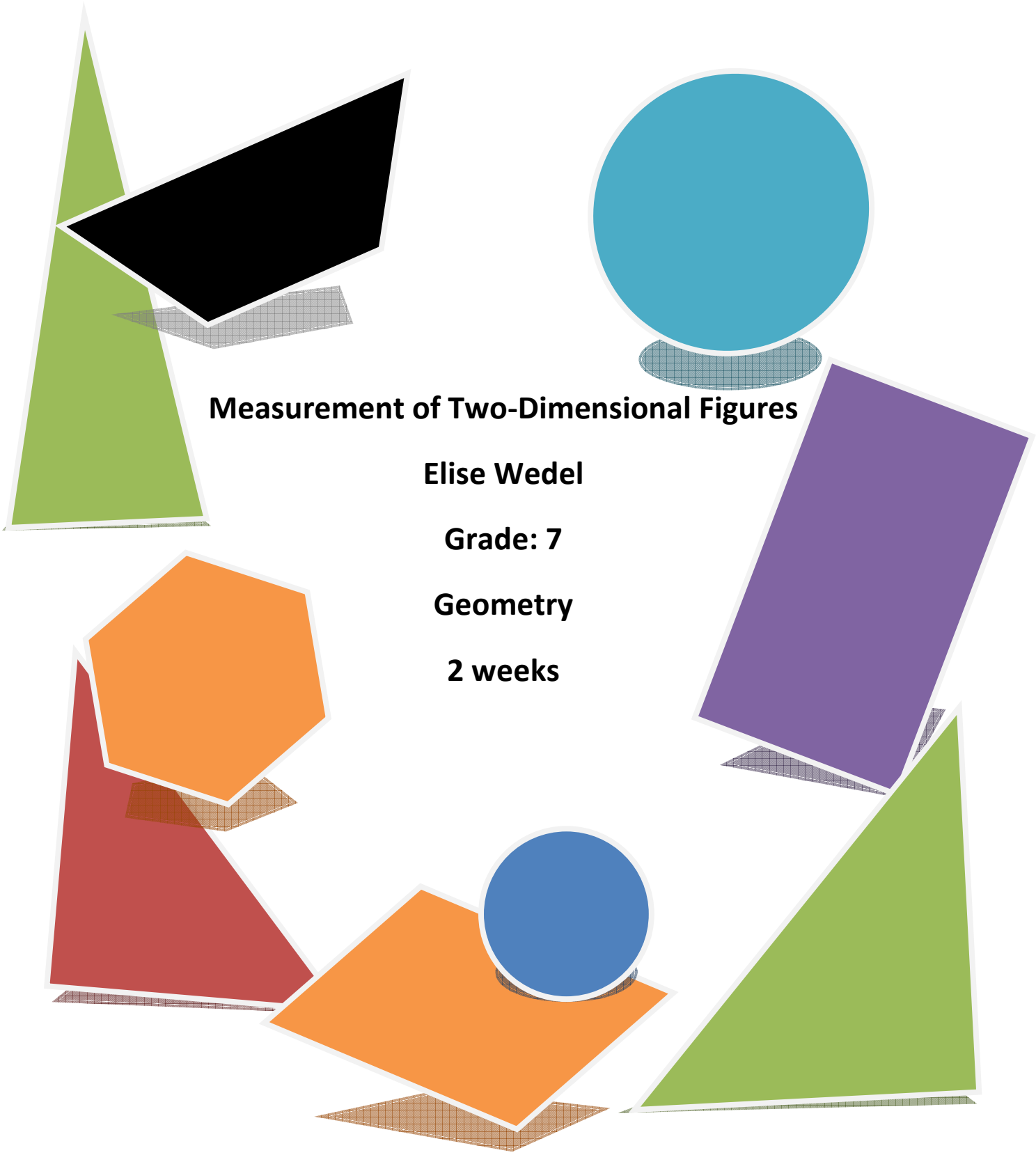


Measurement of Two-Dimensional Figures

Elise Wedel

Grade: 7

Geometry

2 weeks

Thematic Statement:

Understanding how to use concepts of geometry is an important skill for approaching many problem solving situations. It is also an important building block for further math knowledge. As we work with geometric concepts it is important that we have a conceptual understanding of the vocabulary used, the formulas/theorems, shapes, and measurement. By measuring two-dimensional figures, we will learn how to solve various real-life problems and we will explore how these concepts are consistently true. Not only will my students complete the required curriculum standards for geometry according the NCTM and Iowa Core curriculum, they will be able to see what geometry reveals about God's creation.

Creation

God created order in the universe in which we can use concepts of geometry to find solutions that reveal truth. We serve an unchanging and faithful God who holds every aspect of his creation together; therefore, the geometry concepts are unchanging. Because of God's unchanging order of creation, we can use the measurement of two-dimensional figures to solve problems and describe the world around us.

Fall

The effect of sin on the world can make learning geometry a negative, difficult, and sometimes even stressful experience as some students will have trouble making precise measurements, recognizing what formulas are needed to solve the problems, and the overall application to their life. Sin makes students lose sight of the fact that God's consistency is revealed through the consistency seen in geometry. Also people may be tempted to use concepts of geometry such as measuring two-dimensional figures in a sinful way. Many jobs require people to make accurate and precise measurements in order to do the job well and with honesty and integrity. Without being able to recognize what concepts of geometry should be used, we make mistakes and are sometimes unable to solve the problems we are presented with.

Redemption

Students will see the importance of math through God's truth and order. Learning about the measurement of two-dimensional figures will help my students see consistent relationships and their application to further mathematical concepts. We will practice discovering and using these relationships in non-routine problems so the students will be able to apply the relationships to real-life problems and other subject areas.

Unit Goals:

- Compare the precision of measurements and determine acceptable levels of accuracy.
- Find the perimeter of a polygon and the circumference of a circle.
- Find the area of rectangles and other parallelograms.
- Find the area of triangles and trapezoids.
- Find the area of circles.
- Find and estimate square roots of numbers.
- Explore the Pythagorean Theorem.
- Value God's unchanging and consistent creation order.
- By measuring two-dimensional figures, students will learn how to solve various real-life problems and they will explore how these concepts are consistently true.

Outline of Unit: Measuring Two-Dimensional Figures

I. Preassessment

II. Lesson 1: Accuracy and Precision (CFR: Fall-discuss how it is difficult/tedious/impossible to make precise, 100% accurate measurements.)

III. Lesson 2: Perimeter and Circumference

*Enrichment-Formulas for Perimeters

IV. Lesson 3: Area of Parallelograms

*Enrichment-Spaghetti and Meatballs for All!

V. Lesson 4: Area of Triangles and Trapezoids

LAB: Compare Perimeter and Area of Similar Figures

VI. Lesson 5: Area of Circles

*Enrichment-Area of irregular figures

VII. Lesson 7: Squares and Square Roots

VIII. Lesson 8: The Pythagorean Theorem

SmartBoard Lesson/Manipulative

*Enrichment Webquest

IX. Test Review-Excercises out of book p. 574-576

X. Test

**The lessons that are bolded are the ones I developed lesson plans for.

On a scale of 1-10, how confident do you feel about the concepts on this sheet?
(Circle any sections/problems you are confused about.)

Some more math fun!

Are You Ready?

Chapter 9: Measurement of Two Dimensional Figures

Diameter
Parallelogram
Radius
Right Triangle
Trapezoid

✓ Vocabulary

Choose the best term from the list to complete each sentence:

1. A(n) _____is a quadrilateral with exactly one pair of parallel sides.

2. A(n) _____is a four-sided figure with opposite sides that are congruent and parallel.

3. The _____of a circle is one-half the _____of the circle.

Review and Show What You Know!

✓ Round Whole Numbers

Round each number to the nearest whole number and nearest ten and hundred.

4. 1,535 **5.** 294 **6.** 30,758 **7.** 497

✓ Round Decimals

Round each number to the nearest whole number and nearest tenth.

8. 6.18 **9.** 10.50 **10.** 523.93 **11.** 29.06

✓ Multiplying with Decimals

Multiply.

12. 5.63 · 8 **13.** 9.67 x 4.3 **14.** 8.34 x 16 **15.** .33 · .08

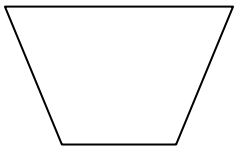
✓ Order of Operations

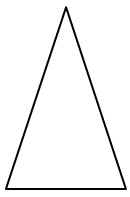
16. Write the rule for order of operations. _____

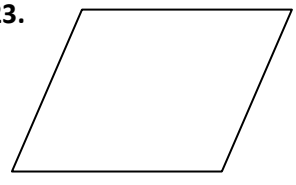
Simplify Each Expression. (Show your work. If you need extra space use the back!)

17. $2 \cdot 9 + 2 \cdot 6$ **18.** $2(15 + 8)$ **19.** $(27.3 + .7) \div 2^2$ **20.** $66 \cdot [5 + (3 + 3)^2]$

✓ Identify Polygons

21. 

22. 

23. 

Lesson Plan Template - - H. Van Brummelen, *Walking With God in the Classroom*

Grade Level: 7th **Time: (45 min class)**

Curriculum Area: Measurement and Geometry **Unit topic: Measuring Two-Dimensional Figures**

Curriculum standards tied to this lesson:

NCTM:

Geometry:

- precisely describe, classify, and understand relationships among types of two- and three-dimensional objects using their defining properties;
- draw geometric objects with specified properties, such as side lengths or angle measures;
- recognize and apply geometric ideas and relationships in areas outside the mathematics classroom, such as art, science, and everyday life.

Measurement:

- develop and use formulas to determine the circumference of circles and the area of triangles, parallelograms, trapezoids, and circles and develop strategies to find the area of more-complex shapes;

IOWA CORE:

Draw, construct, and describe geometrical figures and describe the relationships between them.

- Draw (freehand, with ruler and protractor, and with technology) geometric shapes with given conditions.

Solve real-life and mathematical problems involving angle measure, area, surface area, and volume.

- Know the formulas 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.

Intended learning outcomes (to know, to do, to create, to value) aka Goals & Objectives:

- To find the perimeter of a polygon.
- To find the circumference of a circle.
- To do real-life/problem solving problems involving perimeter and circumference.
- To value how relationships found in geometry are consistently true.

Assessment strategies: How will you assess attainment of the intended learning outcomes?		
_X_ Observation students as they find the perimeter of their desks and the circumference of the circles. Walk around and observe students work during their independent practice.	___ Rubric	___ Peer Assessment
___ Work samples/portfolio	___ Presentation or performance	___ Self-assessment
___ Anecdotal notes	___ Learning log/journal	_X_ Focused questions written into lesson plans.
___ Interview/Conference	___ Other (explain): grade homework.	

Materials/preparation:
Curriculum text: Holt McDougal Mathematics Course 2, transparency of Fig. 1.1, rulers/meter sticks, different sized circle manipulatives, enrichment activity worksheets, calculators

Introduction:

#1-Setting the stage:

Engaging, motivating, experiencing, connecting with prior knowledge, reflecting, conjecturing posing problems

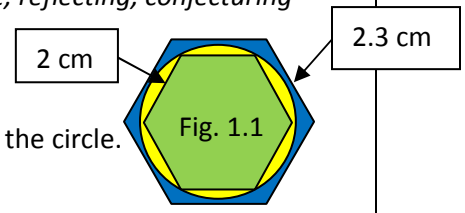


Fig. 1.1

Estimating the circumference of a circle.

1. Use Figure 1.1 (use transparency) to estimate the circumference of the circle.
   a. Find the perimeter of the green (inner) hexagon.
   b. Find the perimeter of the blue (outer) hexagon.
   c. Average the two perimeters in parts a. and b. to estimate the circumference of the circle.

Think and Discuss:

2. Why were you asked to average the two perimeters of the hexagons to estimate the circumference of the circle?
3. What is the difference between perimeter and circumference?
4. What other ways might someone measure or estimate the circumference of a circle?

Guided Learning Steps:

#2-Disclosing: *Acquiring knowledge/skills, conceptualizing, developing, understanding, integrating*

- **Review the definition of perimeter and have students think of some real-life examples in which finding the perimeter would be important/useful. Could perimeter be used in God's redeeming work?**
- **Have the students find the perimeter of the rectangular part of their individual desk and then the perimeter of the four desks in their group.**
- **Is the perimeter four times that of the individual desk? If not, why?**
- **In their table groups of four, have students try to come up with a formula for the perimeter of a rectangle.**
- **What are the advantages of using the formula instead of measuring out the entire perimeter?**
- **Now have students calculate the perimeter of their individual desks and their group of desks using the formula. Did they get the same answer as before? Is the formula for the perimeter of a rectangle consistently true?**

- **Discuss circumference-For every circle C/d is the same and is represented by pi. Give each group a different sized circle and have them find the circumference using C=pi*d.**
- **Create a chart on the board of the circles diameter, radius, and circumference.**
- **Now have each group divide C by d to explore whether or not the ratio of circumference to diameter is always pi.**
- **What is pi approximately? What are the different ways we can represent it?**

#3-Practicing, reinforcing: *Modeling, giving instructions, checking for understanding, guided practice, independent practice, applying, posing and solving problems*

- **Now do problems from EX. 3 (p. 531) individually and check with group.**
- **Have students do EX #4 and Additional EX. #4 (p. 531) by drawing a picture and explaining their steps to the person sitting next to them.**
- **Independent practice: do problems 12, 14, 18, 20, 26 from their homework assignment and check for understanding.**
- **ENRICHMENT ACTIVITY: if used during class time these students will work on enrichment activity instead of doing the independent practice problems above. If not used during class, it will be used during an enrichment/extension period. (example of wkst is attached).**
- **Problem of the day: students can do individually if they have extra time.**
    - **"A pizza cutter has a diameter of 2.5 inches. To cut a pizza in half, the cutter makes two complete revolutions. What is the diameter of the pizza? What is the circumference of half the pizza?"**

#4-*Transcending:* Summing up, responding, creating, Performing, committing, evaluating, Closure

- Have students discuss the difference and similarity between perimeter and circumference
- Solve the problem of the day as a class reviewing perimeter and circumference.
- Briefly discuss how amazing it is that God has created order in the universe and that we can use concepts of geometry such as circumference and perimeter to find solutions that reveal truth. Throughout this chapter be looking for all the relationships and concepts of geometry that reveal order and truth in God's creation. God is unchanging (Psalm 25-27, Hebrews 13:8, James 1:17). He holds everything together (Col. 1:16-17).
- Give homework assignment.

Modifications: How will you change the lesson to meet the needs of individual students?		
___ Increase time, space, amount: allow time during independent practice to work with students one on one if necessary.	_X_ Scribe for students with disabilities affecting their fine motor skills.	_X_ Include visuals: Have students draw pictures of the problems and label them. Use different colors to highlight the different lengths of a rectangle and then write the formula using those colors.
___ Decrease	___ Oral explanation: review meaning of units of measure, and the meaning of radius, diameter, and center of a circle.	_X_ Use manipulatives such as a string and circular objects to help students gain a concrete understanding of circumference.
___ Change homework assignments depending on skill level.	___ Peer/tutor/partner	_X_ Extend: bring string and ruler for students who are struggling with circumference.
_X_ Other: Use ESL program provided in the textbook to help meet the needs of ESL students. Review vocabulary…use multilingual dictionary to develop understanding of terms. Have students draw pictures and label different parts.		
Who will require modifications:		

Personal notes/reminders/homework:
Remediation (blue group): 1-8, 10-14, 17, 18, 20, 26-29
Average (green group): 1-4, 7, 9, 11-14, 18, 20, 25-27, 29, 31
Enrichment Students (red group): Finish enrichment activity and problems 1, 2, 4, 10, 25, 27-29, 31
***Use color to signify which students do which assignment, but during lessons create groups with varying skill levels. Note: students may need to be moved to a different group throughout the year. (this applies for all lessons.)**

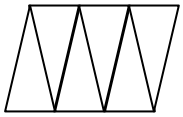
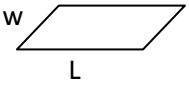
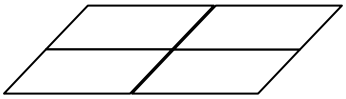
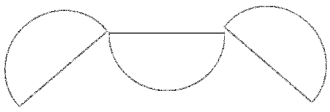
For the problem of the day some students may find the circumference by multiplying the circumference of the whole by one-half, but one half of the circumference of the whole circle give only the length of the arc of the semi circle.

****Enrichment activities are included in 'Practicing/Reinforcing' part of lesson plans, but whether or not they are used at that time will depend on the how the school/class schedule is set up...whether or not they have a class specifically for enrichment activities.**
Post-lesson reflections:

Challenge!

Circumference and Perimeter

Instructions: Use the first figure in each row to write a formula for the perimeter of the combined figure next to it. Use your formulas in Exercises 5-8.

Original Figure	Combined Figure	Perimeter
A regular octagon:  m		
An isosceles triangle:  b		
A parallelogram:  L		
A semicircle:  d		

5. What is the perimeter of the combined figure in Exercise 1 if m=4 inches?

6. What is the perimeter of the combined figure in Exercise 2 if s=4.5 m and b=5.2 m?

7. What is the length of the original figure in Exercise 3 if the width is 6 in. and the perimeter of the combined figure is 56 in.?

8. What is the perimeter of the combined figure in Exercise 4 if the d=10 cm?

Lesson Plan Template - - H. Van Brummelen, *Walking With God in the Classroom*

Grade Level: 7th **Time: (45 min class)**

Curriculum Area: Measurement and Geometry **Unit topic: Measuring Two-Dimensional Figures**

Curriculum standards tied to this lesson:

NCTM:

Geometry:

- precisely describe, classify, and understand relationships among types of two- and three-dimensional objects using their defining properties;
- understand relationships among the angles, side lengths, perimeters, areas, and volumes of similar objects;
- draw geometric objects with specified properties, such as side lengths or angle measures;
- recognize and apply geometric ideas and relationships in areas outside the mathematics classroom, such as art, science, and everyday life.

Measurement:

- select and apply techniques and tools to accurately find length, area, volume, and angle measures to appropriate levels of precision;
- develop and use formulas to determine the circumference of circles and the area of triangles, parallelograms, trapezoids, and circles and develop strategies to find the area of more-complex shapes;
- understand, select, and use units of appropriate size and type to measure angles, perimeter, area, surface area, and volume.

IOWA CORE:

Solve real-life and mathematical problems involving angle measure, area, surface area, and volume.

- Solve real-world and mathematical problems involving area, volume and surface area of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms.

Draw, construct, and describe geometrical figures and describe the relationships between them.

- Draw (freehand, with ruler and protractor, and with technology) geometric shapes with given conditions.

Intended learning outcomes (to know, to do, to create, to value) aka Goals & Objectives:

- **To know how to find the area of rectangles.**
- **To know how to find the area of parallelograms.**
- **To know the relationship between rectangles and parallelograms.**
- **To solve real-life and problem solving problems connected to the area of rectangles and parallelograms.**

Assessment strategies: How will you assess attainment of the intended learning outcomes?

_X_ Observation throughout lesson and during independent practice.	___ Rubric	___ Peer Assessment
___ Work samples/portfolio	___ Presentation or performance	___ Self-assessment
___ Anecdotal notes	_X_ Learning log/journal at conclusion of the lesson.	_X_ Focused questions throughout the lesson.
___ Interview/Conference	___ Other (explain): grade homework	

Materials/preparation:
Curriculum text: Holt-McDougal Mathematics Course 2, graph paper, meter stick, construction paper manipulatives.

Introduction:

#1-Setting the stage:

Engaging, motivating, experiencing, connecting with prior knowledge, reflecting, conjecturing posing problems

- Introduction Question: Are perimeter and area the same? How are they different? How do they relate?!
- Discuss real-world situations that require knowledge of perimeter and/or area.
    - Making a border for a bulletin board, buying a carpet for a room, construction, baking, etc.
- Point out that perimeter is a one-dimensional measure and is measured in linear units, whereas area is two-dimensional and is measured in square units. Bulletin border versus the bulletin board itself.

Guided Learning Steps:

#2-Disclosing: *Acquiring knowledge/skills, conceptualizing, developing, understanding, integrating*

- **What does it mean to measure area in square units? What is a square unit?**
- **Give each student a sheet of graph paper.**
- **Have students demonstrate what a square unit is on their graph paper.**
- **Why are aspects of perimeter important for finding the area?**
- **As a class come up with the formula for the area of a rectangle. A=L x W**
- **Find the area of a rectangle when given the height and the width. Do Example #1 (p. 536) as a class and then with their seat partner have them find the area of the rectangular top of their desks using a meter stick.**
- **Find the length and width of a rectangle given the area. Do Example #2 (p.536) as a class and then have them do Additional Example #2 (p. 537) individually and compare with their seat partner…compare work an answers.**
- **Have students make predictions about how to find the area of a parallelogram.**
- **Using their graph paper, have students show why the area of a parallelogram is the same as the area of a rectangle even though they are different shapes. Is A=b x h the same as A=L x W?**

#3-Practicing, reinforcing: *Modeling, giving instructions, checking for understanding, guided practice, independent practice, applying, posing and solving problems*

- **Is a rectangle a parallelogram? Is a parallelogram a rectangle?**
- **Critical Thinking Question: Does a parallelogram and a rectangle have the same perimeter if they have the same area?!?**
- **Do real-life application problem (Example #4, p. 537) as a class…encourage students to draw picture of the problem.**
- **Independent Practice: Exercises 10, 12, 14, 16, 22**
- **ENRICHMENT ACTIVITY: This activity will have to be done in an enrichment period (or could be substituted for this lesson if students already know how to find the area for rectangles and parallelograms) because it involves reading a book and doing problem solving. Spaghetti and Meatballs for All? –Comparing perimeter and area. (Wkst for activity is attached at end of lesson plan)**

#4-*Transcending:* Summing up, responding, creating, Performing, committing, evaluating, Closure

- Journal:
  - Have students write in their own words the difference between A=l x w and A=b x h. They may want to draw a picture to illustrate their explanation.
  - How did we see God's creational order in today's lesson? Did you find any relationships that were consistently true? How did those relationships help you solve problems? (Redeeming value?!)
- Ask students if any of them are willing to share what they wrote in their journals.
- Give homework assignment.

Modifications: How will you change the lesson to meet the needs of individual students?

___ Increase time, space, amount: Work with students one on one during independent practice.	___ Scribe for students who have disabilities with fine motor skills.	___ Include visuals by drawing problems on graph paper.
___ Decrease	___ Oral explanation: review with students the meaning of parallel and perpendicular. Have them identify a vertex in a parallelogram.	___ Use manipulatives: have parallelograms cut out of paper that they can manipulate to show why area of a parallelogram and a rectangle are related. Model that when you mark off the height on both sides of a parallelogram, the resulting interior shape is a rectangle.
___ Change	___ Peer/tutor/partner	___ Extend
___ Other: ESL students- provide them with graph paper and have them draw the shapes in the problem and compare their pictures to their calculations.		

Who will require lesson modifications?

Personal notes/reminders/homework:

- **Remediation(blue group): 2-16 even, 17, 18, 21, 22, 24**
  Average(green group): 2-16 even, 17, 18, 21-25
  Enrichment(red group): Enrichment activity and problems 21-25.

- **Have students take a piece of graph paper home and find an example of rectangle and parallelogram and find area of each. Ex. Pans, floor, ceiling, designs, toys, etc. If you cannot find an example of a parallelogram, why do you think objects are more often rectangular instead of parallelograms.**

- **Some students might incorrectly try to find the area of a parallelogram by multiplying the side lengths rather than the height and base.**

Post-lesson reflections:

Spaghetti and Meatballs for All!

Grade Level: 7th Grade

Objective: To provide students with a real-world application in finding area and perimeter and to compare area and perimeter.

Materials: A copy of Spaghetti and Meatballs for All! By Marilyn Burns, a worksheet for students to do while listening to the story, and plastic one inch tiles for them to follow along with (if time permits). An overhead projector would be ideal so that you can show the students what is going on while the story is occurring.

Instructions:

Pass out worksheets and tiles.

Remind students to pay very close attention to what is going on.

While reading the story take a number of breaks so that students can fill out the worksheet. If an over-head projector is available, work out what is happening in the story with transparent tiles. If none is available, work it out on the board.

Occasionally, ask students how many people can be seated if there are x number of tables put together (with the table arrangement visible – four tables can seat 10 people or 8 people depending on the arrangement).

While reading the story, ask the students what they think might happen next. What do you think will happen now that they ran out of tables and not all the guests have yet to arrive?

After the story have the students fill in the remaining gaps of the table, and try to come up with a relationship between the number of people a certain table arrangement can seat.

*Name*_____

Date _____

Spaghetti and Meatballs for All !

~During the story~

Please listen and fill in the chart as we go along.

NOTE: Only one person per table edge, they need elbow room!

Table 1

Number of tables combined	Dimension of tables (# in row x # in column)	Total number of people seated

~After the story~

Mrs. Comfort is still a little upset that there was too much commotion over the rearranging of tables during the family reunion. She decides to plan ahead for the next party. Assuming that she and Mr. Comfort invite the same people, what are the all the possible dimensions of the tables that will always seat 32 people?

Table 2

Number of tables	Arrangement of tables	Area of tables
Ex. 15	1 x 15	15

Which arrangement uses the most tables? Which uses the least?

Since it seemed that the Comforts ran out of food, Mrs. Comfort wants the next party to have just the right amount of food. How many different ways can she make one big table that sits 32 people? She needs this information to see how much table space she has to fill up with food.

Table 3

Number of tables needed	Arrangement of tables	Area of tables

BONUS:

What if there were only going to be 12 people at the family reunion? What if there were 36 people at the reunion?

Anyone in the mood for Spaghetti and Meatballs?

~to the teacher~

Discussion/Follow up: As a follow up activity, go over the information gathered on the three tables as a class. Ask the class if they noticed any patterns (functions), generalizations. Then make the transition into the new unit.

Also, let the students share new/old information with the class, what they learned from the story. Whether or not they liked it.

To relate it to everyday life, ask them if they had ever been in a situation like the Comforts, if so how did they handle the problem. Did people end up having to stand?

Sources:

http://jeffconet.jeffco.k12.co.us/isu/math/literature/lessons/spaghetti.htm

~Dee Dolfinger, Jefferson County Public Schools, 2000

www.mste.uiuc.edu/m2t2/

~the niftyM2T2 packet.

Lesson Plan Template - - H. Van Brummelen, *Walking With God in the Classroom*

Grade Level: 7th

Time: (45 min class)(May take 1.5-2 class periods due to the lab activity.)

Curriculum Area: Measurement and Geometry

Unit topic: Measuring Two-Dimensional Figures

Curriculum standards tied to this lesson:

NCTM:

Geometry:

- precisely describe, classify, and understand relationships among types of two- and three-dimensional objects using their defining properties;
- understand relationships among the angles, side lengths, perimeters, areas, and volumes of similar objects;
- draw geometric objects with specified properties, such as side lengths or angle measures;
- recognize and apply geometric ideas and relationships in areas outside the mathematics classroom, such as art, science, and everyday life.

Measurement:

- select and apply techniques and tools to accurately find length, area, volume, and angle measures to appropriate levels of precision;
- develop and use formulas to determine the circumference of circles and the area of triangles, parallelograms, trapezoids, and circles and develop strategies to find the area of more-complex shapes;
- understand, select, and use units of appropriate size and type to measure angles, perimeter, area, surface area, and volume.

IOWA CORE:

Solve real-life and mathematical problems involving angle measure, area, surface area, and volume.

- Solve real-world and mathematical problems involving area, volume and surface area of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms.

Draw, construct, and describe geometrical figures and describe the relationships between them.

- Draw (freehand, with ruler and protractor, and with technology) geometric shapes with given conditions.

Intended learning outcomes (to know, to do, to create, to value) aka Goals & Objectives:

- **To know how to find the area of triangles.**
- **To know how to find the area of trapezoids.**
- **To understand the relationship between the area of a trapezoid and a triangle.**
- **To know how the area of a trapezoid and triangle can be used in real-life situations.**
- **To value God's unchanging order in creation.**

Assessment strategies: How will you assess attainment of the intended learning outcomes?		
_X_ Observation during lesson and during independent practice.	___ Rubric	___ Peer Assessment
___ Work samples/portfolio	_X_ Presentation or performance: LAB activity	_X_ Self-assessment included in the journal entry.
___ Anecdotal notes	_X_ Learning log/journal	_X_ Focused questions throughout the lesson
___ Interview/Conference	___ Other (explain): grade homework	

Materials/preparation:
Curriculum text: Holt McDougal Mathematics Course 2, map of Bermuda triangle, attribute blocks, calculator

Introduction:

#1-Setting the stage:

Engaging, motivating, experiencing, connecting with prior knowledge, reflecting, conjecturing posing problems

- As a class think of real-world examples where it would be useful to know the area of triangles or trapezoids. (triangles provide support for many structures/ex. Bookshelves, bridges, …)
- Talk about the Bermuda Triangle in the Atlantic Ocean where many aircrafts and ships have mysteriously disappeared. Bring map!
- Review the parts of a triangle: 3 sides, base, altitude…

Guided Learning Steps:

#2-Disclosing: *Acquiring knowledge/skills, conceptualizing, developing, understanding, integrating*

- **Have students use attribute block manipulatives to help them find the formula for the area of a triangle.**
- **Ask students what must always be true about the height. Is the height always the longest side? Sometimes! Height is always perpendicular to the base.**
- **What does perpendicular mean?**
- **Have students find some 'lines' in the room that are perpendicular and some that are not.**
- **Do Ex. 1 p. 540 as a class and then have students do Additional Ex. 1a. and b. (p. 541) and check their solutions with their seat partners.**
- **How did you use the sides of a right triangle to find the area? Would you get the same area if you used the opposite side as the height? For example in Additional Ex. 1a, What if you used height 8 units instead of 5 units?**
- **Now talk about the characteristics of a trapezoid…two parallel bases and two lines connecting the bases that are not parallel.**
- **How are trapezoids different from parallelograms or rectangles?**
- **Now have students use their manipulatives again to help them find the formula for the area of a trapezoid.**
- **Have students show how they could use the area of a triangle to find the area of a trapezoid.**
- **Critical thinking: how could you use the area of a parallelogram to find the area of a trapezoid?**

- **Do Ex. 2 p. 541 as a class and then have students try Additional Ex. 2a and b. and check with their seat partner.**
- **Do real-life application, Ex. 3 p. 541…Finding the approximate area of Nevada. What could we do to find an even more exact area than the just using the formula for a trapezoid?**

#3-Practicing, reinforcing: *Modeling, giving instructions, checking for understanding, guided practice, independent practice, applying, posing and solving problems*

- **Lab Activity: Comparing Perimeter and Area of similar figures.**
  Critical thinking: can the area and perimeter of a 2 dimensional figure such as a rectangle, square, triangle, parallelogram or trapezoid be equal?
- **Enrichment Activity: Challenge wkst.**
  ***Do this activity instead of having them do the lab.**

(these two activities are explained at the end of this lesson plan)

#4-*Transcending:* Summing up, responding, creating, Performing, committing, evaluating, Closure

- Have students journal about the differences they found between area and perimeter. Did it surprise them that the area and perimeter were not equal? Have them write the formulas for the area and perimeter of a rectangle, parallelogram, triangle, trapezoid and the circumference of a circle. Have them rate their understanding of area and perimeter on a scale of 1-10 (1 "I am just about as lost as if I was on Mars," 10 being "Complete understanding-I'm dominating area and perimeter!" ;)

Modifications: How will you change the lesson to meet the needs of individual students?

___ Increase time, space, amount	___ Scribe for students with fine motor skill disabilities.	___ Include visuals: draw pictures of problems.
___ Decrease	___ Oral explanation	_X_ Use manipulatives: provide students with several triangle cutouts, so they can trace them, label the base and height, and trace the other half of a parallelogram with the same base and height.
___ Change	___ Peer/tutor/partner	_X_ Extend going through more guided practice problems. Review what it means to multiply by ½ and order of operations.

_X_ Other: ESL- Ask students to restate, in their own words, what the base and height of a triangle are. Ask them to draw a triangle and Label the base and height of it. Have students read formulas and make sure they use words for A, ½, b, h, l, and w. Ask them to show Where each part is on particular figures.

Who will require lesson modifications?

Personal notes/reminders/homework:

- **Some students may be tempted find the area of a triangle by mentally multiplying the base by the height, forgetting to multiply by ½. Have students write out the formula they are going to use until the formula becomes more intuitive. Make sure students understand why they are multiplying by ½.**
- **Homework:**
  -Remediation and Average (Blue and green groups): Quick Check: p.542-543: 8, 12, 20, 22 and problem solving problem: A flower bed is shaped like a trapezoid with a height of 3.5 yards, one 2.8-yard base, and another 4.6-yard base. A packet of flower seeds covers 5.6 square yards. What is the least number of packets needed to plant the flower bed!? Think about: relationships found in this section that are consistently true and allow us to solve more complex problems. Does this reflect God's consistency and unchanging hand in creation?
  -Enrichment: enrichment activity and problem solving problem above.

