Lesson Plan 8-2A

Text: Financial Algebra
Chapter: 8-Independent Living
Section 2-Read a floor plan
Developed by: Samuel McNeill
Date: 6/26/2012

Short Description:

After completing 8-1, this lesson plan introduces students to using perimeter, area, and volume with potential floor plans of rooms and houses. Students will use measures and conversion of measures to determine costs in one, two, and three dimensions. They also are introduced to a new way to determine the area of any regular polygon.

LESSON PLAN

TEACHER: Teacher Prep/ Lesson Plan

- **Lesson Objectives (Students will be able to convert measures and use formulas to find area and volume)**

- **List of prerequisite skills needed:**
  1. **understand perimeter and area of rectangles/triangles**
  2. **solve proportions**

- **Vocabulary: area, perimeter, molding, apothem, length, width, height, volume**

- **State Standards addressed:**
  Math: G.6.F—solve problems involving measurement conversions
  G.7.A—analyze a problem situation and represent it mathematically

- **Teacher Preparation:** *Demonstration worksheet "Demo 8-2A" with examples 1,3,6 from text set up with space to do these examples with students. Teacher and each student needs a copy.*

- **Content Delivery:** *Direct instruction. With class opener, have students find the area and perimeter of a rectangle representing a basic floor plan of a shed. Hand out Demo 8-2A and do these three examples as a class (these are examples 1,3,6 from page 394 in the text)*

- **Instructional Documents** *see Demo 8-2A*

- **Assessment Tool used in this Lesson** *problems from page 399;2-5; formatively check student's ability with these the next day in class.*

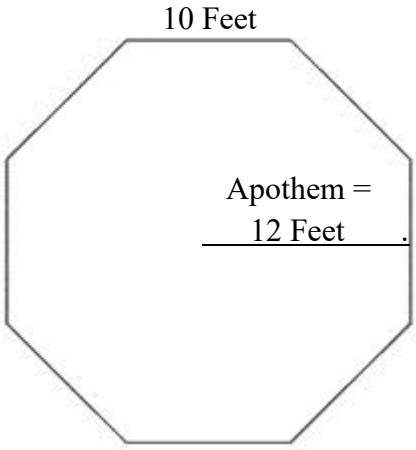
- **Extend with #6 on page 400 ; Could have struggling students just do 2&5.**

A) Jerry is using the floor plans for his new home to help him purchase base molding for the place where the walls meet the floor. The plans are drawn using a scale of ¼ inch represents 1 foot. With a ruler he discovers the plans show he needs 23 ½ inches. If molding costs $2.10 per foot, how much will Jerry need to spend?

Decide how many feet of molding :

Use length in feet to find cost :

B) Del's Landscape Design is building a large gazebo for a backyard. It is in the shape of a regular octagon. Each side of the gazebo is 10 feet. They need to purchase wood for the floor. It costs $14 per square foot for the special type of wood. Find the cost of the gazebo's floor.



All eight sides of the regular octagon are congruent, so they all have the same length. To find the area of a regular octagon, you need its apothem and its perimeter. The apothem is a line segment through the center of a regular polygon that is perpendicular to a side.

$A = \frac{1}{2} ap$ Where: A is the area of the regular polygon,
a is the apothem
p is the perimeter

C) Mike's bedroom measures 16 feet by 14 feet, and has a 9-foot ceiling. It is well insulated and on the west side of his house. How large of an air conditioner should he purchase?

Find the volume (length x width x height) :

Determine BTU rating

BTU (British Thermal Units) ≈ "while" divided by 60

While = w×h×i×l×e = _____

W=width of room (in ft)
H=height of room (in ft)
I= insulation level (well-insulated = 10 ; poorly insulated = 18)
L=length of room (in ft)
E=exposure to sun (north, e = 16; east, e = 17; south, e = 18; west, e = 20)

Financial Math

Quiz 8-2A

Name _____ **Period** _____

Directions: You may use a calculator to answer the following questions/problems, however, you must show how you got your answers by showing your work, (even if you can do it in your head).

