

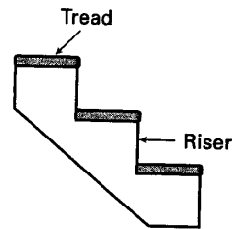
Project: Going Up!

For use with Chapter 7

OBJECTIVE Explore how relationships among stair dimensions affect safety and comfort.

MATERIALS inch ruler, paper, pencil, graph paper

INVESTIGATION Have you found that some stairways are more difficult to climb or easier to trip on than others? Have you thought about why this happens? Stairway safety and comfort can be influenced by the length of the riser (the vertical part between treads), the length of the tread (horizontal surface we step on), and the ratio of these lengths.



1. Make a table with the heads shown below. Collect and fill in the data for at least eight different stairways. Try for a good variety of step sizes.

Stairway location	Tread length (in.)	Riser length (in.)	Riser/Tread ratio	How hard or easy to climb?	How safe does it feel?
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2. Based on the data you collected, what seems to be a good riser/tread ratio. Explain your decision. Did the stairways with tread lengths or riser lengths within a certain range seem safer or easier to climb? Explain.
3. Use your answers to Question 2. Design your own stairway to go up a total distance of 120 inches from one floor to the next. Determine the riser and tread lengths and the number of steps. Then make a scale drawing.
4. Below are two generally accepted rules for stairway construction. To find the riser and tread lengths that satisfy these rules, first write the relationships as four inequalities involving tread length t and riser length r . Then graph the solution of that system. Since the boundary lines are close together, use small intervals such as $\frac{1}{2}$ or $\frac{1}{4}$ along axes. (You can make the graph very large or you can use breaks in the axes and focus on the part of the graph near the solution region.)

Rule 1: The sum of one riser length and one tread length should be from 17 inches to 18 inches.

Rule 2: The sum of two riser lengths and one tread length should be from 24 inches to 25 inches.
5. On the same graph, plot the ordered pairs from the data you collected and from the stairway you designed. Do the stairways all satisfy the two rules?

PRESENT YOUR RESULTS Make a poster presenting your results. Include your graph and the scale drawing of the stairway you designed. Also include an analysis of the safety of the stairs for which you collected data and of the one you designed.

Rubric for Stairway Project:

Technical Requirements.	Evaluation	Points	SWR
Acquire all necessary materials as outlined in the handout.		5	
Academic Requirements A. Read the objectives and instructions carefully.	The student shows a clear understanding of materials read by demonstrating a well thought out project design and conclusion. All instructions are understood and followed with accuracy.	15	EE ME NI 1.2.1
B. Make a table as outlined in the instructions with the heads as specified. Collect data as outlined from at least 8 stairways. Arrange data collected from a variety of stairways.	Data is organized and presented in a neat and clear fashion. A variety of stairways is chosen. Measurements are accurate and display reasonable results.	20	EE NI ME 1.3.1
Analyze the data from your eight stairways and form a conclusion about how easy or safe the stairways are based on the comparison of the riser (y) and the tread (x) ratios. Explain your conclusion in a paragraph of about 25 words.	The analysis shows a clear understanding of the relationship between the safety and comfort of stairways, and the ratio of riser and tread measurements. The conclusion is written in a clear, grammatically accurate and convincing manner.	20	EE ME NI 1.1.1 1.1.2
C. On a poster board display the following, including part D below. Write the equations of the rules of thumb as outlined in # 4 of the instructions. Graph the equations as outlined in # 4 of the on a piece of graph paper or poster. Be sure to be as accurate as possible. On the same graph, as in part C, plot the ordered pairs of the 8 stairways that you measured. Answer the following: Do your stairways fit within the safety zone of your graphs?	The equations and graphs are presented clearly and accurately. The equations are correct, calculations and measurements. Collected data ordered pairs are plotted accurately and analysis of whether the data falls within the safety zone is correct.	20	EE ME NI 1.3.1
D. Create your own stairway to go to a height of 120 inches. Determine the riser and tread lengths and the number of steps. Make a scale drawing of your stairway.	Student creates a stairway that meets all design requirements and creates an accurate scale drawing of the stairway that meets safety and comfort guidelines as seen in the rule of thumb graphs.	20	EE ME NI 1.4.1