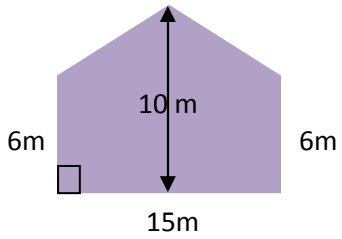
Post-lesson reflections:

Challenge!

Break it Up!

One way to find the area of this figure is to divide it into rectangles and triangles. Use this concept to find the area of the following figures.

1.



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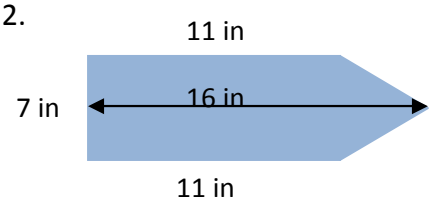

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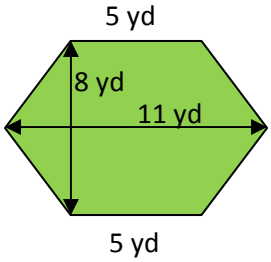

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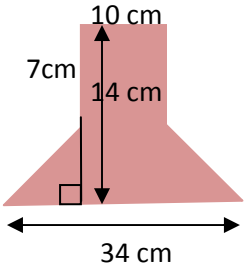

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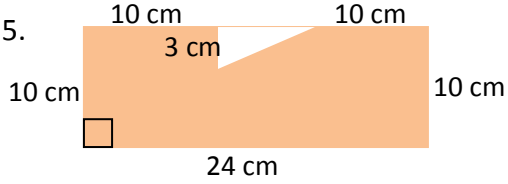

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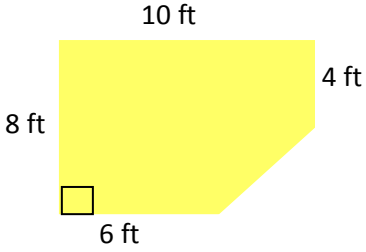


Lesson Plan Template - - H. Van Brummelen, *Walking With God in the Classroom*

Grade Level: 7th **Time: (45 min class)**

Curriculum Area: Measurement and Geometry **Unit topic: Measuring Two-Dimensional Figures**

Curriculum standards tied to this lesson:

NCTM:

Geometry:

- precisely describe, classify, and understand relationships among types of two- and three-dimensional objects using their defining properties;
- understand relationships among the angles, side lengths, perimeters, areas, and volumes of similar objects;
- draw geometric objects with specified properties, such as side lengths or angle measures;
- recognize and apply geometric ideas and relationships in areas outside the mathematics classroom, such as art, science, and everyday life.

Measurement:

- select and apply techniques and tools to accurately find length, area, volume, and angle measures to appropriate levels of precision;
- develop and use formulas to determine the circumference of circles and the area of triangles, parallelograms, trapezoids, and circles and develop strategies to find the area of more-complex shapes;
- understand, select, and use units of appropriate size and type to measure angles, perimeter, area, surface area, and volume.

IOWA CORE:

Solve real-life and mathematical problems involving angle measure, area, surface area, and volume.

- Know the formulas 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.
- Solve real-world and mathematical problems involving area, volume and surface area of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms.

Intended learning outcomes (to know, to do, to create, to value) aka Goals & Objectives:

- **To know how to find the area of a circle.**
- **To understand how the area of a parallelogram relates to the area of a circle.**
- **To understand how the area of a circle relates to real-life situations.**
- **To value consistent relationships found in geometry that reveal truth.**

Assessment strategies: How will you assess attainment of the intended learning outcomes?		
_x_ Observation of students during lesson	___ Rubric	___ Peer Assessment
___ Work samples/portfolio	_x_ Presentation or performance during circle/parallelogram activity	___ Self-assessment
___ Anecdotal notes	___ Learning log/journal	_x_ Focused questions throughout lesson
___ Interview/Conference	_X_ Other (explain): mini quiz, grade homework.	

Materials/preparation:
Curriculum text: Holt McDougal Mathematics Course 2, card-stalk circle manipulatives, protractor, ruler, calculator, colored pencils, calculator

Introduction:

#1-Setting the stage:

Engaging, motivating, experiencing, connecting with prior knowledge, reflecting, conjecturing posing problems

- Give mini quiz over perimeter, circumference, and area of rectangles, parallelograms, triangles and trapezoids.
- Intro: Ask students to describe what they would need to know to plan a pizza party for the class.
- Lead students to discuss how the size of the pizzas ordered affects the number of pizzas needed to feed the class.
- Discuss how you can find the best deal by comparing the unit cost per square inch of two differently sized pizzas if you can determine the area of each pizza, a circular figure.
- Have students brainstorm about how we used the perimeter to help us find the area of other shapes and what we would need to know about circles in order to find the area.
- Ask students if they have any ideas about how we could use the circumference of a circle to find its area.

Guided Learning Steps:

#2-Disclosing: *Acquiring knowledge/skills, conceptualizing, developing, understanding, integrating*

- Give each student in the class a circle made out of card-stalk paper, a protractor, and a ruler.
- Have students use the ruler to draw a line through the center of the circle splitting it in half and then have them color half the circle one color and the other half another color.
- Have some of them measure their circles into 12 equal sections, some 15 equal sections and some 18 sections using protractor. (you could have some of the more advanced students even try to cut measure their circle into even smaller sections.)
- Now have them cut out each of their equally measured sections to form a parallelogram.
- What is the area of a parallelogram?
- Have students now explore how they could write the formula for the area of a parallelogram in terms of the circumference of the circle. A=bh or A=1/2Cr
- Why do you need to multiply the Circumference by 1/2 ? Why is the radius equal to the height?
- Since $C=2\pi r$; $A=1/2(2\pi r)r=\pi r^2$
- Have students explain to their seat partner why this works! What does pi mean again!?

Why did we square r?

#3-Practicing, reinforcing: *Modeling, giving instructions, checking for understanding, guided practice, independent practice, applying, posing and solving problems*

- **Using $A=\pi r^2$ do Example 1 (p. 546) as a class.**
- **Have students try to do Additional Ex. 1 p. 547 and compare with their seat partner, then do Example 2 p. 547 individually.**
- **Work through Example 2 as a class.**
- **Do 'Measurement application' Example 3 p. 547**

Allow students to use calculator to find answers…ask them what other ways they could approximate the area of a circle if they didn't have a calculator. (22/7 or just using 3.)

