Math-in-CTE Lesson Plan Template

Lesson Title:		Lesson #
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Occupational Area: Engineering Technologies		
CTE Concept(s): Project-based Cost Estimating & Decision Making		
Math Concepts: Estimating, Order of Operations		
Lesson Objective:	Develop parts cost considering quantity discounting, minimum orders, complex units (volu area, weight), decision making using complex criteria.	
Supplies Needed:	Part pricing worksheets (blank & partially filled, catalogs, Order of Ops worksheet	

THE "7 ELEMENTS"	TEACHER NOTES (and answer key)
1. Introduce the CTE lesson. **As part of the larger culminating project, one of the tasks is to develop a comprehensive cost estimate for materials and other items. Because the project needs to meet customer specs, we need to develop multiple options, with cost/benefit analysis to present to the customer for direction before proceeding further.** **Things you'll need to particularly look for are correct part (esp. form factor), minimum purchase quantity, volume discounts (!), cost per unit, minimum order requirements, shipping & handling charges and (if time is an issue) stock availability.**	**Students will already have worked through the customer specs and plans; they will have developed a preliminary design and list of materials. By the end of this unit, students will have quantified and priced two or three options to present to the customer. They will need to understand how to estimate the quantity of materials needed for the project. They will need to get prices from more than one source. Finally, they will need to describe the pros and cons of each option they present to the "customer".**

2. Assess students' math awareness as it relates to the CTE lesson. Provide 2 or 3 Catalogs with similar parts for comparison. Ask class to make observations about similar items on each page. If necessary point out minimum quantities, volume discounts, minimum purchases and S/H charges. Note that online many vendors also list stock availability.	- Materials - two or three different electronics parts catalogs
3. Work through the math example *embedded* in the CTE lesson. Complete the 'Part Pricing Worksheet' using the provided catalog page – do not be concerned if you don't know what the parts are at this point. Enter appropriate data in cells on worksheet, calculate total cost for purchase quantity of each part and enter in Total/Notes column. If item is available in different forms use multiple rows on worksheet USE NOTES for listing differences, selection choices, catalog page numbers, questions, anything that may help make final selection. Vendor column is used when you have more than one vendor and part number helps locate correct item when placing order. We will not be calculating totals at this time. (Why?)	- Provide 'Part Pricing Worksheet' with sample parts & quantity listed and single "Jameco" Catalog Page - When preparing a worksheet for other areas choose examples of minimum quantity items, quantity discount & other special situations - Totals will be calculated at the time of decision-making and final quote preparation.
4. Work through *related, contextual* math-in-CTE examples. Using Blank Part Pricing worksheets and 2-3 catalogs prepare create parts price lists using the parts list from your circuit design. Remember to include circuit board material, connectors, wires and boxes. What happens if we want to make more than one unit?	Materials – Catalogs, previously created parts list. Each class member creates their own part pricing worksheets. Discuss issues related to more unusual unit quantities, volume, area, gases, hazardous materials, assemblies, etc.

5. Work through *traditional math* examples. Complete Order of Operations math worksheet. Use “Please Excuse My Dear Aunt Sally” or PEMDAS 1. Parentheses and other grouping symbols. 2. Exponents. 3. Multiply and Divide from left to right. 4. Add and Subtract from left or right. What we are doing when we total out the pricing is a lot like substituting and evaluating in your algebra classes. In algebra you do 3x+4y+2z. In our class x is the cost of a diode, y the cost of a certain transistor and z could be the cost of a resistor. We could use that formula and SUBSTITUTE in the different costs from different distributers to find the lowest cost.	Order of operations, reasonableness of answers, reality check - Order of Operations Worksheet 1. First you do whatever is inside the parenthesis, or brackets following the order of operations inside the parenthesis 2. Exponents 3. Whichever comes first left to right. If division comes first left to right, then you MUST divide first. Multiplication and division can be thought of as basically the same thing. Dividing by 7 is the same as multiplying by $1/7^{th}$. 4. Also Whichever comes first left to right. These are also basically the same. Subtracting 5 from something is the same as adding -5 to that thing.
6. Students demonstrate their understanding. Group member get together, compare sheets done in #4 when there are differences discuss/defend and make a group decision. The students look in different catalogues and find the costs of the parts of other projects. The students will have to decide what to order keeping in mind all of the variables like, I can order this in tens, hundreds, etc, different costs in different catalogues, delivery times, stock availability, name brands vs generic, functionality, etc	- Mediate!

7. Formal assessment. **Assessment for this project is done by presentation of completed price quote to the "customer" (industry partner).**	

NOTES: