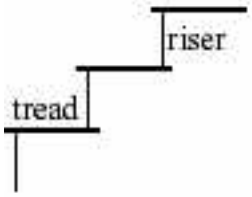
Name:
Date:

Are the Stairs 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 might not be in complete compliance of current laws on risers and treads (however, any "gross" violations do have to be changed!!)

IDEAL BUILDING CODES:

* 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 fit these guidelines?

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

Stair location	**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 $r \cdot t$**
1.							
2.							
3.							
4.							
5.							

Conclusions: *Answer the question,* ***Do the stairs fit these guidelines?*** *in at least TWO complete sentences*.

_____

_____

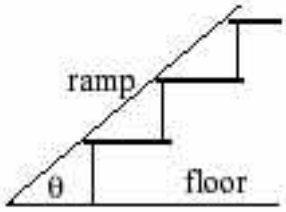
_____

_____

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...

the IDEAL staircase: _____
show work!



Stair Location

1. : _____
2. : _____
3. : _____
4. : _____
5. : _____

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 need to be changed? _____

List the ones that needed to be changed. _____

III. Other common slopes in buildings...

6. You could think of a floor as a BIG tread with no riser.

   What is the slope of the floor? _____

7. You could think of a wall as a LONG riser with no tread.

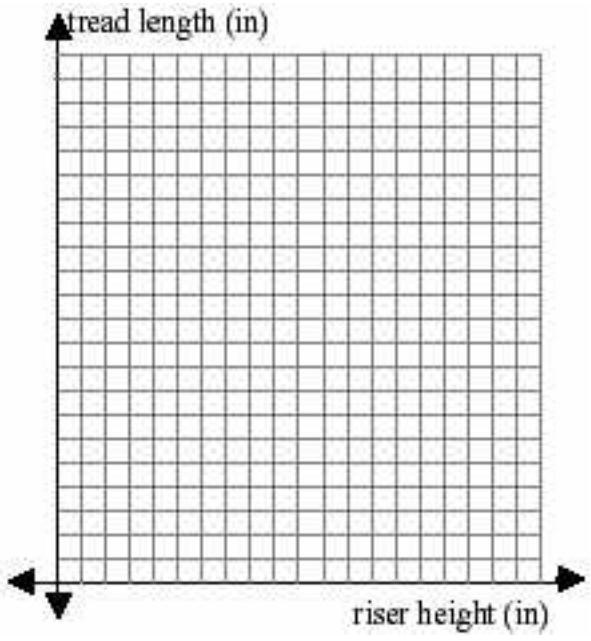
   What is the slope of a wall? _____
   (remember, division by zero is considered "undefined.")

IV. Another rule for risers and treads...

Risers and treads can also meet the following rule to fit the law:
$2\boldsymbol{r} + \boldsymbol{t} = 24$ inches , where $\boldsymbol{r}$ = riser height and $\boldsymbol{t}$ = tread length.

We can rewrite this equation as: $\boldsymbol{t} = -2r + 24$, or, written in function notation,
$\boldsymbol{t}(\boldsymbol{r}) = -2r + 24$, where the tread length, $\boldsymbol{t}(\boldsymbol{r})$, depends on the riser height, $\boldsymbol{r}$.
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	_____



8. a) What is the y-intercept of this equation? _____
   b) What does the y-intercept mean for lengths of treads and heights of risers?
   _____
9. 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* _____
10. Can you have a riser of more than 12 inches? Why or why not?
    _____
    _____
11. a) What is the slope of this equation? _____
    b) Explain what the slope means in words, including units:
    _____
12. Do any of the stairs that satisfy this rule? _____
    Show your calculations to SHOW HOW YOU KNOW:

V. Summary

Write a 3-paragraph letter to the principal advising him or her of your calculations and whether or not s/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**
- paragraph 3: a recommendation of further action by the school and conclusion

Be sure you sign your letter!

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) clear flow; correct grammar, spelling, etc. 1 2 3

TOTAL: _____/15

DUE DATE: _____

Some NOTES about use, extensions, etc.

A. 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!)

B. 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.)

C. 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.