- **Independent practice: 9-12**
- **ENRICHMENT: Problem Solving (TE p. 549: 1, 4, 5, 7)**

#4-*Transcending:* Summing up, responding, creating, Performing, committing, evaluating, Closure

- Problem solving: There is a water reservoir beneath a circular garden to supply a fountain in the garden. The reservoir has a 26-inch diameter. The garden has a 12-foot diameter. How much of the garden does not contain the water reservoir?
- Solve as a class
- Once, again we see relationships in geometry that are consistently true that allow us to find solutions and solve real-life problems. This is just one of the many ways we can see that we that we serve an unchanging and faithful God who holds every aspect of his creation together!

Modifications: How will you change the lesson to meet the needs of individual students?

___ Increase time, space, amount: Provide students who are struggling Some extra practice problems.	___ Scribe for students who have fine motor disabilities.	_X_ Include visuals: draw pictures of the problems.
___ Decrease	___ Oral explanation	_X_ Use manipulatives: use fraction circles instead of handmade manipulatives to help explain the area of a circle.
___ Change	___ Peer/tutor/partner: students who are struggling with area may benefit from having a tutor work with them one on one after school or even during class when doing independent practice.	___ Extend: create problem solving examples that help guide the student through the problems.

_X_ Other: ESL-go over Vocabulary used when finding area of a circle. Have them draw and label a circle.

Who will require lesson modifications?

Personal notes/reminders/homework:

- **For Ex. 20-22, caution students that substation into the formula for the area of the circle will leave r^2. To solve for r, they will have to ask themselves, "What number r when squared equals r^2?"**

- **Homework:**
  No homework for today! Buuuut…try to look for ways you see the concepts we've been using in geometry being used in everyday life. Ask your parents, friends, relatives how they use geometry in their everyday lives, if not every day, when have they used it to solve a problem? You might have to share with them what we've been doing in class to give them some ideas!

Post-lesson reflections:

Challenge!

Area of Circles

1. According to the Royal Canadian Mint Act, a 50-cent Canadian coin must have a diameter of 27.13 millimeters. What is the area of this coin to the nearest tenth of a square meter?

4. A frying pan has a diameter of 11 inches. What is the area to the nearest square inch of the smallest cover that will fit on top of the frying pan?

5. In the state of Texas, Austin is about 80 miles northeast of San Antonio. What area is represented by all of the land within 80 miles of San Antonio?

a. 251.2 mi^2

b. 502.3 mi^2

c. 5,204 mi^2

d. 20,096 mi^2

7. A round dining table has a diameter of 2.5 meters. A round tablecloth has a diameter of 3.5 meters. What is the area to the nearest tenth of a meter of the part of the tablecloth that will hang down the side of the table?

a.18.8 m^2

b. 6.3 m^2

c. 4.7 m^2

d. 1.0 m^2

Show what you know!

Quiz: (Draw a picture, write formula used, show your work.)

1. Find the perimeter of a 10 in. by 8 in. rectangle.

2. What is the circumference of a circle with a radius of 8 in.? Use 3.14 for π.

3. Diego is building a rectangular platform measuring 36 in. by 54 in. What is the area of the platform in square feet?

4. What is the area of a parallelogram whose height is 4.5 ft and base is 6.25 ft?

5.What is the height of a triangle with area 36 cm^2 and base 9 cm?

6. The bull's eye on a target has diameter 2 in. What is the area of the bull's-eye to the nearest tenth? Use 22/7 for π.

Lesson Plan Template - - H. Van Brummelen, ***Walking With God in the Classroom***

Grade Level: 7th

Time: (45 min class) (2 days)

Curriculum Area: Measurement and Geometry

Unit topic: Measuring Two-Dimensional Figures

Curriculum standards tied to this lesson:

NCTM:

Geometry:

- precisely describe, classify, and understand relationships among types of two- and three-dimensional objects using their defining properties;
- understand relationships among the angles, side lengths, perimeters, areas, and volumes of similar objects;
- draw geometric objects with specified properties, such as side lengths or angle measures;
- recognize and apply geometric ideas and relationships in areas outside the mathematics classroom, such as art, science, and everyday life.

Measurement:

- select and apply techniques and tools to accurately find length, area, volume, and angle measures to appropriate levels of precision;
- understand, select, and use units of appropriate size and type to measure angles, perimeter, area, surface area, and volume.

IOWA CORE:

Understand and apply the Pythagorean Theorem.

- Explain a proof of the Pythagorean Theorem and its converse.
- Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions.
- Solve real-world and mathematical problems involving area, volume and surface area of two- and three-dimensional objects composed of triangles, quadrilaterals, polygons, cubes, and right prisms.

Intended learning outcomes (to know, to do, to create, to value) aka Goals & Objectives:

- To know and understand the Pythagorean Theorem
- To value how the Pythagorean theorem can be used in real-life situations and subject areas
- To create their own problem that can be solved using the Pythagorean theorem.
- To value the unchanging order of God's creation.

Assessment strategies: How will you assess attainment of the intended learning outcomes?		
_X_ Observation students during lesson.	___ Rubric	___ Peer Assessment
___ Work samples/portfolio	_X_ Presentation or performance: creating a problem that uses the Pythagorean Theorem	___ Self-assessment
___ Anecdotal notes	_X_ Learning log/journal about real world applications.	_X_ Focused questions throughout lesson
___ Interview/Conference	___ Other (explain): grade homework.	

Materials/preparation:
Curriculum text: Holt McDougal Mathematics Course 2, History Link transparency, graph paper, picture of the pyramids.

Introduction:

#1-Setting the stage:

Engaging, motivating, experiencing, connecting with prior knowledge, reflecting, conjecturing posing problems

- Use transparency for the "History Link" on p. 569
- Talk about how the Egyptians build pyramids to serve as tombs for their kinds.
- Give example of pyramid, Menkaure(extra credit if you know how to say the names of these pyramids! No, not really!), which has a square base with an area of about 12,100 m^2.
- Connecting to previous lessons:
    - Using knowledge about the area and perimeter of a square, find the length of each side.
- Ask students to find the length of the diagonal of the base, rounding answer to the nearest tenth. (We have not talked about how to do this yet…just getting them to start thinking!)
- Now look at the pyramid Khafre p. 569: Use previously learned concepts about triangles and squares to find the area of one side of the pyramid.
- Using information we already know, can we find the distance from one corner of the Pyramid of Khafre to its peak?
- Stumped?!? In order to find the hypotenuse of right triangles we must discover the relationship between the two legs of a right triangle and the hypotenuse…the Pythagorean Theorem!!

Guided Learning Steps:

#2-Disclosing: *Acquiring knowledge/skills, conceptualizing, developing, understanding, integrating*

- Hand out pieces of graph paper and rulers/straight edges to students and have them all construct a right triangle with two legs of length 3 and 4 units.
- Now have them draw three squares on the sides of their triangle. Allow the first part of the Smartboard manipulative to play to provide an extra visual that they can follow along with.
- Just like the manipulative shows, have them label each of their sides a, b, and c.
- Talk about why each square they drew would equal a^2, b^2, c^2 (A of a square=s^2)
- Beside their triangle have them figure the area for each of their squares, then play the Smartboard manipulative to reveal whether or not their answers are correct.
- The Smartboard manipulative then claims that the area of the largest square equals the sum of the area of the smaller squares…have students check to see if this is true.

