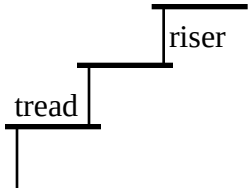
fall '01

Name:
Date:

Is Aderhold up to Code???

Stairs are made up of **treads**, the horizontal distance that you step on, and **risers**, the vertical distance that you step up.



For both safety and comfort reasons, treads and risers must meet certain requirements by law. These laws allow for small errors in construction and settling of buildings over time (and consequent changes in riser height, for example). The building laws also change over the years--so, houses and buildings built earlier than 1999 might not be in complete compliance of current laws on risers and treads (however, any "gross" violations do have to be changed!!)

CURRENT BUILDING LAWS:

* The ideal ratio of riser to tread is 0.7
* $r + t = 17$ inches
* $r \cdot t = 70$ to 75
* there can be no more than $\frac{3}{16}$ of an inch variation in height of risers in a set of stairs.

I. Do the stairs in and near Aderhold fit these guidelines?

To find out, you and your partner will use a ruler to measure FIVE risers and FIVE treads from ONE set of stairs in **INCHES.** Then complete the appropriate row in the following table. We will share our findings in class.

	avg. riser height (in)	**any riser variation $> \pm \frac{3}{16}$?**	**avg. tread length (in)**	**SLOPE = $\frac{\text{riser}}{\text{tread}}$**	**constant slope?**	**sum, r + t**	**product r · t**
Stairs behind elevators							
"Escalator stairs"							
Stairs outside to Aderhold from parking lot							
Stairs outside to parking lot							
Stairs outside "front" to Carleton Street							

Conclusions: *Answer the question of part I. in at least TWO complete sentences.* _____

_____

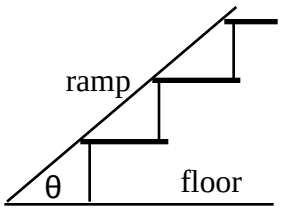
_____

_____

_____

II. Angles of Inclination...

The angle of inclination of a staircase is the angle of the ramp you'd make with the floor if you laid a board up the stairs. Compute the angle of inclination for...



1) the IDEAL staircase: _____
show work!

2) the stairs behind elevators: _____

3) the "escalator stairs": _____

4) the stairs outside to Aderhold from parking lot: _____

5) the stairs outside to parking lot: _____

6) the stairs outside "front" to Carleton Street: _____

Generally, staircases do not have to be changed if the angle of inclination is LESS than the ideal, but they do if the angle is MORE than the ideal.

Do any of the stairs in or near Aderhold need to be changed? _____

III. Other common slopes in buildings...

7) You could think of a floor as a BIG tread with no riser. What is the slope of the floor? _____

8) You could think of a wall as a LONG riser with no tread. What is the slope of a wall? _____
(remember, division by zero is considered "undefined.")

IV. Another rule for risers and treads...

Risers and treads can also meet the following rule to fit the law:

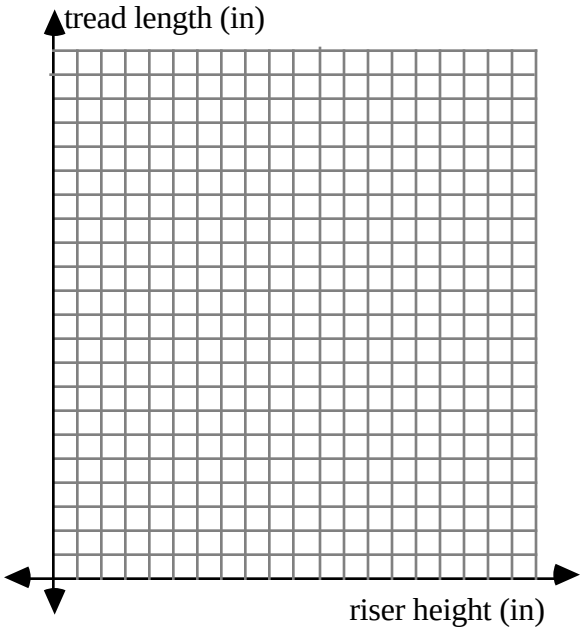
$\boxed{2r + t = 24 \text{ inches}}$, where r = riser height and t = tread length

We can rewrite this equation as: $t = -2r + 24$, or, written in function notation,

$\boxed{t(r) = -2r + 24}$, where the tread length, t(r), depends on the riser height, r

Now it looks like equations we've already graphed!
Complete the table below and graph the different possibilities for risers and treads on the grid.

riser (r, or input)	tread (t(r), or output)
1 inch	_____
2 inches	_____
3 inches	_____
4	_____
5	_____
6	_____
7	_____
8	_____
9	_____
10	_____
11	_____
12	_____
13	_____



9) a) What is the y-intercept of this equation? _____

b) What does the y-intercept mean for lengths of treads and heights of risers?

_____

10) a) What riser will give you a tread of 12 inches? *Show work*

_____

b) What riser will give you a tread of 9 inches? *Show work*

_____

11) Can you have a riser of more than 12 inches? Why or why not?

_____

_____

12) a) What is the slope of this equation? _____

b) Explain what the slope means in words, including units:

_____

13) Do any of the stairs in or near Aderhold satisfy this rule? _____
Show your calculations to SHOW HOW YOU KNOW:

V. Summary

Write a 3-paragraph letter to the dean, Dr. Louis Castenell, advising him of your calculations and whether or not he needs to have any stairs changed. Your letter should include the following:

-paragraph 1: a short introduction of yourself and the project
-paragraph 2: an explanation of your measurements and calculations for **slope** and **angle of inclination** (sections I & *part of* II)
-paragraph 3: a recommendation of further action by the school and conclusion
****Be sure you sign your letter!

Extra Credit: Add a paragraph to your letter in which you explain section IV. to Dean Castenell, telling him whether any set of stairs fits this guideline.

VI. Evaluation

		not yet…		OK		expert!
1)	address & signature	1		2		3
2)	three paragraphs	1		2		3
3)	thorough, correct discussion of slope	1		2		3
4)	thorough, correct discussion of angle of inclination	1		2		3
5)	thorough, correct recommendation to Dean Castenell	1	2	3	4	5
6)	clear flow; correct grammar, spelling, etc.	1		2		3

TOTAL: _____/20

DUE DATE: _____ if hand-written; _____ if typed

Some NOTES about use, extensions, etc.

I. You could ask: To satisfy the rule $r + t = 17$ with the given riser heights, what should the length of the treads be for each set of Aderhold stairs? According to the rule in part IV.? (You could also take the treads as given and ask what the riser heights should be.)

II. You could also investigate how much total space (both horizontally and vertically) is available for stairways when constructing a building. Given certain available dimensions, students could figure out how many stairs are necessary and possible according to the rules (and how much they may need to make slight adjustments in the rules!)

III. In the original lab, students did not measure several risers and treads and did not take an average as this lab indicates to do, but I think it is a worthy addition. Students could also discuss whether the slope of the stairs is constant and how building code inspectors might deal with variations (i.e., by taking averages, etc.)

IV. Later on in this unit when we do work on solving systems of linear equations, students find what riser and tread satisfy both the rule $r + t = 17$ and the rule in part IV.