Grade: 5th and 6th  
Subject: Math  
Time required: 1-2 class periods  
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OVERVIEW  
Students will use real world examples of mathematics to determine the measurements of historic Tennessee buildings.

UNDERSTANDING GOAL  
Using images of architectural drawings from the Historic American Buildings Survey collection at the Library of Congress, students will measure and solve ratios to determine the measurements of Rock Castle.

OBJECTIVES  
- Students will use appropriate materials to measure architectural drawings.  
- Students will evaluate the measurements of drawings by evaluating proportions and ratios.

INVESTIGATIVE QUESTIONS  
What can architectural drawings tell you about buildings? How do architects use building measurements? How are measurements and ratios used outside of the classroom?

TENNESSEE CURRICULUM STANDARDS  
- 5.MD.A.1 Convert customary and metric measurement units within a single system by expressing measurements of a larger unit in terms of a smaller unit. Use these conversions to solve multi-step real-world problems involving distances, intervals of time, liquid volumes, masses of objects, and money (including problems involving simple fractions or decimals).  
- 6.RP.A.3 Use ratio and rate reasoning to solve real-world and mathematical problems

LIBRARY OF CONGRESS RESOURCES  
- Historic American Buildings Survey / Historic American Engineering Record / Historic American Landscapes Survey  
- Rock Castle, Hendersonville vicinity, Sumner County, TN  
- 12. VIEW OF NORTH (FRONT) ELEVATION WITH TWO-STORY PORCH - Rock Castle, Indian Lake Road (Berry Lane), Hendersonville, Sumner County, TN [1970]  
- 1. Historic American Buildings Survey, Lester Jones, Photographer August 18, 1940 VIEW FROM NORTHEAST - Rock Castle, Indian Lake Road (Berry Lane), Hendersonville, Sumner County, TN [1970]  
- 11. NORTH (FRONT) ELEVATION - Rock Castle, Indian Lake Road (Berry Lane), Hendersonville, Sumner County, TN [1970]  
- 13. VIEW OF MAIN (LEFT) AND BACK PARTS OF HOUSE, FROM WEST - Rock Castle, Indian Lake Road (Berry Lane), Hendersonville, Sumner County, TN [1970]  
- HABS TENN,83-HEND.V.2- (sheet 6 of 9) - Rock Castle, Indian Lake Road (Berry Lane), Hendersonville, Sumner County, TN [1970]  
- HABS TENN,83-HEND.V.2- (sheet 7 of 9) - Rock Castle, Indian Lake Road (Berry Lane), Hendersonville, Sumner County, TN [1970]
Step 1
From the link to the bibliographic page for each primary source, click on the icon for “drawings” on the left. You will see a series of thumbnail images of the architectural drawings for each building. Click on a thumbnail for a closer look at a drawing, and then select an option to view as a larger, higher resolution picture. (Note: The letters and numbers are all legible from the TIFF file.) Download and print out the six larger images. To see photographs of the buildings, click on “photos” from the bibliographic pages.

Step 2
Discuss perimeter and measurements with your students. Explain how math is important to creating architectural drawings of buildings. What if an architect or engineer makes a mistake with a measurement? What could happen?

Step 3
Distribute copies of the four photographs of Rock Castle or project them on a screen. Ask students to make observations about the building. What use do you think this building had when it was built? What materials do you recognize? Using information from The Tennessee Encyclopedia of History and Culture, provide your students with an overview of the history of the building.

Step 4
Explain to your students that the class will be taking measurements of the building without leaving the classroom. To do this, explain that architectural drawings will allow us to make accurate measurements of the length and height of Rock Castle. Introduce your students to the two architectural drawings from the Historic American Buildings Survey/Historic American Engineering Record/Historic American Landscapes Survey.

Step 5
Distribute the “Measurement with Architectural Drawings: North Elevation” worksheet and the architectural drawing that accompanies it. Explain what an elevation is and that it is a representation of the front side of the building, drawn to scale. Explain what scale is to students in terms of ratios and proportions. Distribute the class rulers and calculators and review the directions to the worksheet. Students may work in pairs to complete this worksheet.

Step 6
Once the worksheets have been completed, review the answers and address any questions from the students. Distribute the “Measurement with Architectural Drawings: East Elevation” worksheet and the architectural drawing that accompanies it. Students should complete this worksheet on their own.

