The concept of stairs was "believed to appear around 6000BC." Stairs seem to have changed shape throughout the centuries. According to Eleve, Peter Nicholson developed a mathematical system for stairs and railings. By the end of 1980 Eva Jiricna in London started designing stairs in glass and stainless steel.

A stairstep is considered a rectangle. A rectangle has many equations that can be used. Today we are finding slope and volume of a rectangle or stairstep. Then we are using this information to find the slope and volume of a staircase (multiple stairs). The slope ( m ) is found by finding $\frac{\operatorname{rise}(y)}{\operatorname{run}(x)}$. Rise is how many points on a graph that a person goes up on the $y$-axis. Run is how many points on a graph a person goes across on the $x$-axis. The volume is found by multiplying length $x$ width $x$ height of a rectangle.
The problem: A construction worker was asked to copy a staircase inch by inch. The worker needs to know the slope and volume of the staircase. Given: binder paper, ruler or tape measure, staircase, pencil or pen, a notepad, and a friend, find the volume and slope of the staircase.

## Slope

1. Take out a piece of binder paper to use as your ruler. Have someone with you to record and check your measurements.
2. To get the rise of the stairwell, measure one stairstep height using binder paper (note you may need to fold or mark your paper to have the exact height of the stairstep).

3. Count the number of stairsteps up the staircase (note your starting point is the ground, and remember to stop counting when you reach the top of the staircase)
4. Measure the length of a stairstep with binder paper (note start at the beginning of the first stairstep and add a full step on the top of the staircase.

5. Make sure to subtract the additional length of any landings; if you make extra steps

6. Measure the width of one stairstep from one side to the other by using binder paper (Note you may need more than one sheet or count the same sheet more than once making sure to mark the endpoints).


## Stairs: A Little Bit About Them

7. Measure binder paper in inches with a ruler or tape measure.

8. To find your rise, multiply the measurement of the binder paper by the number of steps found in \#3. (can be converted into feet by dividing by 12)
9. To find your run; multiply the measurement of the binder paper by the number found in \#5. (Can also be converted into feet by dividing by 12).
10. To find the width of one stair if you only used one sheet of paper, if not skip to \#11, multiply the measurement of the binder paper by the number found in \#6.
11. To find the slope of the staircase use the equation slope $=\frac{\text { rise }(\# 8)}{\text { run (\#9) }}$.
12. Fun fact: The slope of the staircase in Mendocino Hall is .42 inches.

## Volume

1. To find the volume of the staircase use the equation volume=length $x$ width $x$ height.
2. Find the length, width, and height of the bottom or base step.

3. Measure the difference between the length of the base step, and the length of the step above that.

4. Use the measurement from Step 13 to find the length of each step by subtracting 29 cm from the length of the previous step. (starting from the base step)
length of stair 1 (base step) $=x$ length of stair $2=x-29 \mathrm{~cm}$
5. Use the results for step 14 find the volume of each step. The width and height of each step are equal to that of stair 1.
6. Add the volume of all the stairs. Now we have found the volume of the staircase.
7. Fun fact: The voume of a staircase on CSU Sacramento campus is 4,693, 360 cubic cm or $1,847,779.528$ cubic inches.

Other applications can be using other objects, such as a shoe or pencil, to measure the width, height, and length of a staircase and find the perimeter of a staircase.

Here is an actual pic of the CSU Sacramento stair case with a landing:


