

# Geometry

## Deconstructing Burbank

Subject Area: Geometry

Grade Levels: 9-12

Date: 11/01/09

### Lesson Overview

#### Previous Knowledge Required for Lesson:

Sections from McDougal Littell Geometry, California Edition, © 2001

- 1.3 Segments & Their Measures
- 1.4 Angles & Their Measures
- 1.7 Introduction to Perimeter, Circumference, & Area
- 6.7 Areas of Triangles & Quadrilaterals
- 8.3 Similar Polygons
- 9.2 The Pythagorean Theorem
- 11.3 Perimeters & Areas of Similar Figures
- 12.2 Surface Area of Prisms & Cylinders
- 12.4 Volume of Prisms & Cylinders
- 12.7 Similar Solids

#### Materials Included in this Lesson

- Handouts (Scale Worksheet, Sample Floor Plan, Floor Plan Symbols)
- Examples of Student Work

#### Other Materials for this Lesson

- Sample plans from an existing building
- Photos of construction process
- Architectural scales
- Measuring tapes
- Graph paper

#### Skills the Student will Learn

- measuring dimensions of an actual building
- using an architectural scale to make a scale model (similarity) of a building floor plan and unit plans
- using concepts of area and perimeter to estimate amount of concrete used in interior walls, bricks used in exterior walls, and paint used on interior of classrooms.
- estimating cost of materials for concrete, brick, and paint using figures from above

#### Student Deliverables

- actual measurements of both interior and exterior of LBHS building containing rooms F-4 to F-6
- conversion of measurements using architectural scale
- student created building & room plans for F-wing including all dimensions and conversion scale
- estimate of cost for concrete, brick, and paint using student calculated area & perimeter from building plans

## Length of Lesson: 15 Days

### Activity Day One

1. Introduce students to concept of using similarity (just covered) and how that is used to design buildings.
2. Hand out sample floor plan and explain how we are going to use geometry to create a similar drawing of the building our classroom is in.
3. Hand out architectural scales and explain to students how they work.
4. Handout "Scale Worksheet" and walk students through how to use the scale at different "scales".
5. If students are showing understanding, choose several lengths and have students practice drawing lines of different length in feet using the  $3/32 = 1$ ,  $3/16 = 1$ , and other scale measures.

### Activity Day Two

1. Introduce students to using a measuring tape & review of fractions of an inch.
2. Show students examples of unit plans for apartment buildings.
3. Demonstrate to students the process of using a tape measure to find dimensions of F-4 (classroom).
4. Have students make a rough sketch of the building to be measured including six classrooms, two handicap bathrooms, and a staff bathroom for use in recording measurements on day 3.

### Activity Day Three

1. In teams of two, have students use tape measures to measure the perimeter of the building, the lengths and widths of the bathrooms and classrooms, and any other features the students have time to record.
2. Have students record these measurements on their rough sketch that was drawn the previous day.

### Activity Day Four

1. Continue measuring process.

### Activity Day Five

1. Using the architectural scales, have students reproduce their measurements from day 3. They will use graph paper to aid in the drawing of right angles and  $3/32'' = 1'$ .
2. Students will attempt to determine the average width of the walls by using their measurements for the classrooms and bathrooms against their total perimeter.

### Activity Day Six

1. Have students tape 4 pieces of graph paper together for their final drawing of the building. They should be advised to tape carefully as the graph paper is to aid in the drawing of right angles and not to be used as a scale itself.
2. Have the students draw the perimeter of the building using  $3/16'' = 1'$  on the four pieces of graph paper.

3. Have the students draw the exterior walls assuming that the walls are  $\frac{1}{2}'$  because the scales are difficult to use to measure different increments that  $\frac{1}{2}'$  at the  $\frac{3}{16}'' = 1'$ .
4. Students who finish early may begin drawing in the first two classrooms by measuring from the outside walls. Have them use whatever is left over between the rooms as the wall space.

### Activity Day Seven

1. Have students continue with the drawing from day 6.
2. Students who finish through the first two classrooms begin on the next two by measuring another  $\frac{1}{2}'$  wall between the first set of classrooms. They should, again, use the left over space between the rooms as wall space.
3. Students will continue with this process until all six classrooms are drawn.
4. It is advisable to have students who finish early work with those who were absent or are having difficulty as peer tutoring on this type of activity is helpful.

### Activity Day Eight

1. Have students finish drawing in their classrooms.
2. When finished, students should begin sketching in bathrooms making sure to leave space for walls between the rooms.

### Activity Day Nine

1. Have students finish drawing.
2. Students who are finished will help those who are struggling with the task.

### Activity Day Ten

1. Introduce students to the standard drawing symbols for doorways.
2. Have students add to the drawings the nine doorways that are present in the building. Ask them to notice and indicate on their drawings that the handicap restroom doorways open in rather than out.
3. Have them draw the bookshelves and cupboards that are built into each of the classrooms. They need to make sure they measured them and check to see what their positioning is in each of the classrooms.

### Activity Day Eleven

1. Have students measure and/or use their previous drawings to find where the toilets and sinks are in the three bathrooms.
2. Have them measure the dividing wall that is present in the handicap bathrooms.
3. Introduce to them the standard symbols for a toilet and a sink for floor plans.
4. Have students attempt to draw in the dividing wall, toilets, and sinks in the three bathrooms. Tell them to just try their best in their drawings of the toilet and sink symbols... they are a bit difficult to draw by hand.

### Activity Day Twelve

1. Have students finish drawing.

2. Students who are finished will help those who are struggling with the task.

### Activity Day Thirteen

1. Have students finish drawing.
2. Students who are may begin the wrap-up activity, "Final Assignment." They may work together on this assignment but each students needs to turn in their own work.

### Activity Day Fourteen

1. Have students finish drawing.
2. All students should begin the final assignment.

### Activity Day Fifteen

1. Students will finish final assignment and turn in both their final drawing and their final assignment.

## Final Project Assignment #5

Directions: Staple this assignment to your Project Assignment #4, your floor plan using the scale  $3/16'' = 1'$ .

### Part 1:

1. On a sheet of graph paper, draw ONLY the perimeter of the building using the measurements  $96' \times 60'$  and the  $3/32'' = 1'$  scale.
2. Using the perimeter as a guide, add a sidewalk around this building that is  $9'$  wide using the same scale.

On the back of your graph paper, answer the following questions:

3. What is the area of the sidewalk in feet (hint: find the area of the rectangle with the sidewalk and subtract the area of the rectangle without the sidewalk)?
4. What is the area of the sidewalk in inches (hint: scale factor of square feet to square inches is  $(12/1)^2$ , or  $144:1$ )?
5. If the sidewalk is  $4''$  deep, what is the volume of concrete needed to pour this sidewalk? How much is this volume in feet (hint: scale factor of cubic inches to cubic feet is  $(1/12)^3$ , or  $1:1728$ )?
6. If concrete costs  $\$0.50$  per cubic foot, how much does it cost to pour the sidewalk in materials cost only?

### Part 2:

1. If the walls in each classroom have a height of 10 feet, find the area of each wall in each classroom and the bathrooms.
2. If one gallon of paint covers 350 square feet of wall space, how many gallons of paint are needed to cover three walls in each classroom (one of the  $27'$  long walls are the windows and not painted)? In the bathrooms (all four walls)? Please round UP to the nearest gallon.
3. If each gallon of paint costs  $\$25.00$  and each wall gets 2 coats of paint, how much will it cost to paint these rooms?

### Part 3:

1. The front walls of each classroom consist of 3 feet of brick below the windows. If the bricks are  $2.25'' \times 4'' \times 8''$ , what is the maximum number of bricks that can be used to cover the  $.5' \times 3' \times 20'$  space (hint: convert the feet to inches and divide the length by the length of a brick, the width by the width of a brick, the height by the height of a brick and multiply)? Please do not consider the mortar between the bricks and round DOWN to the nearest brick.
2. How many bricks could be used for the six classrooms?
3. If bricks cost  $\$0.25$  each, estimate the cost of brick for the six classrooms?
4. What is the total cost of concrete, paint and brick? What costs were NOT considered in these calculations? Explain.

### Part 4:

1. Think about the last two weeks and the project we have completed. What did you like about the project?
2. What didn't you like about the project?
3. If you were the teacher, what would you change to make the project better?

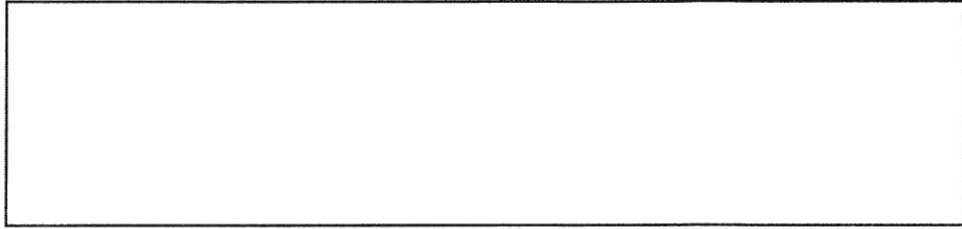
**Good Luck!**

## Rubric for Deconstructing Burbank

Student Deliverables	4 Exceeds Expectations	3 Meets Expectations	2 Approaches Expectations	1 Fails to meet Expectations
Room Plans	Plans are well detailed and compare with little error to actual plans.	Plans are detailed but contain small errors. Compare well to actual plans with 80% accuracy.	Plans are somewhat detailed but contain many errors. Errors are apparent in 50-80% of measurements.	Plans are attempted but fail to achieve 50% or better accuracy.
Building Plans	Plans are well detailed and compare with little error to actual plans.	Plans are detailed but contain small errors. Compare well to actual plans with 80% accuracy.	Plans are somewhat detailed but contain many errors. Errors are apparent in 50-80% of measurements.	Plans are attempted but fail to achieve 50% or better accuracy.
Cost Estimates	Calculations of perimeter, surface area, and volume and accurate and cost estimates are well within reason.	Calculations and cost estimates contain minor errors but are still within reason.	Calculations and cost estimates contain major errors but the reasoning process is valid.	Calculations and cost estimates are highly flawed and not reasonable.

### Using the Architectural Scale Worksheet

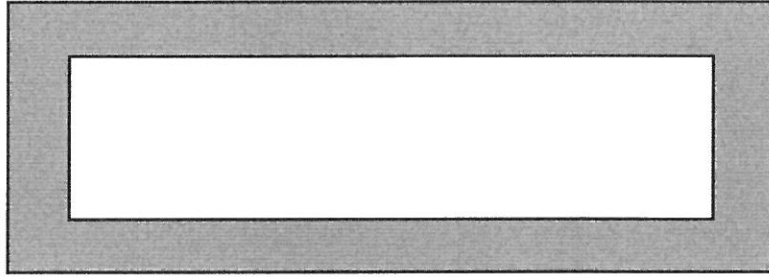
1. Measure the height and width of this rectangle. The scale is 1/4 inch equals 1 foot.



Height: \_\_\_\_\_ feet

Width: \_\_\_\_\_ feet

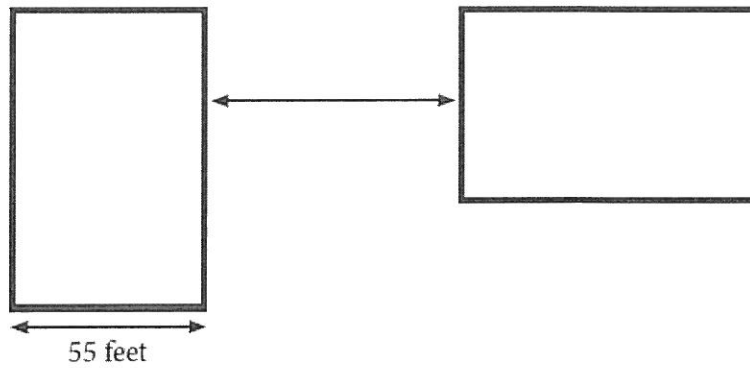
2. Measure the exterior dimensions of this rectangle. The scale is 1/8 inch equals one foot.



Height: \_\_\_\_\_ feet

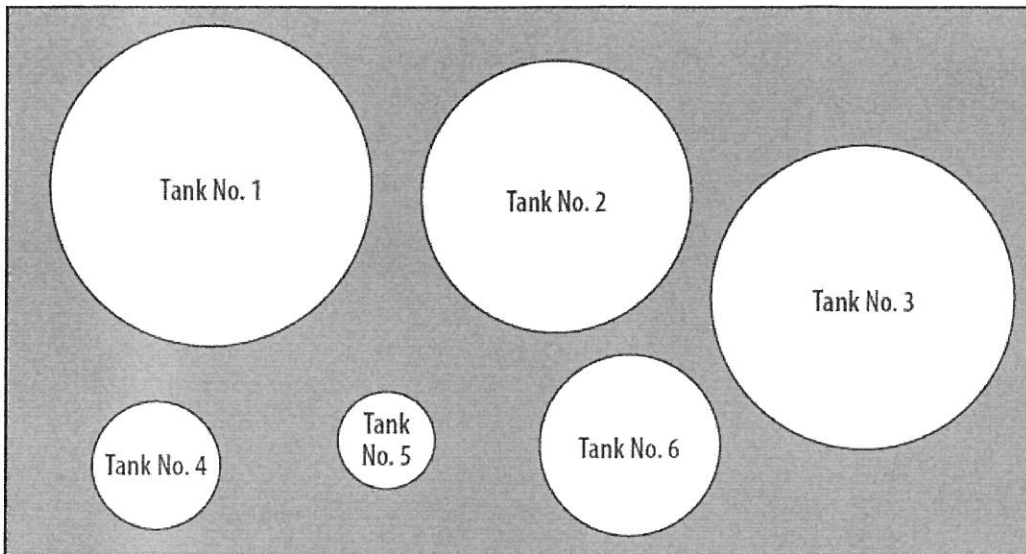
Width: \_\_\_\_\_ feet

3. In scale, how far apart are these two rectangles?



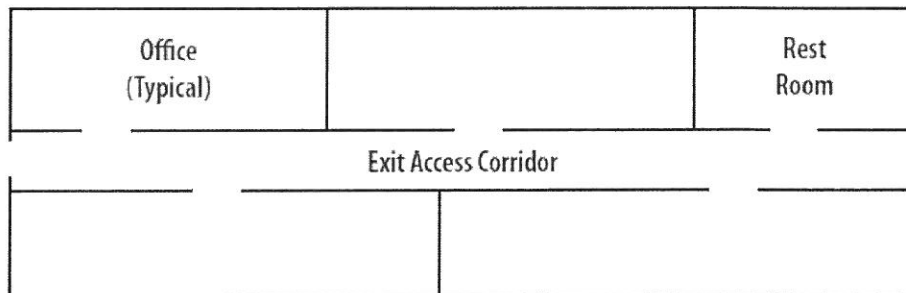
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4. This drawing represents the plan view of a bulk tank facility. The scale is 1:60. What are the tank diameters in feet?

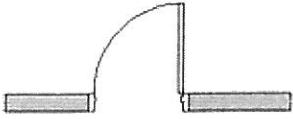


Tank No. 1 = _____ feet	Tank No. 4 = _____ feet
Tank No. 2 = _____ feet	Tank No. 5 = _____ feet
Tank No. 3 = _____ feet	Tank No. 6 = _____ feet

5. Given the above information, how far apart at their nearest edges are Tanks 1 and 6, measured in a straight line?
6. This drawing represents the floor plan of a small office. Given a scale of  $\frac{3}{32} = 1$  foot, how long in feet is the exit access corridor?







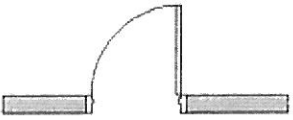
**Door Swing** - Indicates direction the door opens, and location of door knob.



**Toilet** - Symbol for toilet.



**Bathroom Sink** - Symbol for bathroom sink.



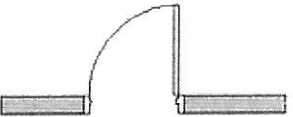
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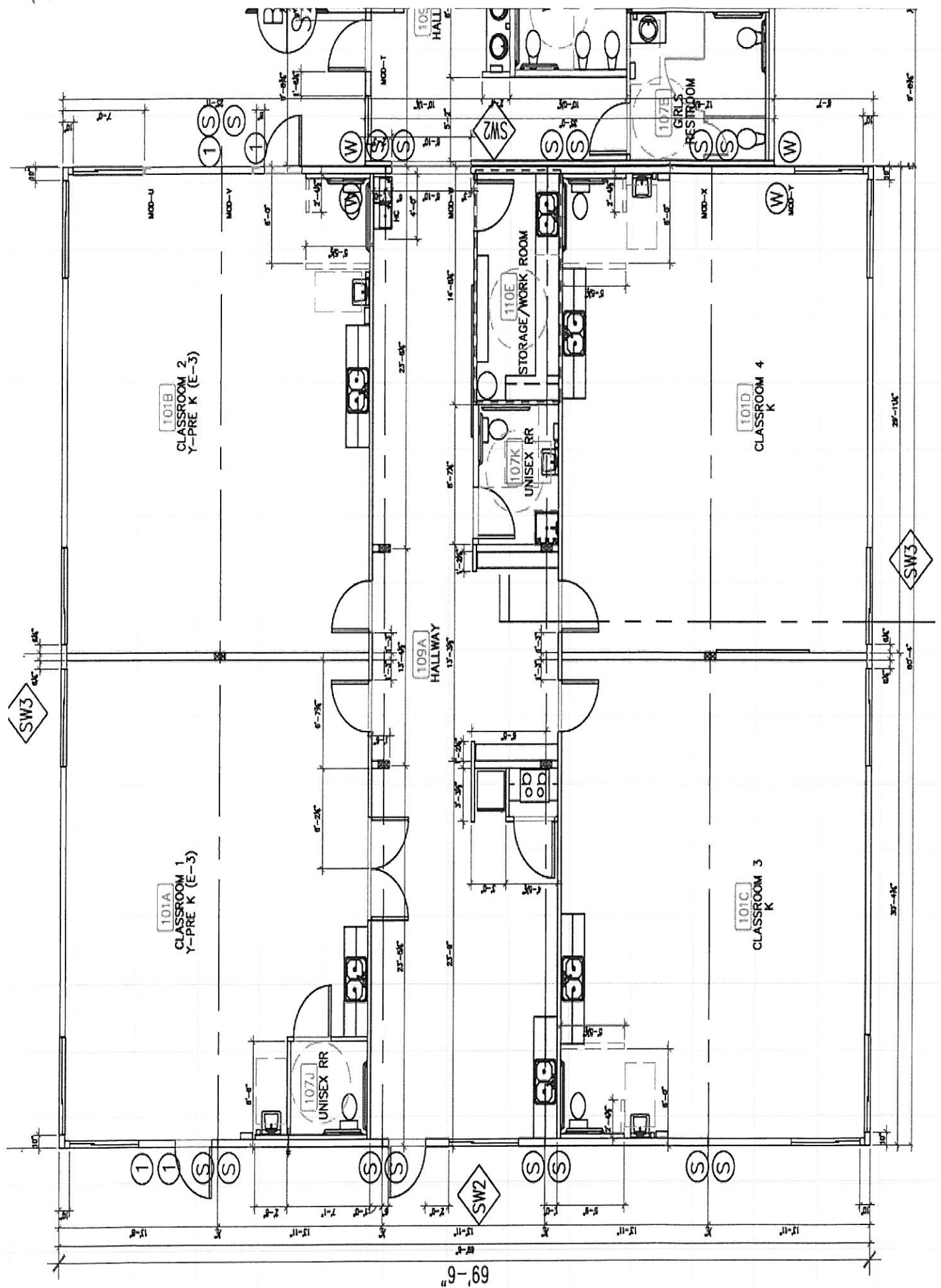
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