ADDITIONAL MATERIALS

- Set of class rulers
- Set of class calculators
- “Measurement with Architectural Drawings: North Elevation” worksheet and drawing
- “Measurement with Architectural Drawings: East Elevation” worksheet and drawing

1. Historic American Buildings Survey, Lester Jones, Photographer August 18, 1940 VIEW FROM NORTHEAST. - Rock Castle, Indian Lake Road (Berry Lane), Hendersonville, Sumner County, TN [1970]
Step 7 Once the worksheets have been completed, review the answers and address any questions from the students. Explain to students that they have completed work that many architects do every day: scale a drawing. What was difficult about these worksheets? What have you learned about architectural drawings and what they can tell us? How do architects use building measurements? How are measurements and ratios used outside of the classroom?

**EVALUATION**

Student grades should be based on

1) the accuracy of their measurements  (40%),
2) the accuracy of their calculations  (40%), and
3) the thoughtfulness of their class participation  (20%).

**EXTENSION**

Find out more about the history and visitor information for this building by visiting the following Web sites:

- Rock Castle: [www.historicrockcastle.com/](http://www.historicrockcastle.com/)
- The Tennessee Encyclopedia of History and Culture: [Rock Castle entry](http://www.tennesseeencyclopedia.com/)

Students can examine photographs of the inside and outside of Rock Castle from the Web sites listed above can compare them to the historic photographs listed on the surveys for each building. Have the buildings changed at all? You could even take a field trip to one of these locations, so that students can compare the drawings to the pictures and the actual site!

Ask your students what they would have done differently, had they been the architect for Rock Castle. Thicker walls? More chimneys? More floors? How would that affect the measurements of this building?
Using the attached architectural drawing to answer the questions below. Don’t forget to show your work and to use the correct units for each question. Each inch is equal to eight feet (1" = 8’).

1. Looking at the “North Elevation” on the other side of this paper, use your ruler to measure the length of the building. Measure the distance between the ends of both chimneys. Round your answer to the nearest 1/2 inch.

   Measurement: ______________

   According to your instructions, how many feet are there per inch? ________

   _________ x __________ = __________

   (Inches) (Feet per inch) (Feet)  

   According to the formula above, what is the final architectural measurement of the length of the building? Don’t forget to include proper units.

   Length: ______________

2. Use your ruler to measure the height from the foundation (bottom) of the building to the top of the roof. Round your answer to the nearest 1/2 inch.

   Measurement: ______________

   According to your instructions, how many feet are there per inch? ________

   _________ x __________ = __________

   According to the formula above, what is the final architectural measurement of the height from the foundation to the top of the roof? Don’t forget to include proper units.

   Height: ______________

3. Use your ruler to measure the height from the foundation (bottom) of the building to the top of one of the chimneys. Round your answer to the nearest 1/2 inch.

   Measurement: ______________

   According to your instructions, how many feet are there per inch? ________

   _________ x __________ = __________

   According to the formula above, what is the final architectural measurement of the height from the foundation to the top of the chimney? Don’t forget to include proper units.

   Height: ______________
1. Looking at the “East Elevation” on the other side of this paper, use your ruler to measure the length of the building. Measure the distance between the end of the wall on the left to the end of the stairs on the right. Round your answer to the nearest 1/4 inch.

Measurement: ______________

According to your instructions, how many feet are there per inch? ________

\[
\text{Measurement (Inches)} \times \text{Feet per inch} = \text{Feet}
\]

According to the formula above, what is the final architectural measurement of the length of the building? Don’t forget to include proper units.

Length: ____________________

2. Use your ruler to measure the height from the foundation (bottom) of the building to the top of the taller chimney. Round your answer to the nearest 1/4 inch.

Measurement: ______________

According to your instructions, how many feet are there per inch? ________

\[
\text{Measurement (Inches)} \times \text{Feet per inch} = \text{Feet}
\]

According to the formula above, what is the final architectural measurement of the height from the foundation to the top of the taller chimney? Don’t forget to include proper units.

Height: ____________________

3. Use your ruler to measure the height from the foundation (bottom) of the building to the top of the shorter chimney. Round your answer to the nearest 1/4 inch.

Measurement: ______________

According to your instructions, how many feet are there per inch? ________

\[
\text{Measurement (Inches)} \times \text{Feet per inch} = \text{Feet}
\]

According to the formula above, what is the final architectural measurement of the height from the foundation to the top of the shorter chimney? Don’t forget to include proper units.

Height: ____________________