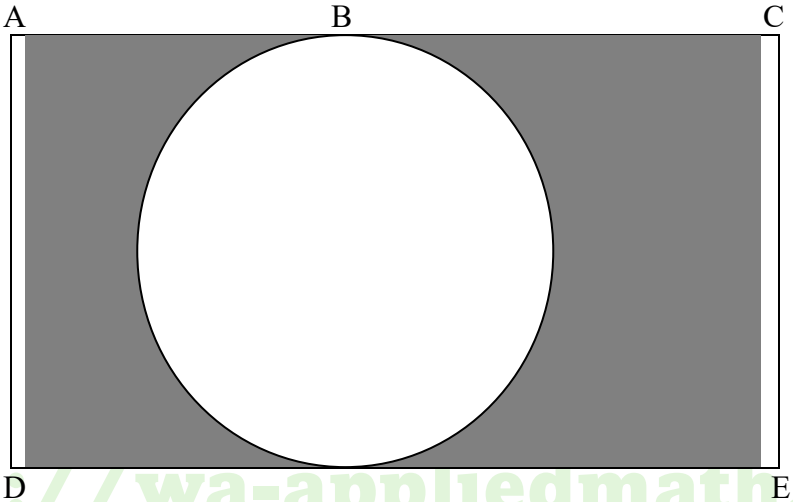
1. The length of a room is 19 ½ feet. When using a ¼ inch = 1 foot scale, what would be the length of the line that represents the wall on a floor plan?

2. Kim is building a large gazebo for her backyard. It is in the shape of a regular hexagon. Each side of the gazebo is 12 feet long. The apothem is 10.4 feet. She needs to purchase stones for the floor. It costs $9.50 per square foot for a special type of interlocking stone. Find the cost of the gazebo's floor rounding your answer to the nearest ten dollars.

   Area of a hexagon = 6 x (.5 x side length x apothem)

3. Find the volume of a rectangular room that measures 13 feet by 15.5 feet with an 8 foot ceiling.

4. The circle below is situated in the rectangle ACDE as shown below. The distance between AB is 10 units, the distance between BC is 18 units, the distance between A and D is 14 units. Area of a circle = πr^2 . Use 3.14 for π. Find the area of the shaded region.



Key

1) 4.875 or 4 7/8 inches
2) Area of 374.4 square feet will cost $3560
3) 1612 cubic feet
4) 238.14 square units

Lesson Plan 8-2B

Text: Financial Algebra
Chapter: 8-Independent Living
Section 2-Read a floor plan
Developed by: Samuel McNeill
Date: 6/26/2012

Short Description:

After completing 8-2A, this lesson addresses how to find irregular shaded regions within a polygon. Connecting to formulas from last lesson, this will introduce the idea of adding or subtracting shapes to get the area needed for a particular job—flooring, paint, etc.

LESSON PLAN

TEACHER: Teacher Prep/ Lesson Plan

- **Lesson Objectives (Students will be able to convert measures and use formulas to find area and volume)**
- **List of prerequisite skills needed:**
  understand area of polygons
- **Vocabulary: area, circle, radius, pi**
- **State Standards addressed:**
  Math: G.6.F—solve problems involving measurement conversions
  G.7.A—analyze a problem situation and represent it mathematically
- **Teacher Preparation:** *Demonstration worksheet "Demo 8-2B"*
- **Content Delivery:** *Direct instruction with guided practice. With class opener, have students find the area and perimeter of an octagon floor plan, given apothem 12cm and side length 10 cm. Transition into "Demo 8-2B". The first problem shows the octagon problem a different way—use to discuss piecewise approach of a combination of shapes. The next example shows cutting out a full circle before addressing example 2 in the book with a quarter circle getting removed.*
- **Instructional Documents** *see Demo 8-2B*
- **Assessment Tool used in this Lesson** *Practice 8-2B*

Financial Math Demo 8-2B

1. Take a piece of grid paper and place a point at the middle. Draw a line twelve units down to represent an apothem. Let's complete a drawing of an octagon that uses an apothem of 12 units and sides of 10 units. Use the grid paper to find the area.

   What is the area of a square that would encase the octagon? (24×24=576 sq units)

   What shapes need to be subtracted out? (triangles)

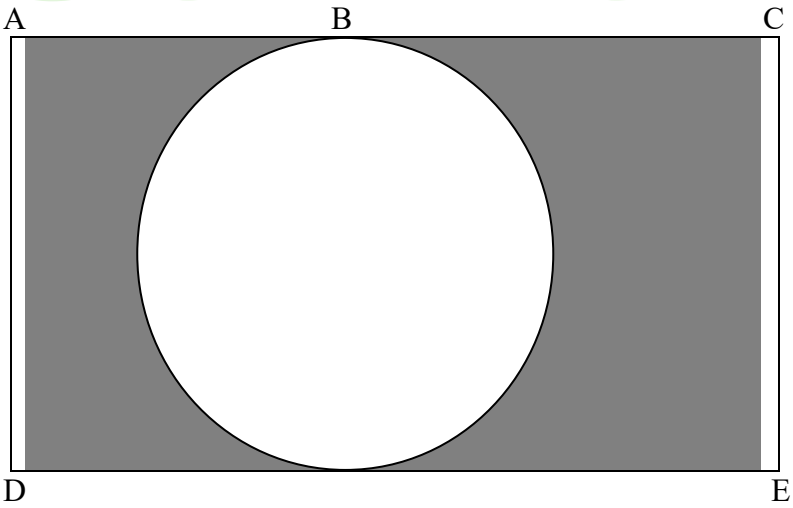
   What is the area of one?

   What area needs to be subtracted?

   Final area of octagon?

   Why is this answer a little different than our warm up?

2. The circle below is situated in the rectangle ACDE as shown below. The distance between AB is 12 units, the distance between BC is 20 units, the distance between A and D is 16 units. Area of a circle = Pi 3.14159 X radius^2



   A) Find the area of the rectangle.

   B) Find the radius of the circle.

C) Find the area of the circle to the nearest whole number.

D) Find the area of the shaded area.

Financial Math Demo 8-2B

1. Take a piece of grid paper and place a point at the middle. Draw a line twelve units down to represent an apothem. Let's complete a drawing of an octagon that uses an apothem of 12 units and sides of 10 units. Use the grid paper to find the area.

   What is the area of a square that would encase the octagon? (24×24=576 sq units)

   What shapes need to be subtracted out? (triangles)

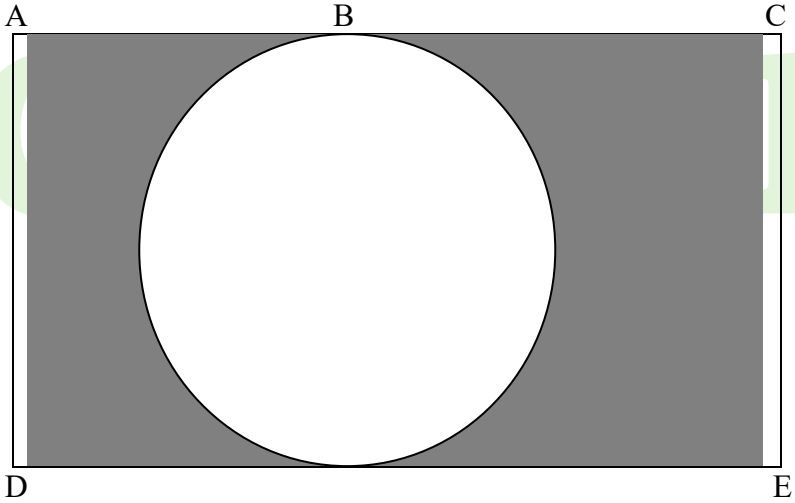
   What is the area of one? (.5x7x7 = 24.5 sq units)

   What area needs to be subtracted? (4x24.5 = 98 sq units)

   What is the final area of octagon? (576 – 98 = 478 sq units)

   Why is this answer a little different than our warm up? (A regular octagon with an apothem of 12 would have side lengths of about 10, not exactly 10)

2. The circle below is situated in the rectangle ACDE as shown below. The distance between AB is 12 units, the distance between BC is 20 units, the distance between A and D is 16 units. Use 3.14 for π. Area of a circle = πr^2



   A) Find the area of the rectangle. (22x16 = 352 sq units)

   B) Find the radius of the circle. (16/2 = 8 units)

   C) Find the area of the circle to the nearest whole number. (3.14x8x8 ≈201 sq units)

   D) Find the area of the shaded area. (352 – 201 = 151 sq units)

3. Gabriela plans to carpet her living room, except for a quarter-circle area in the corner. That area will be a wood floor where she will put her piano. The dimensions of her living room are 25 feet by 16 feet and the radius of the quarter circle is 8 feet. If carpeting costs $9.55 per square foot, what is the cost of the carpeting needed in her living room?

Label dimensions and sketch quarter circle in one of the corners.

Area of rectangle = _____

Area of quarter circle = _____

Area of carpeted region = _____

Cost of carpeting = _____

Financial Math Demo 8-2B

1. Take a piece of grid paper and place a point at the middle. Draw a line twelve units down to represent an apothem. Let's complete a drawing of an octagon that uses an apothem of 12 units and sides of 10 units. Use the grid paper to find the area.

   What is the area of a square that would encase the octagon?

   What shapes need to be subtracted out?

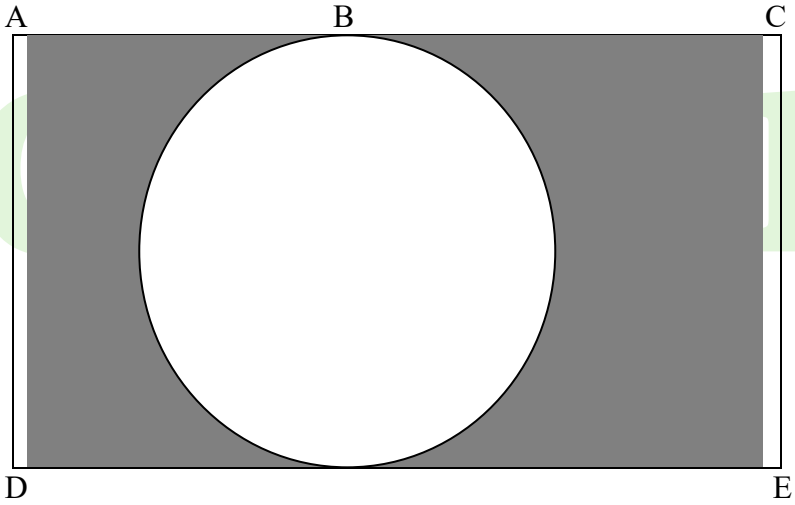
   What is the area of one?

   What area needs to be subtracted?

   What is the final area of octagon?

   Why is this answer a little different than our warm up?

2. The circle below is situated in the rectangle ACDE as shown below. The distance between AB is 12 units, the distance between BC is 20 units, the distance between A and D is 16 units. Use 3.14 for π. Area of a circle = πr^2



   A) Find the area of the rectangle.

   B) Find the radius of the circle.

   C) Find the area of the circle to the nearest whole number.

   D) Find the area of the shaded area.

3. Gabriela plans to carpet her living room, except for a quarter-circle area in the corner. That area will be a wood floor where she will put her piano. The dimensions of her living room are 25 feet by 16 feet and the radius of the quarter circle is 8 feet. If carpeting costs $9.55 per square foot, what is the cost of the carpeting needed in her living room?

Label dimensions and sketch quarter circle in one of the corners.

Area of rectangle = _____

Area of quarter circle = _____

Area of carpeted region = _____

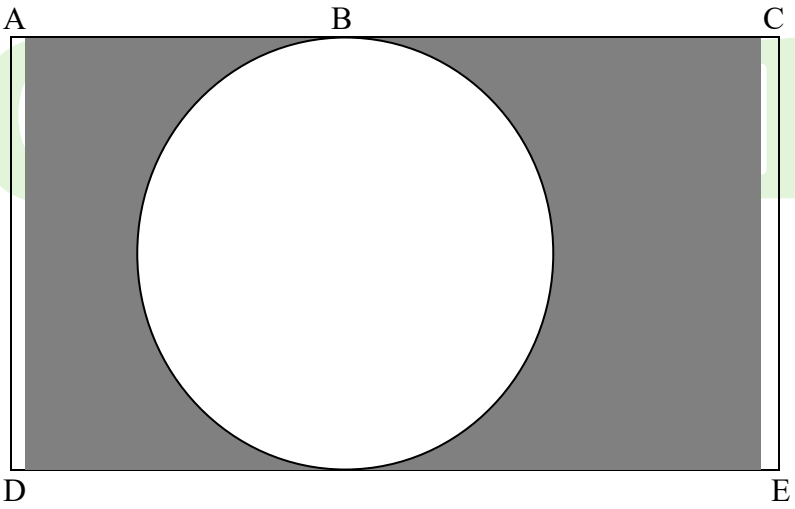
Cost of carpeting = _____

Name_____ **Practice 8-2B**

Financial Math

1. Open to page 400 and complete #8 in the space provided. Show your work.

2. The circle below is situated in the rectangle ACDE as shown below. The distance between AB is 18 units, the distance between BC is 24 units, the distance between A and D is 20 units. Use 3.14 for π and area of a circle = πr^2



A) Find the area of the rectangle.

B) Find the radius of the circle.

C) Find the area of the circle to the nearest whole number.

D) Find the area of the shaded area.

3. Paula is covering her yard with sod which costs $4.50 per square yard. Her yard is rectangular, 50 feet by 120 feet, but with a semicircular pond at one end with a diameter of 40 feet.

A) Sketch a picture of Paula's yard with the pond. Shade the part she will need to cover with sod.

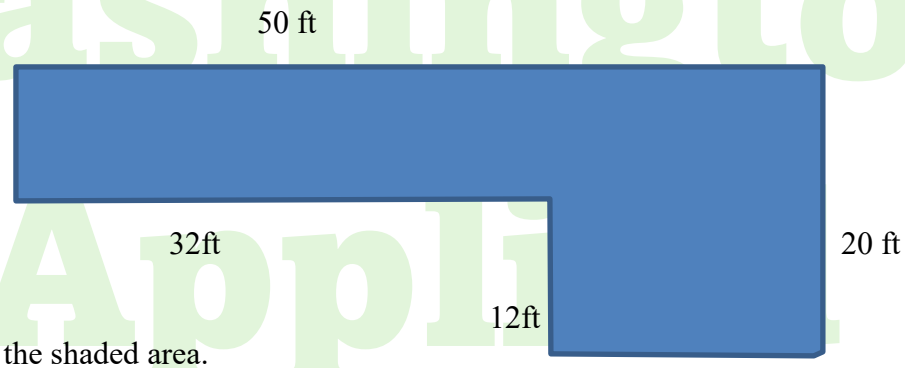
B) What is the area of the shaded region in square yards? (Check your answer a different way. Did you account for how many square feet are in a square yard—it's not 3!)

C) How much will Paula have to pay for her sod?

D) Her friend showed her a deal at Sod-n-Save for $.60 per square foot. Should Paula use her original price or go with Sod-n-Save? Show how you know.

Name_____ **Irregular Shape Quiz**

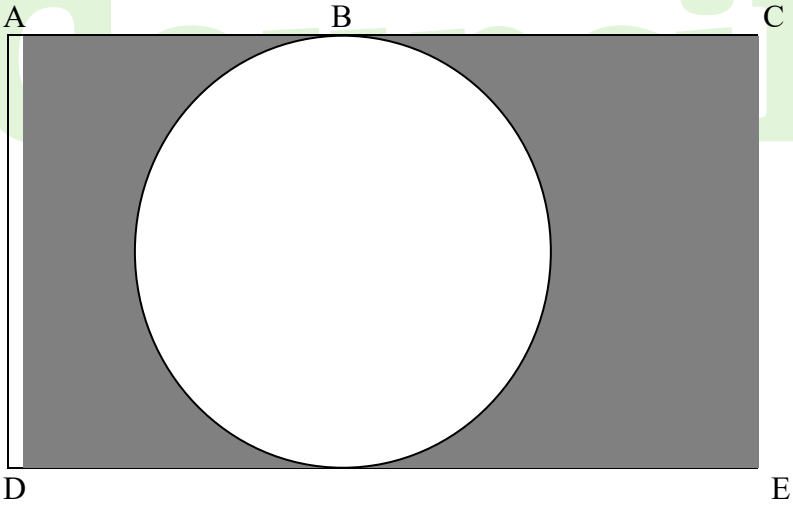
1.



A) Find the shaded area.

B) How much would it cost to carpet this area if it cost $13.75 per square foot?

2. The circle below is situated in the rectangle ACDE as shown below. The distance between AB is 20 units, the distance between BC is 30 units, the distance between A and D is 30 units. Use 3.14 for π and area of a circle = πr^2



A) Find the area of the rectangle.

B) Find the radius and area of the circle.

C) Find the area of the shaded region.

3. Paula is covering her yard with sod which costs $3.50 per square yard. Her yard is rectangular, 60 feet by 150 feet, but with a quarter circle pond at one corner with a radius of 40 feet.

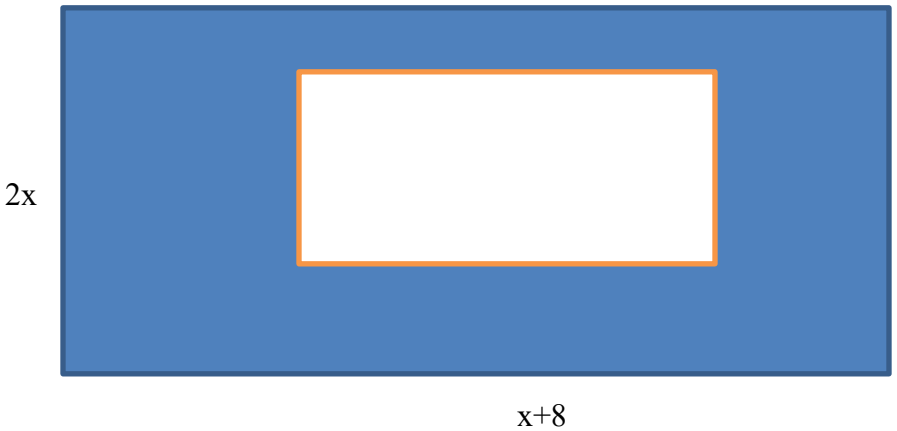
A) Use the sketch below of Paula's yard with the pond. Shade the part she will need to cover with sod.

B) What is the area of the shaded region in square yards?

C) How much will Paula have to pay for her sod?

D) Her friend showed her a deal at Sod-n-Save for $.30 per square foot. Should Paula use her original price or go with Sod-n-Save? Show how you know.

4. BONUS Find an algebraic expression for the area of the shaded region if the inside rectangle is 4 units long and x units wide.



Monte Carlo method

Text: Financial Math
Chapter: 8—Independent Living
Unit number: 2 Title of unit: Floor plans
Developed by : Samuel "Oliver" McNeill
oliver_mcneill@sumnersd.org
Date: 6/28/2012

Attach the Following Documents

1. **Lab Instructions**
2. **Student Handout(s)**
3. **Rubric and/or Assessment Tool**

Short Description (Be sure to include where in your unit this lab takes place):

This lab will come at the end of 8-2 and shows students how the Monte Carlo method works. Students will randomly generate number pairs to use in order to approximate the area of an irregular shape that can be framed inside a rectangle.

When in Monte Carlo….

LAB PLAN

TEACHER: *(Teacher Prep/Lab Plan)*

- **Lab Objective—students will use the monte carlo method to find the area of two dimensional shapes.**
- **Statement of prerequisite skills needed**—area of two dimensional shapes from formulas and adding/subtracting known areas.
- **Vocabulary : area, random, coordinate plane graphing**
- **State Standards addressed:**
  Math: G.6.E Apply estimation strategies to obtain reasonable measurements with appropriate precision for a given purpose.
  Reading: 1.2.2 Apply strategies to comprehend words and ideas
  Writing: 3.2.2 Use language appropriate for specific purpose
- **Leadership Skills**
  Work with a partner or in a group of three to solve a problem.

- **SCAN Skills/Workplace Skills**
  Students will discuss and understand the problem, work together to record results. Students will also complete basic computation.

- **Teacher Preparation:** *(What materials and set-up are required for this lesson?)*
  - Materials: calculators with random number generator and grid paper
  - Set-Up Required: draw picture of octagon from example 3 on page 397 on grid paper as well as the garden picture on separate grid paper from example 4 on page 397. Each pair of students should have a copy of each page. Also each student should have a copy of the student pages for the lab (pages 3-5 of this document). **When doing the RANDOM work with students, have each student using a graphing calculator set their starting value by typing a unique number "STO>" and "RAND" and then "ENTER" (this will make sure no two students get the same random numbers.**

- **Lab Organizational Strategies:**
  - Grouping/Leadership/Presentation Opportunities:
    Students will be sharing in pairs and groups of four, presenting results.
  - Cooperative Learning:
    Students will use each other to make decisions and record results.
  - Expectations:
    Students complete their individual responsibility during class.
  - Time-line:
    Should work for 60 minute class (90 minute would be better)

- **Post Lab Follow-Up/Conclusions** *(to be covered after student completes lab)*
  - Discuss real world application of learning from lab:
    If we needed the size of a lake, or something larger, how could the Monte Carlo be used?
  - Career Applications:
    How might a surveyor make use of this method? Military application?
  - Optional or Extension Activities:
    Create your own design and find it's area.

Monte Carlo Scoring

On time : _____ out of 5 points possible

Followed directions : _____ out of 5 points possible

Complete : _____ out of 5 points possible

Reasonable answers : _____ out of 5 points possible

5 = professional 4 = proficient 3 = working towards proficient 2 = too much missing

Some shapes are not so easy to break into smaller pieces and use addition or subtraction to calculate the precise area. Today you will find out how to get an approximate area using the Monte Carlo method.

Let's start with a shape we are familiar with to see how it works.

1. With a partner, take a look at the octagon and remind yourselves of the area we calculated.
   Area = _____

2. Now notice that on today's picture, an x and y axis have been added so our shape is now on a coordinate plane. In order to use the Monte Carlo, you have to be able to tell if a point is in our target shape or not. With your partner, evaluate these five points:

Point	Is it in our hexagon? Y or N
(2 , 1)	
(21, 2)	
(3.5 , 21)	
(17.5 , 0.5)	
(13.23, 18.45)	

Check your answers in the table with at least one pair near you. Did you agree? If not, explain the issue.

3. Another skill you will need is the ability to generate random numbers. We will use our calculators for that. Find "RAND" on your calculator. On the graphing calculators, press "MATH" and choose the "PRB" menu—"RAND" will be the first choice. Select it by pressing "ENTER" and notice you get a decimal. Since our octagon fits on a 24 by 24 grid, we will need numbers from 0 to 24, so this time calculate "24*RAND" and notice your answer is in that range. Now use this process to create your own points to evaluate, round each to the nearest hundredth

Point	In target shape?

Point	In target shape?

4. Count up how many Y's you found. That number represents the number of randomly generated points were inside the shape. What percent of your points are these (It is out of ten, so if you had 3 Y's, it would be 30%, etc.)? _____

5. Find this percentage of our big rectangle frame. _____. Right now this is your Monte Carlo estimate for the area. How close are you and how much faith do you have in this method right now?

6. Now, combine your Y's with your partners and you have a total out of 20. What is that percent? _____. Find this percentage of our total rectangle area._____. Are we getting closer to what the area should be? And are you gaining confidence in the method? Explain.

7. Now let's get the class results:

   Total Y's =

   Total points =

   Class percentage =

   Class's Monte Carlo estimate =

8. Some shapes do not have an area we can find another way, so we have to trust the method. What could we do to get our answer more accurate?

9. Since you know how it works, you are now ready for the big time so take a look at the grid with the "GARDEN". No straight edges on this target shape, but lucky for you the Monte Carlo can still be used. Start by getting your own individual random points. Notice the rectangular frame uses more possible x-values than y-values. Show how you will account for the difference as you generate random numbers with your calculator.

   For x coordinate, type _____

   For y coordinate, type _____

CHECK THIS ANSWER WITH PARTNER AND TEACHER BEFORE GOING ON!

10. Now go ahead and create your own points to evaluate, round each number you use to the nearest hundredth.

Point	In target shape?

Point	In target shape?

11. What percent of your ten are Y's ?

12. So based on your ten, the area of the garden = _____.

13. Combine your results with your partner. Total Y's =

Total points =
(20, unless group of 3) Percentage of Y's = Target area =

14. Finish with the class results:

Total Y's =

Class percentage = Class's Monte Carlo estimate =

15. Wrap up—does this answer seem reasonable? If graduating depended on an answer within 10% of the exact, how comfortable are you leaving it as is? What could you do to have a more accurate result?

Financial Math

Quiz 8-2 / 8-3

Name _____ **Period** _____

Directions: You may use a calculator to answer the following questions/problems, however, you must show how you got your answers by showing your work, (even if you can do it in your head).

1. Jill plans to put a new wood floor in her den, which measures 17 feet by 14.5 feet.
   A) What is the area of the floor?

   B) At a cost of $11 per square foot, how much will it cost to put down the new floor?

   C) Jill plans to put an area rug in the room. The rug will be large enough so that only a 2-foot wide section of the wood floor will be exposed. Find the dimensions of the area rug.

   D) What is the area of the area rug?

   E) Find the area of the wood floor that will be exposed once the area rug is laid down.

2. A rectangular room measures 16 feet by 18 feet. The ceiling is 9 feet high.
   A) Find the total area of the four walls in the room.

   B) If a gallon of paint costs $37.99 and it covers 400 square feet on average. How many gallons of paint will need to be purchased?

   C) What is the cost of painting the room, including the ceiling, with two coats of paint?

3. The assessed value of the Kreiner family's house is $457,000. The annual property tax rate is 2.66% of assessed value. What is the annual property tax on the Kreiner's home?

4. The annual tax for property in Washington is based on the tax rate of $13.69 per $1,000 of the property's assessed value. If a home has an assessed value of $329,500 what are the annual taxes?

5. The market value of Jennifer and Neil's home is $319,000. The assessed value is $280,000. The annual property tax rate is $19.70 per $1,000 of assessed value.

   A) What is the property tax on their home?

   B) How much do they pay monthly toward property taxes?

Key

1) A) 246.5 square feet
   B) $2,711.50
   C) 13 feet by 10.5 feet
   D) 136.5 square feet
   E) 110 square feet

2) A) 612 square feet
   B) 2 gallons of paint will be needed.
   C) $189.95 (1800 square feet will require 5 gallons)

3) $12,156.20

4) $4,510.86

5) A) $5,376
   B) $448

8-2 Websites that can help

http://tibasicdev.wikidot.com/home : this site will help with remembering how to use the TI-83 or 84 calculators along with programming ideas.

http://www.calculator.net/btu-calculator.html :this page provides a btu calculator, but the site includes calculators for much more. Could be fun to spend some time showing to classes.

http://floorplanner.com :this site has a free sign up, but you can investigate with class in demo mode. Could be helpful if you decided to include designing a floor plan with the class.