- If this is true, have students try to create a formula that displays this relationship.
- Play the rest of the introduction of the SmartBoard manipulative to see if the students found the correct relationship.
- Does this relationship work for all triangles?! Just right triangles?! All right triangles?!
- Have students draw a triangle on their graph paper that is not a right triangle and investigate whether or not the Pythagorean theorem works.
- Now let's see if the Pythagorean theorem works for all right triangles. Show them that the right triangle they drew with sides 3, 4, 5 forms a Pythagorean triple. Play the Smartboard manipulative part about Pythagorean Triples.
- Conclude: Pythagorean Theorem works for all right triangles and a Pythagorean triple is a set of 3 positive integers in which $a^2 + b^2 = c^2$.
- What can the Pythagorean Theorem be used for…why is it useful? In math: finding missing sides of right triangles, figuring out whether a triangle is a right triangle, problem solving. What about in real-world problems?

#3-Practicing, reinforcing: *Modeling, giving instructions, checking for understanding, guided practice, independent practice, applying, posing and solving problems*

- Now go to the problem solving section of the Smartboard manipulative and play the part called identifying right triangles.
- Have students make an educated guess about which of the two triangles will be a right triangle or are they both right triangles (they look like right triangles) before working the problem using the Pythagorean Theorem. Discuss predictions as a class.
- Have students work the problem using the theorem. Were their predictions correct? If not, why? Play SmartBoard manipulative to see if they followed the same steps…if not, how did they do the problem, what did they do incorrectly…talk about any misconceptions.
- So, we can find the length of a missing edge of a right triangle and we can figure out whether or not a triangle is a right triangle, but how does this apply to real life? When might we use the Pythagorean Theorem?
- Play the application part of the Smartboard manipulative and have students try to solve the problem individually. Answer = 127.28 ft from 3^{rd} base to 1^{st} base
- Another real world example: SmartBoard manipulative. Have students try to do problem individually.
- Once students have come up with a solution, play the solution on the SmartBoard Manipulative.
- Have students think of other real world applications of the Pythagorean Theorem.
- If time allows, do SmartBoard Manipulative Quiz to review concepts of the Pythagorean Theorem.
- **ENRICHMENT 1: I made a webquest on zunal.com → "Soccer Conditioning with Pythagorean)**
  ***They would probably have to do this during a separate class period or for homework.**

#4-*Transcending:* Summing up, responding, creating, Performing, committing, evaluating, Closure

- Journal about real-world situations, other than the ones we've already discussed, in which the Pythagorean Theorem would be useful.
- Create a problem of your own that uses the Pythagorean Theorem.
- Could this formula/relationship have redeeming value?

Modifications: How will you change the lesson to meet the needs of individual students?		
_X_ Increase time, space, amount: Create time for students to come in early or stay after school to get extra help.	___ Scribe for students with fine motor skill disabilities.	_X_ Include visuals: have student continue to represent the problems using graph paper to gain a better understanding of the theorem.
___ Decrease	___ Oral explanation	___ Use manipulatives
___ Change	___ Peer/tutor/partner: work with a partner during the lesson activity.	_X_ Extend: use guided problem solving to work through problems.
_X_ Other: extra practice worksheets.		
Who will require lesson modifications?		

Personal notes/reminders/homework:

- **Some students might confuse the legs and the hypotenuse of a right triangle when substituting values in the Pythagorean Theorem. Emphasize that the hypotenuse is always the longest side since it's the opposite and the greatest angle in the triangle.**
- **All students: Homework: have them go back to the History Link problems that we discussed at the beginning of class and using the Pythagorean Theorem finish the problems we were not able to do before we learned the theorem.**

Post-lesson reflections:

Test #9

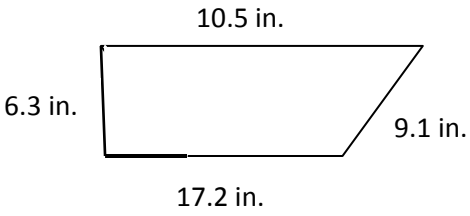
Measurement: Two-Dimensional Figures

Read the instructions carefully for each section. Show ALL of your work!

Choose the more precise measurement in each pair.

1. 80 m, 7.8 cm **2.** 18 yd, 5 mi **3.** 500 lbs, 18 oz

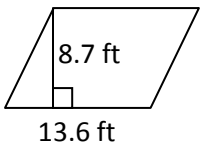
4. Find the perimeter of the trapezoid.



5. The opening of a playscape tunnel has a circumference of 25 ft. What is the radius of the tunnel to the nearest tenth?

Find the area of each figure.

6.



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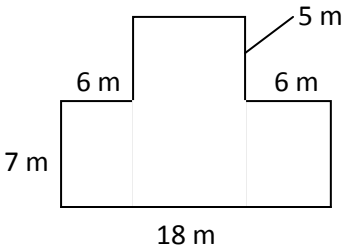

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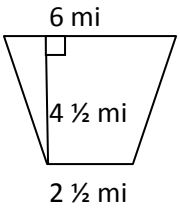


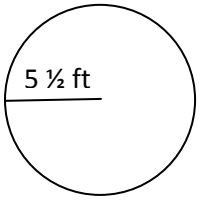
9. The area of a rectangular computer lab is 660 ft², and the width is 22 ft. What is the length of the computer lab? Give formula.

10. The area of a circular fountain is 66 cm2. What is its radius to the nearest tenth? Give formula.

11. The area of a triangle is 40 m^2, and the base is 10 m. What is the height? Give Formula.

Use the diagram for Question 12 and 13.

12. Find the circumference of the circle to the nearest tenth.

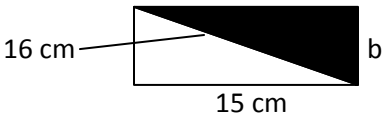


13. Find the area of the circle to the nearest tenth.

Find each square or square root.

14. 15^2 **15.** 23^2 **16.** The square root of 1600 **17.** Square root of 961

18. The tiles of Sara's new floor are black and white as shown. What is the missing length to the nearest tenth?



19. Triangle park has a trail that follows the path of a right angle. One leg of the trail is 2.1 miles, and the other leg is 3.0 miles. What is the distance of the third side of the trail to the nearest tenth of a mile?

20. In what ways have you seen God's creational order through the geometry concepts discussed in this chapter? List one way geometry can have redeeming value.

<u>Extra Credit: Real-World Connection on p. 571 in your textbook!</u>

Show your work and solve the problems in the space provided below.