Math-in-CTE Lesson Plan Template

Lesson Title: The ABC's of QC		**Lesson #**
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Occupational Area: Machine Tool/ Welding Fabrication		
CTE Concept(s): Micrometers/Calipers/		
Math Concepts: Precision/Accuracy/Fractions/Decimals		
Lesson Objective:	To be able to measure a part accurately to ensure quality and integrity of the part.	
Supplies Needed:	Parts to be measure and the corresponding print. Steel Rule Micrometer Caliper Smith & Peterson Mathematics for Machine Technology 6th Edition Whiteboard & markers Traditional math example worksheets Final Assessment Rubric	

THE "7 ELEMENTS"	TEACHER NOTES (and answer key)
1. Introduce the CTE lesson. *"Today's lesson is about accuracy versus precision. Looking at the worksheet #1, how would you measure the fish/lobster? Why is it important to measure these accurately/correctly?* *Now that we have finished our first project we need to measure it to the print. We will be using a ruler, micrometers, and calipers to do this. We have used these tools to make the part. Does anybody want me to review how to use these?* *We will be working on the distinction between precision and accuracy while we measure the part to the print.* *In the manufacturing world your parts will be inspected before they are shipped to the customer."*	Have the parts to measure and have rulers, micrometers and calipers handy. Jail time Financial loss Loss of license Note: the part that they will be checking to meet specs is the very first part they have made in the class.)

2. Assess students' math awareness as it relates to the CTE lesson.	Each student will receive a part (ie bolt) along with the print identifying different dimensions of the part to measure. Each student will receive an identical part. (This is not the part that they have made.)
"How would you check the part against the print?	If the student chooses the ruler, ask if it is the most **accurate** way to measure.
	Accuracy is defined as, "The ability of a measurement to match the actual value of the quantity being measured".
	Precision is defined as, "(1) The ability of a measurement to be consistently reproduced"
Lets review how to use how to use a steel ruler, and a micrometer.	Review steel rulers. Review micrometer. Explaining the accuracy vs precision
Read the spec on the print and decide which tool to use." *Would you use a scale (ruler)? If yes, does it have the accuracy the print calls for? If it does not what other tool would you use?*	Give the student a part and the print at this point (use what projects or parts you have available) to determine what tool to use looking at the tolerances called for on the print.
Convert measurements from fractional inches to decimal inches and vise-versa.	

3. Work through the math example *embedded* in the CTE lesson. *"Looking at the print, measure the part.* *If the part is out of spec it is not usable by the client. If it is out of spec the part would need to be reworked or a new one made.* *Use the sheet I give you to record your measurements."*	Keep asking if the tool is correct by identifying tolerance. **Write on board for reminder:** ***Tolerance levels for these parts are always***  ***Two place decimal of***  ***Three place decimal of***  Review: Tolerances. Limitations. Degree of precision of a number (show) Absolute Error & Relative Error (show/explain) Fits of mating parts. Use a generic sheet for the part.
4. Work through *related, contextual* math-in-CTE examples. *"Now take this other part and print and measure it.* *Record all of your measurements."*	Whatever piece is used for element 3 find one smaller or larger to reinforce the lesson. To differentiate between 1st and 2nd year students change the shape of the object. For example go from rectangular shape to circular.

5. Work through *traditional math* examples.

"In your math book from school you might find examples like the ones shown on this worksheet. On this worksheet they have you measuring to an eighth of an inch, but remember, in machine tool class we will work to a one sixty-fourth tolerance."

Kuta Software - Infinite Geometry Name_____

Line Segments and Measure Date_____ Period____

Use a ruler to measure the length of each line segment. Measure each segment in inches. Round your measurements to the nearest $\frac{1}{8}$ of an inch.

1)

2)

3)

4)

5)

6)

7)

8)

9)

10)

11)

12)

13)

14)

Use a ruler to measure the length of each line segment. Measure each segment in inches. Round your measurements to the nearest $\frac{1}{8}$ of an inch. Also state the maximum error and maximum percent of error in each measurement.

15) 

16)

17)

18)

19)

20) 

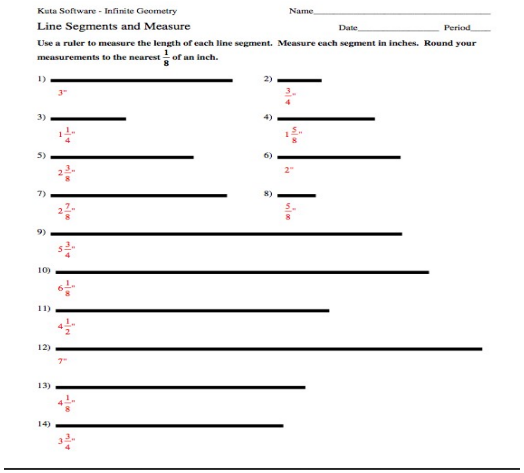
Critical thinking questions:

21) Jessica measures a line segment to the nearest $\frac{1}{8}$ of an inch. She calculates that her measurement has up to 0.1% error in it.

What measure did she find for the line segment?

22) What is the minimum error and minimum percent error in Jessica's measurement?

Pass out the worksheet with traditional math questions.



Kuta Software - Infinite Geometry Name_____

Line Segments and Measure Date_____ Period____

Use a ruler to measure the length of each line segment. Measure each segment in inches. Round your measurements to the nearest $\frac{1}{8}$ of an inch.

1) 3"

2) $\frac{3}{4}$"

3) $1\frac{1}{4}$"

4) $1\frac{5}{8}$"

5) $2\frac{3}{8}$"

6) 2"

7) $2\frac{7}{8}$"

8) $\frac{5}{8}$"

9) $5\frac{3}{4}$"

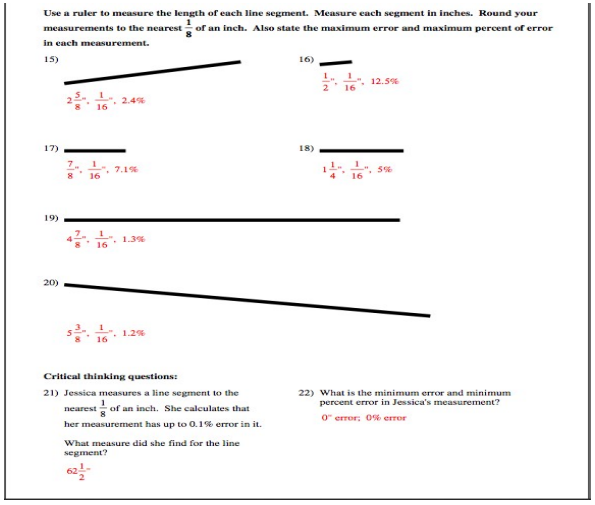
10) $6\frac{1}{8}$"

11) $4\frac{1}{2}$"

12) 7"

13) $4\frac{1}{8}$"

14) $3\frac{3}{4}$"



Use a ruler to measure the length of each line segment. Measure each segment in inches. Round your measurements to the nearest $\frac{1}{8}$ of an inch. Also state the maximum error and maximum percent of error in each measurement.

15) $2\frac{5}{8}$", $\frac{1}{16}$", 2.4%

16) $\frac{1}{2}$", $\frac{1}{16}$", 12.5%

17) $\frac{7}{8}$", $\frac{1}{16}$", 7.1%

18) $1\frac{1}{4}$", $\frac{1}{16}$", 5%

19) $4\frac{7}{8}$", $\frac{1}{16}$", 1.3%

20) $5\frac{3}{8}$", $\frac{1}{16}$", 1.2%

Critical thinking questions:

21) Jessica measures a line segment to the nearest $\frac{1}{8}$ of an inch. She calculates that her measurement has up to 0.1% error in it.

What measure did she find for the line segment?

$62\frac{1}{2}$"

22) What is the minimum error and minimum percent error in Jessica's measurement?

0" error; 0% error

6. Students demonstrate their understanding. *"Now lets look at these parts. Find the measurements that don't meet spec. Why don't they meet spec?"*	Have a few parts out to measure. Have something on the parts or print to be faulty. The students need to identify where the errors occur.
7. Formal assessment. *"Now take your part and measure it for spec. If your part meets specs then you can send it off to your client. If it does not meet specs then the part needs to be reworked or remade."* *See rubric and score your project."*	Have the students retrieve the parts that they have made along with the original print. Makeup a rubric and score part.

NOTES: