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Squaring a foundation

MONTANA UNIVERSITY SYSTEM

http://mus.edu/2yr/RPOS/Math-In-CTE.asp

Literacy - In - CTE

Staircase Stringers

Staircase Stringers Project

Montana Math-In-CTE

How to Integrate Math Skills into your CTE Course using the NRCCTE Math-In CTE Model

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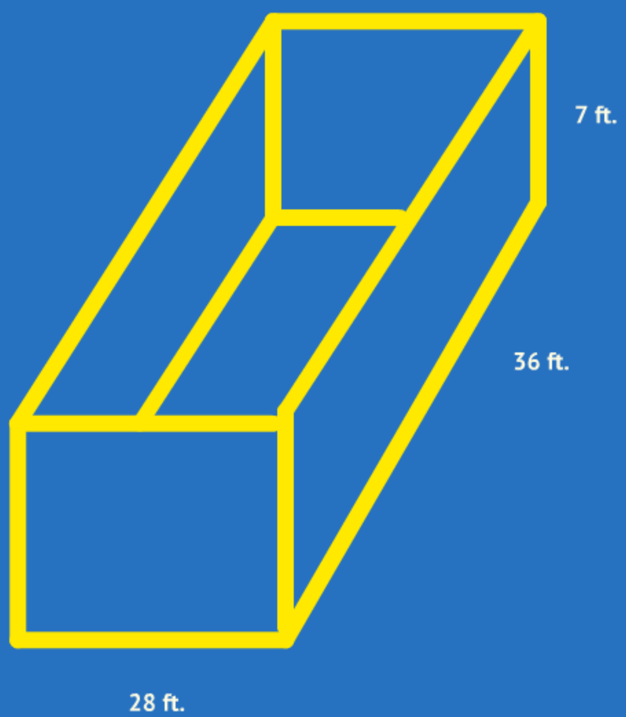
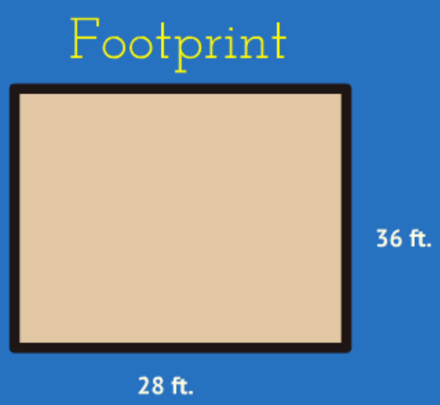
Let's Excavate!

Excavators come in many different sizes.

EX: Let's find out how much earth we need to remove if we want to build a house that measures 36 ft wide, 28 ft long, and needs to be 7 ft deep.





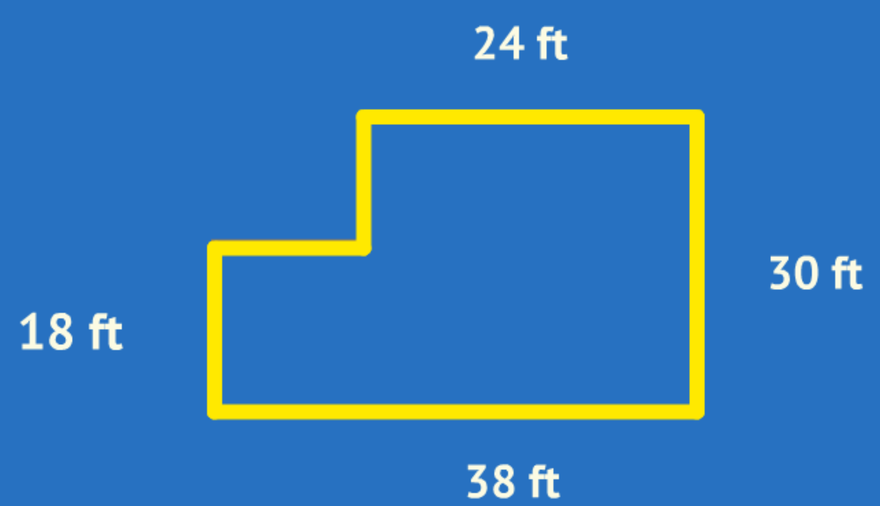
Soil Data Tables

Swellage Factors

Soil Type	100% relative compaction	Excavated and loose
Sand	1	1.15
Sandy – Loam	1	1.20
Clay – Loam	1	1.30
Clay	1	1.35

1. Find the volume in yd3 that a backhoe bucket can hold if it is 24 in. wide, 36 in. deep, and 30 in. tall.

2. Find the amount of earth in yd3 that will be removed if you are laying a slab for a garage with extra parking pad. The dimensions are shown below, and the depth needs to be 18 in.



3. Find the amount of earth in yd3 that will be removed if you are installing a square swimming pool that's sides are 21 ft. and has a depth of 5 ft. Assume the slope of the property is zero. Also give the number of truck loads needed to haul the soil away assuming 25% expansion.

4. Find the volume of a rectangular prism that is 16 ft. by 18 ft. by 6 ft.

5. The area of a L shaped playground is 370 ft2. Find the volume in yd3 of pavement if it is 6 in. deep.

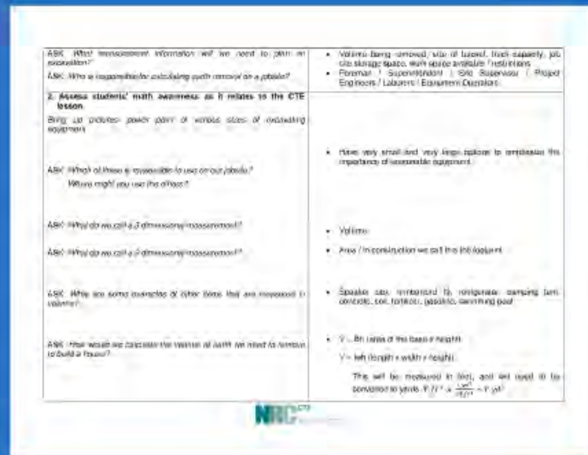
If you were a hotel clerk and a customer called and asked you for the size of the hotel room, describe how and what you would tell the customer.

You are buying a cargo type van for your construction company. Dealer A has a van with a box that is 10 ft long, 6 ft wide, and 5 ft high, while Dealer B's van measures 9 ft long, 7 ft wide, and 6 ft high. What is the cargo space for Van A and Van B. Which can will you buy and why?

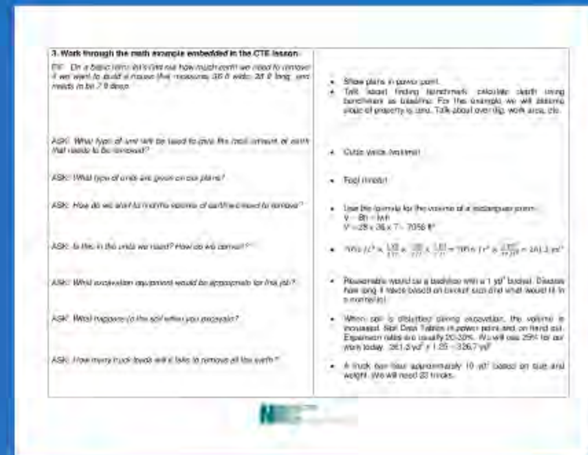
Math-in-CTE Lesson Plan Template

Lesson Title: Let's Excavate!		Lesson #
Author(s):	Phone Number(s):	E-mail Address(es):
Bruce Barta	(406)-268-6210	[illegible]
Amanda Kolus	(406)-268-6165	[illegible]
Occupational Area: Construction		
CTE Concept(s): Excavation		
Math Concepts: area, volume, units Common Core State Standards – MT: N-Q, A-REI-3, G-GMD		
Lesson Objective:	Students will be able to calculate the amount of material that will need to be removed based on a given plot plan. Students will be able to comprehend concept of volume. Students will know units of volume for excavating. Students will be able to apply formulas to solve a variety of volume and excavation problems.	
Supplies Needed:	Pencil, calculator Optional: soil density chart	

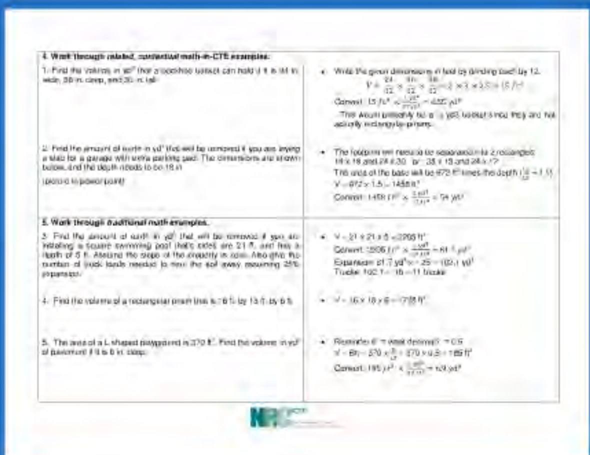
THE "7 ELEMENTS"	TEACHER NOTES (and answer key)
1. Introduce the CTE lesson.	
ASK: *What unit of measurement will we use to calculate the amount of earth being moved?*	• Volume (cubic) measured in feet and translated to cubic yards.
ASK: *Why is it important to know how much earth needs to be removed?*	• Calculate cost and determine type and amount of equipment to have at the site.



2. Assess students' math awareness as it relates to the CTE lesson.



3. Work through the math example embedded in the CTE lesson.



4. Work through related, contextual math-in-CTE examples.

5. Work through traditional math examples.

6. Students demonstrate their understanding.

7. Formal assessment.

Test: 5 questions, attached document | Key: attached

NOTES:

Squaring a foundation

Math-in-CTE: Pythagorean Theorem Lesson

1. Introduce the CTE lesson.

Today we are going to practice laying out foundations and checking to make sure they are square.

Math-in-CTE: Pythagorean Theorem Lesson

2. Assess students' math awareness as it relates to the CTE lesson.

- Students will use a ruler, some string, and a blank sheet of paper to draw a 6" x 8" rectangle on the piece of paper.
- Can anyone explain how to make sure we are parallel from the edge of the paper?
- How will we guarantee that the sides are square?
- How will we locate the other corners?

Math-in-CTE: Pythagorean Theorem Lesson

3. Work through the math example embedded in the CTE lesson.

- Using a pencil, rule and some string, draw a 6" x 8" rectangle on your paper.
- Students use Pythagorean Theorem in the form of a 3-4-5 right triangle to square up the corners.

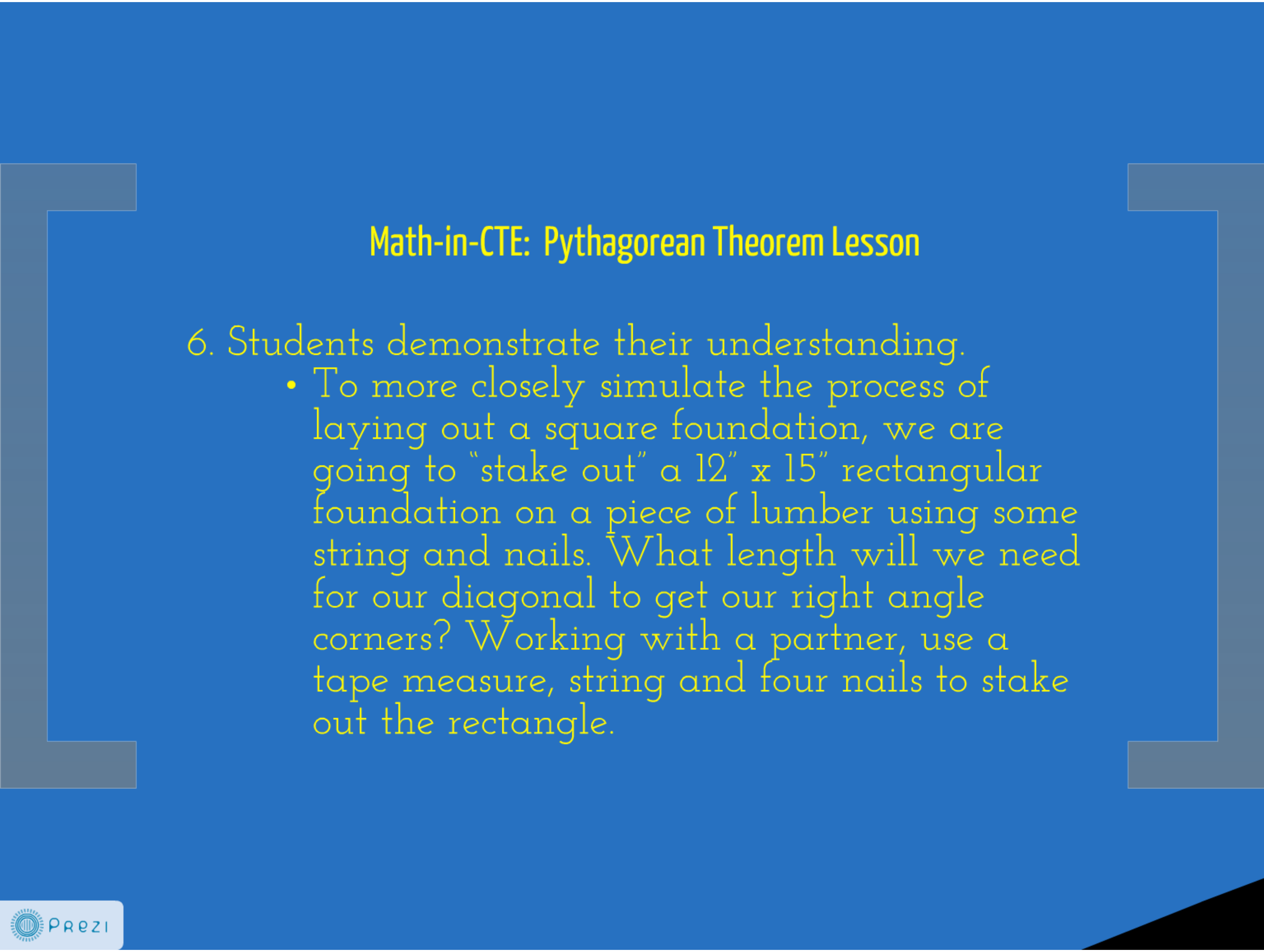
Math-in-CTE: Pythagorean Theorem Lesson

4. Work through related, contextual math-in-CTE examples.

- Students will use the Pythagorean Theorem to determine the length of the common rafter on a gable roof given the total rise and run.

Math-in-CTE: Pythagorean Theorem Lesson

5. Work through traditional math examples.
    - Students will solve three traditional math examples using the Pythagorean Theorem as might be found in a math textbook.


Math-in-CTE: Pythagorean Theorem Lesson
6. Students demonstrate their understanding.
• To more closely simulate the process of laying out a square foundation, we are going to "stake out" a 12" x 15" rectangular foundation on a piece of lumber using some string and nails. What length will we need for our diagonal to get our right angle corners? Working with a partner, use a tape measure, string and four nails to stake out the rectangle.

Math-in-CTE: Pythagorean Theorem Lesson

7. Formal assessment.

- Students will work in groups (three or four) to go outside and stake out a 24' x 24' foundation using some string, four stakes, and a hammer. They will also need a calculator to find the correct diagonal length to the nearest 16th of an inch. You may want the students to determine the diagonal length prior to going outside.

Math-in-CTE: Pythagorean Theorem Lesson

Some difficulties we encountered:

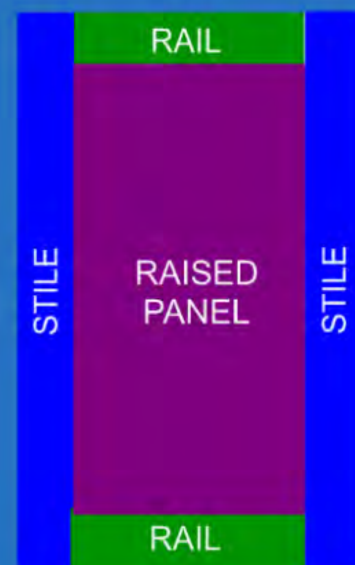
- Students had challenges working between feet and inches
- Students had trouble working between fractions and decimals
- Students really struggled when we combined the two issues above and the Pythagorean Theorem

Math-in-CTE: Pythagorean Theorem Lesson

As a result of the difficulties encountered we:

- Worked with students on converting between feet—inches—fractions of an inch.
- Broke down the Pythagorean Theorem into sub-sets of skills and worked on each skill.
- Took an approach of doing a few minutes of math each day instead of "spending a day on the math".

INTRODUCTION
RAISED PANEL DOORS



Working with Mixed Numbers

Mathematical Language

Convert to improper fractions.

Find the common denominator.

Simplify the fraction.

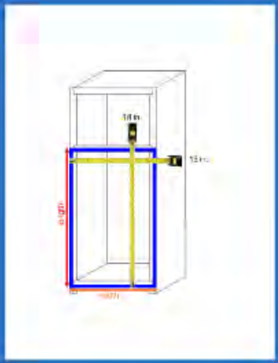
Add or subtract the numerators.

Construction of a Door Panel

Materials: Boards at least 5.25" wide.

1. Measure dimensions for the door.
2. Determine the number of doors.
3. Plane all boards to 0.78"
4. Sand all boards to 0.75" on the speed sander.
5. Joint 1 edge on all boards.
6. Rough cut boards to 0.5" longer than finished sizes.
7. Square all boards on a table saw to a minimum of 5.5" wide.
8. Cut rails to finished length on the table saw.
9. Set shaper and check using scrap wood.
10. Machine end-grain on the rails.
11. Change shaper bits to cut rails and stiles length-wise.
12. Rip all boards to 2.5" wide on the table saw.
13. Cut stiles to finished length.
14. Cut raised panel to size.
15. Glue pieces together.

Finding the Overall Door Dimensions

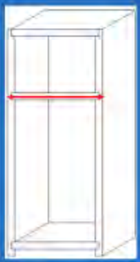


rail length = total width - 2 x stiles + 2 x profile cut

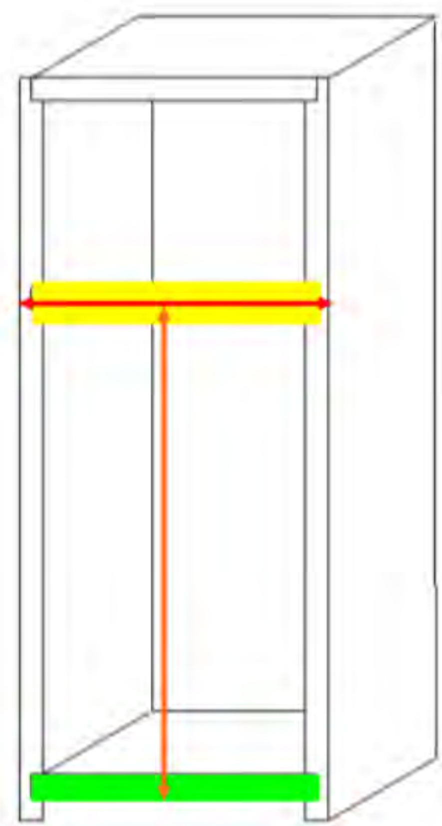
rail length = total width - 2 x 2.5" + 2 x 3/8"

rail length = total width - 5" + 3/4"

rail length = total width - 4 1/4"



stile length = distance between bottom shelf and mid-line of face frame

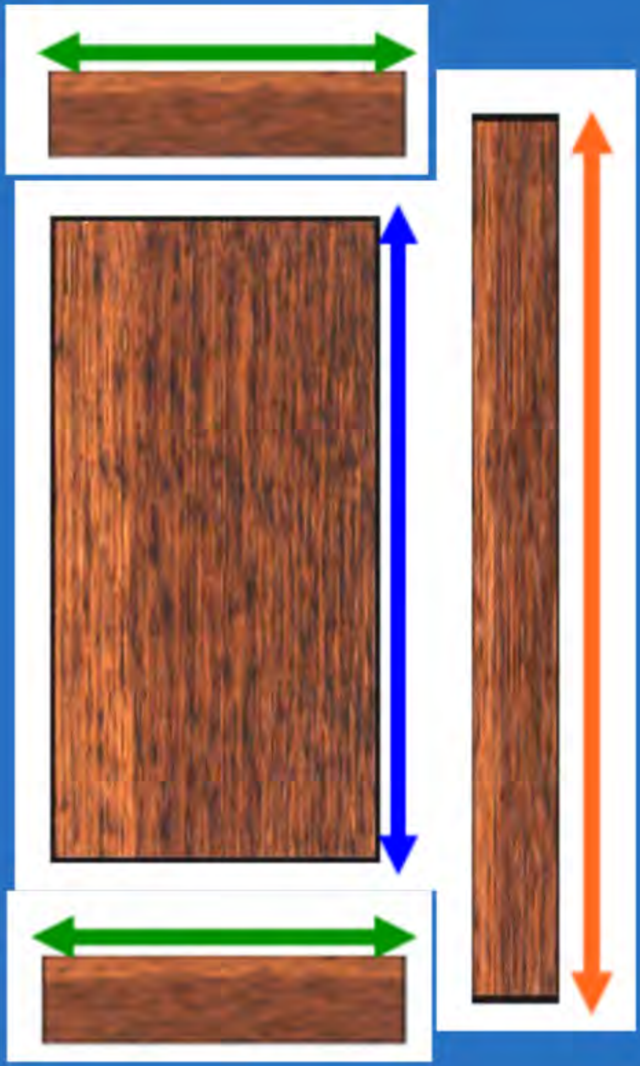


Panel Length = Stile Length - 2 x Rail Width + 2 x Profile Cut Gap

Panel Length = Stile Length - 2 x 2.5" + 2 x 1/4"

Panel Length = Stile Length - 5" + 1/2"

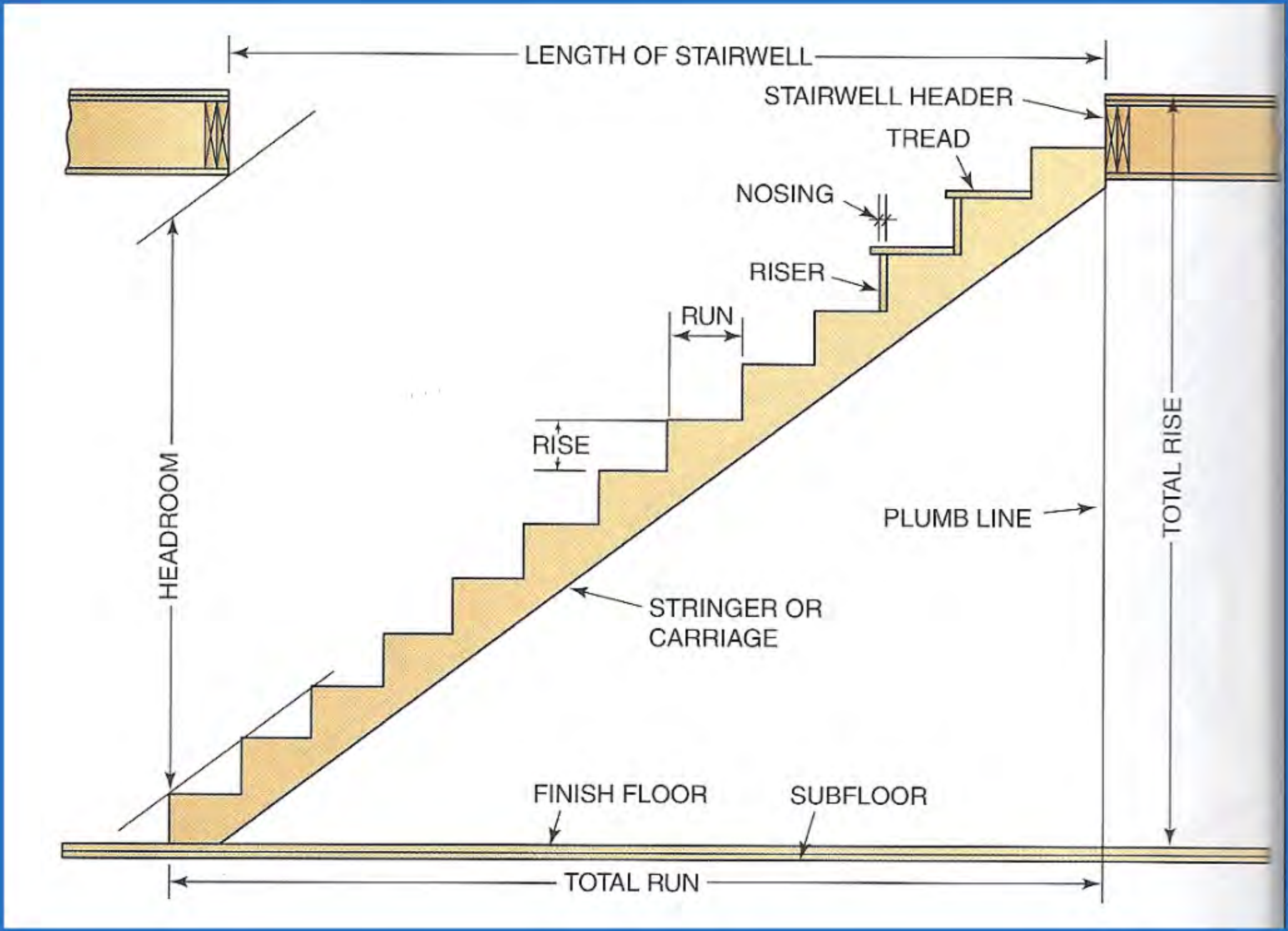
Panel Length = Stile Length - 4.5"



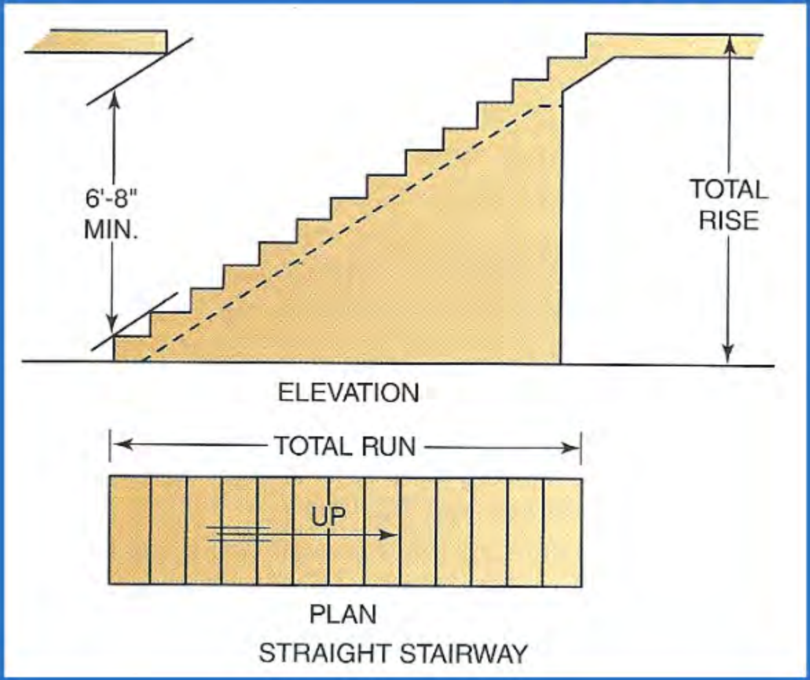
Panel Width = Rail Length - 1/4"

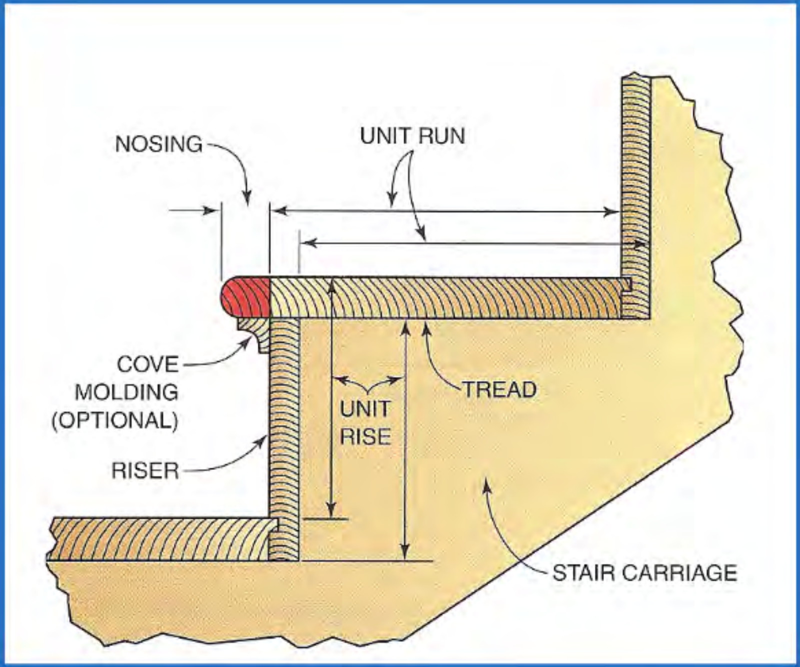
Staircase Stringers

Staircase Stringers Project



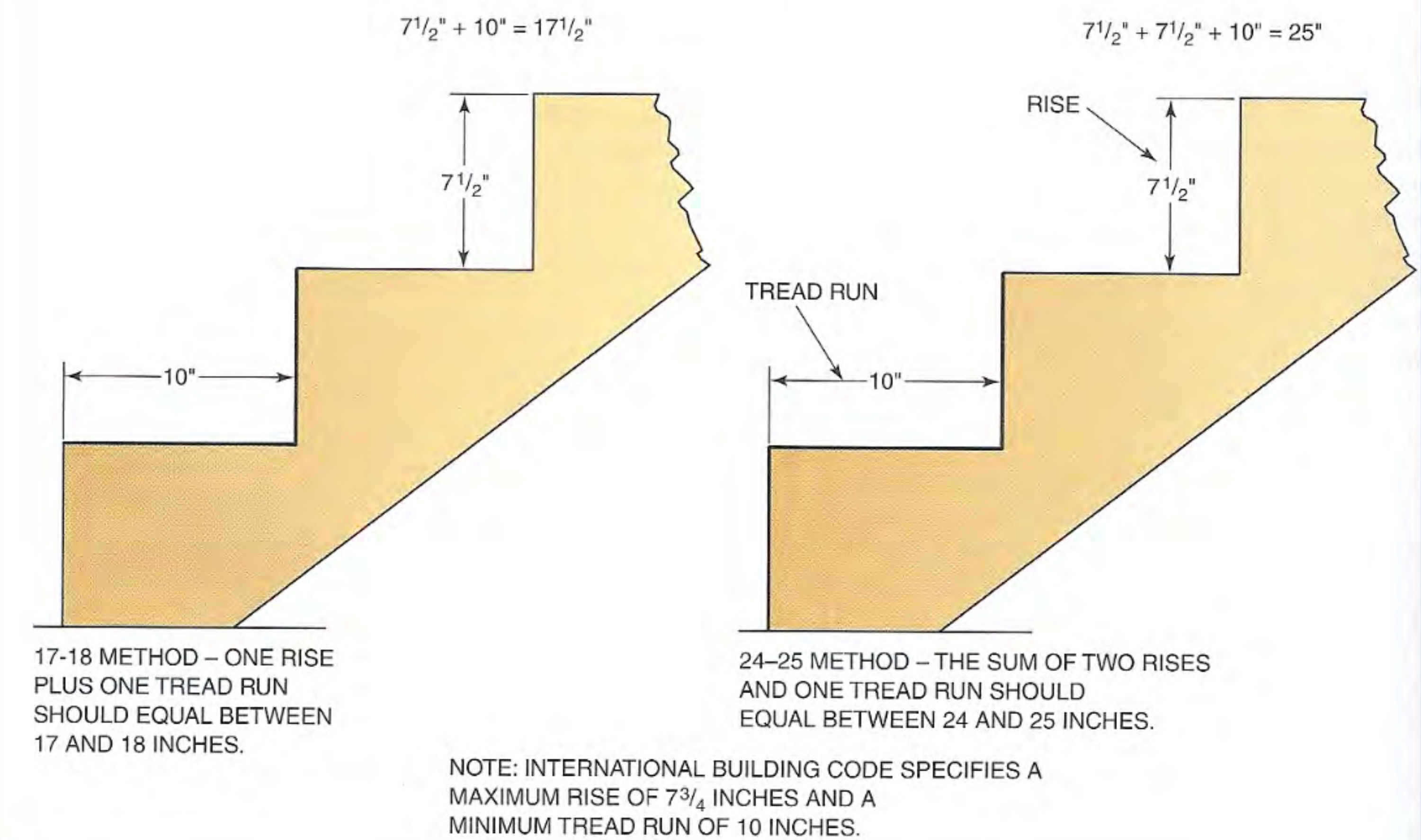
Staircase Stringers Project





Staircase Stringers Project

Two formulas are used to determine the unit run for stairs (Fig. 16-7).



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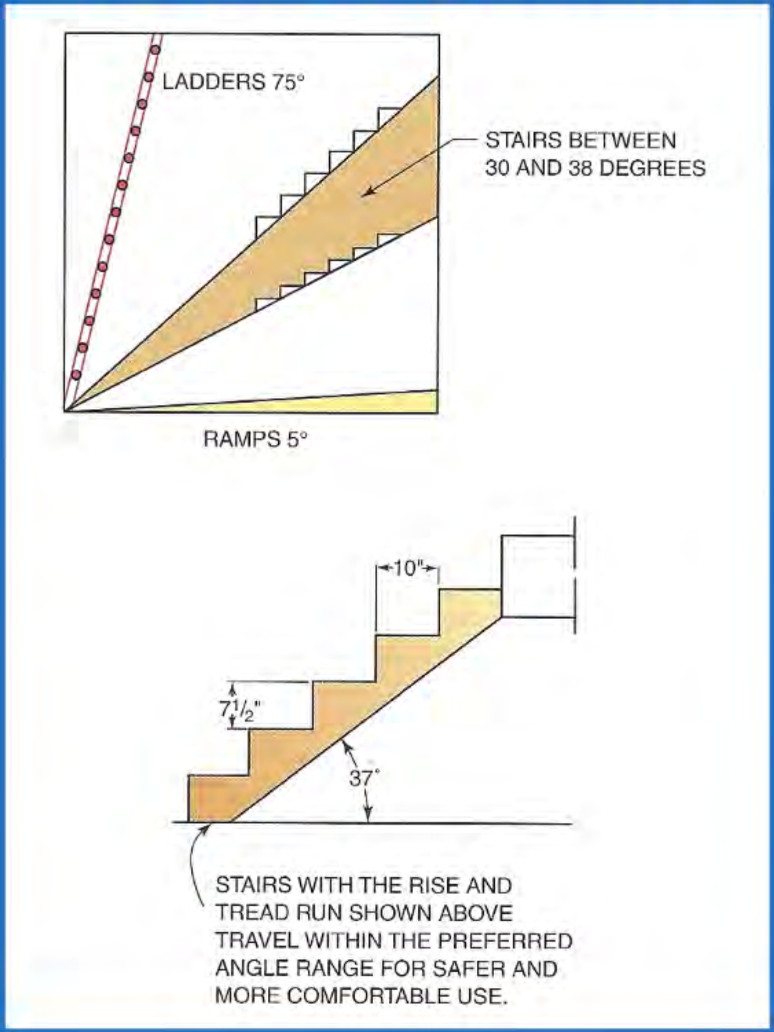
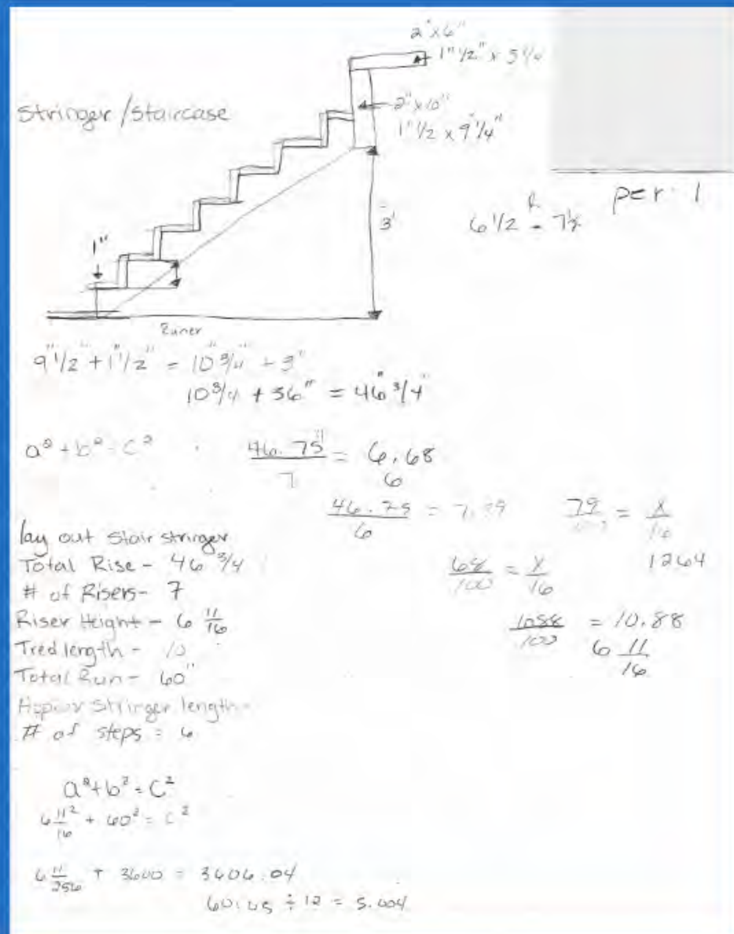


Staircase Stringers Project

- Team taught with carpentry teacher to cover both the math and building codes properly.
- Practiced calculations, then practiced laying out a stringer using butcher paper.
- Final assessment involved calculating, laying out, and cutting a staircase stringer out of OSB.
- Next year will incorporate Technical Writing to produce instructions for laying out a stringer

Staircase Stringers Project



Staircase Stringers Project

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