


Math-in-CTE Lesson Plan Layout-minimizing waste

Lesson Title: Layout- minimizing waste		Lesson # M-06
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Occupational Area: Metal Fabrication/Welding		
CTE Concept(s): Layout- Minimizing waste		
Math Concepts: Unit conversion, measurement.		
Lesson Objective:	To develop a cut procedure from a material list in order to minimizing waste.	
Supplies Needed:	Calculators, worksheets, white board markers	

THE "7 ELEMENTS"	TEACHER NOTES (and answer key)
<p>1. Introduce the CTE lesson.</p> <p>What we need to learn today is how to develop a material cut procedure from a material list in order to minimize waste in our use of materials when building one of our aluminum dock ramps.</p> <p>Last class, we learned what a cut list is and how do develop it from our blueprints.</p> <p>Also we learned that different materials come stock in different lengths</p> <p>In math class, this is called linear measurement.</p>	<div> <p>Why is this called Linear ? (Measurement in a straight line).</p>  </div>

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

Who remembers how to **convert** feet to inches?

Your math instructor will probably use the term “**Unit Conversions**”

On your worksheet are a few examples to be completed.

Formula: Length in feet x 12 = Total inches

Hand out worksheet 1.

In every job, there is a certain amount of waste. Our goal is to minimize the amount of waste.

NOTE: Always plan or determine if calculating **kerf** is needed for the application.

Let's calculate waste in these examples on your worksheet.

Remember that in industry we use the term **Drop** and **Waste** as the same where your math teacher would use the term **remainder** when dividing and the term would be **difference** when subtracting.

4. How much waste is there from a 20' bar after you cut 11 pieces @18”?

5. How many 18” pieces can you cut from a 20' bar? How much waste is there?

Worksheet 1

1. $20' \times 12'' = 240''$
2. $12' \times 12'' = 144''$
3. $10.5' \times 12'' = 126''$

Answers

Cut list = 11 pcs @ 18”

4. $11 \times 18 = 198''$ $12 \times 20 = 240''$
 $240 - 198'' = 42''$ drop/waste.

5. $240''$ divided by $18'' = 13.33$, or 13 pieces.
 $13 \text{ pcs} \times 18'' = 234''$.
 $240'' - 234'' = 6''$ drop/waste.

The following are two examples of POOR of a cut procedure

Cut list : 10 pcs @ 8' and 8 pcs @ 12'

Poor example:

1. From bars 1 thru 5 cut 2 pcs @ 8' - with 4' drops.
2. From bars 6 thru 13 cut 8 pcs @ - 12' with 8 ' drops.
13 bars required with 5 drops @ 4' and 8 drops @ 8'.

Good example:

1. From bars 1 thru 8 cut 8 pcs @ 8' and 8 pcs @ 12' with 0 drops.
2. Bar 9 cut 2 pcs @ 8' with 4' drop.
9 Bars required with one drop @ 4'

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

Now we need to order some materials or should I say what is the correct number of bars needed for our job with minimum waste.

Ordering too many bars costs us more money, ordering too few bars means we need to reorder and may cause possible delays in completion and delivery to the customer.

Hand out A: Cut procedure example. **Estimation**

Hand out work sheet 2.

Hand out A:

Material list: 4 pcs @ 12' - 4 pcs @ 7' - 8 pcs @ 4'-6"

Bars 1 thru 4 = 4 pcs @ 12' - 4 pcs @ 7' with 1' drop

Bars 5 thru 6 = 4 pcs @ 4'-6" with 2' drop

6 Bars required with 4 drops @ 1' and 2 drops @ 2'

Worksheet 2

Material list: 3 pcs @ 5'

3 pcs @ 14'

Cut procedure:

Bars 1 thru 3 = 1 pc @ 14' – 1 pc @ 5'

	3 bars required with 3 drops @ 1'.
<p>4. Work through <i>related, contextual</i> math-in-CTE examples</p> <p>Up to this point we've been dealing with mostly in feet. In many situation such as this project we will be working in inches. The dimensions in following worksheet will be in inches.</p> <p>Remembering that the bars of material you will be using come in 20' lengths. You will need to convert the 20' bars into inches and develop a cut procedure.</p> <p>Hand out worksheet 3</p>	<p>Worksheet 3</p> <p>From the material list develop a cut procedure.</p> <p>Include actual cut procedure, number of bars required, and size and number of drops.</p> <p>Material list:</p> <p>12 pcs @ 42"</p> <p>16 pcs @ 88"</p> <p>16 pcs @ 56"</p> <p>ANSWER:</p> <p>Bars</p> <p>1 thru 8 = 2 pcs @ 88" - 1 pc @ 56" with 8" drops</p> <p>9 thru 12 = 2 pcs @ 56" - 3 pcs @ 42" with 2" drops</p> <p>12 Bars required – with 8 drops @ 8" and 4 drops @ 2"</p>
<p>5. Work through <i>traditional math</i> examples.</p> <p>In geometry, linear measurement is used for figuring the perimeter of different shapes. In the case of fencing in a backyard, we need to know the perimeter, or total length of fencing needed to enclose the yard. However, we also need to know the lengths fencing comes in. This will allow us determine the number and length of pieces needed to</p>	<p>Worksheet 4.</p> <p>1. You have a backyard that is 28' x 24'. What is the total perimeter of the yard?</p>

minimize the waste.
Hand out worksheet 4.

Fencing is available in 10' or 8' lengths. How many of each length will you need to enclose the yard? How much is left over?

Answer.

Perimeter is 104'.

You can fence this area with 4 sections @ 10' and 8 sections @ 8'. This leaves you with 0 wasted fence.

2. Here is a more complex shape. What is the perimeter of the figure? How many of each length will you need, and how much fence is wasted?

Answer:

The perimeter is 144'. Required lengths of fencing 6 pcs @ 10' and 11 pcs @ 8' with one 4' drop.

6. Students demonstrate their understanding.

Form a cut procedure sheet with the given material list including the size and number of drops/waste and number of bars needed to complete the order.

Hand out Worksheet 5

Worksheet 5

NOTE: All material to be 1-1/4" x sch 40 aluminum pipe

MATERIAL LIST

32 - pcs @ 62"

34 - pcs @ 35"

Best case:

1. Bars 1 thru 8 cut 2 pcs @62" – 3 pcs @ 35"
= 16 pcs @ 62" and 24 pcs @ 35"
2. Bars 9 thru 13 cut 3 pcs at 62" and 1 @ 35"
= 15 pcs @ 62" and 5 pcs @ 35"
3. Bar 14 cut 1 pc @ 62" and 5 pcs @ 35"

	<p>TOTALS</p> <p>Step 1 = 16 pcs @ 62" and 24 pcs @ 35"</p> <p>Step 2 = 15 pcs @ 62" and 5 pcs @ 35"</p> <p>Step 3 = 1 pc @ 62" and 5 pcs @ 35"</p> <p>TOTAL 32 pcs @ 62" -- 34 pcs @ 35"</p> <p>14 Bars required with</p> <p>8 drops @ 11" - 5 drops @ 19" - 1 drop @ 3"</p>
<p>7. Formal assessment.</p> <p>Using the developed cut procedure sheet cut material to numbers and sizes.</p> <p>Turn in material cut procedure sheet and cut material stock for verification of accuracy and compliance to cut procedure.</p>	<p>From 14 Bars student should yield</p> <p>32 pcs @ 62" -- 34 pcs @ 35" with</p> <p>8 drops @ 11" - 5 drops @ 19" - 1 drop @ 3"</p>

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