

# Math-in-CTE Lesson Plan Template

Lesson Title: Introduction to Stair Layout		Lesson # C14
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Occupational Area: Carpentry		
CTE Concept(s): Stair Design		
Math Concepts: Rise, Run, Slope, Division, Unit Conversion, Plotting/Graphing		
Lesson Objective:	Introduction to determine space needed for stairs	
Supplies Needed:	Tape measure, straight edge, IBC codes, Carpentry Fundamentals text, graph paper, pe calculator	

<b>THE "7 ELEMENTS"</b>	<b>TEACHER NOTES (and answer key)</b>
<p><b>1. Introduce the CTE lesson.</b></p> <p>Cover basic concepts of stair design:</p> <ul style="list-style-type: none"> <li>• Total rise is the amount of vertical gain</li> <li>• Total run is the amount of horizontal gain</li> <li>• Number of treads has to be a whole number and they have to be uniform</li> <li>• Height of risers must fit the International Building Code (IBC) The minimum is 4" and the maximum is 7.75". 7" is the ideal residential height.</li> </ul>	<p>Whole Number means no fractions/ decimals</p>



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

Some of the math concepts we will see that relate to this are slope, slope formula, x-axis, y-axis, ordered pair, Graphing a straight line by plotting points.

**Slope:** the measurement of the steepness of a line and is described as the ratio of the rise divided by the run.

**Slope Formula:**

**x-axis:** The Horizontal axis on the coordinate system

**y-axis:** the Vertical axis on the coordinate system

**ordered pair:** A location on a coordinate graph in relation to zero with the horizontal position first, and the vertical position second.

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

We are going to make a graph of a set of stairs

Students will need graph paper, pencil, and a straight edge.

How many risers would we need to go up to a landing 98" high? Assume we are using 7" as the riser height

Mark each division on the y-axis in increments of 7, and the x-axis will be in increments of 11.

Starting at 11 on the x-axis draw a vertical line going up 1 division on the paper to represent a rise of seven inches.

Then draw a horizontal line 1 division to the right to represent a tread of 11 inches.

Keep repeating this process until you get up to 98 inches on the y-axis and 154 inches in the x-axis

With the straight edge draw a straight line through the points that represent the front of the stair treads.

To calculate the slope of the staircase divide the total vertical distance by the total horizontal distance

Now we are going to pick two points on the line and calculate the slope again.

Have the class make a graph of stairs up to a 98" landing with 11 inch treads

For this example we are assuming we have all the horizontal distance we need – No constraints.

Make sure everyone's graph is accurate.

$$(98/154) = 0.64$$

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

- Different examples for students to work through independently
- Limited space for run

**5. Work through *traditional math* examples.**

Here are some examples that you may see in your regular math class

Use this link to give a traditional example of calculating slope through two points on a line.

<http://coolmath.com/algebra/08-lines/06-finding-slope-line-given-two-points-01.htm>

Have the students complete the example at the end of the second page.

If you want to do more examples use the Slope Examples worksheet. Only use #1-16.

**6. Students demonstrate their understanding.**

Now lets look at some examples that are a little more difficult.

What do we do if I don't get a whole number when I divide the total height by 7?

The tables are set at different heights. You are going to measure the height and calculate the proper riser height and number of treads for the stairs.

Pick 2 to 3 different heights in the shop for the students to work with if tables aren't adjustable.

Tell them to use trial and error to pick different riser heights until they find one that divides evenly into the total height.

**7. Formal assessment.**

After lessons on using framing square and stair gauges, student will be required to cut a stair stringer from the floor to one of the classroom tables. Grade will be based on classroom participation and the quality of the stringer.

NOTES: