

WAMC Lab

Math Concept(s): Measurement, scale, subtraction, adding fractions

Source / Text: Backstage Handbook, Paul Carter

Developed by: Ben Stuart

E-Mail: btstuart@seattleschools.org

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Attach the following documents:

- Lab Instructions-Student Handout
- Summative Assessment Sheet

Short Description (Be sure to include where in your instruction this lab takes place):

In this lab, students will use their understanding of actual versus nominal lumber sizing to ultimately calculate a precise list of materials and their dimensions required to make two, 2'x6' scenic flats (one Broadway style and the other Hollywood) in the summative assessment. This lesson should follow instruction on stock scenery, types and dimensions of lumber, sheet woods, and pneumatic staples.

Lab Plan

Lab Title: *Making a Cut List*

Prerequisite skills: The students should have an understanding of imperial measurements, measurement tools (tape measure, scale rule, square), right angles, and squares. The students should know the nominal and actual dimensions of 1x3 lumber.

Lab objective: In this lab, students will understand the components of a written cut list with guided instruction and independent practice before making a cut list for two, 2'x6' scenic flats (one Broadway style and the other Hollywood) in the Summative Assessment Sheet.

Standards: (Note SPECIFIC relationship to Science, Technology, and/or Engineering)

[Mathematics K–12 Learning Standards:](#)

- G-MG.1 Use geometric shapes, their measures, and their properties to describe objects
- G-MG.2 Apply geometric methods to solve design problems (e.g., designing an object or structure to satisfy physical constraints or minimize cost; working with typographic grid systems based on ratios)

[Standards for Mathematical Practice:](#)

- Make sense of problems and persevere in solving them.
- Attend to precision.
- Look for and make use of structure.
- Look for and express regularity in repeated reasoning.

[K-12 Learning Standards-ELA](#) (Reading, Writing, Speaking & Listening):

- ELA-W.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

K-12 Science Standards/Engineering

- HS-ETS1-2. Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

Technology

- 4.a. Students know and use a deliberate design process for generating ideas, testing theories, creating innovative artifacts or solving authentic problems.

Leadership/21st Century Skills:

21st Century Interdisciplinary themes (Check those that apply to the above activity.)			
<input type="checkbox"/> Global Awareness	<input checked="" type="checkbox"/> Financial/Economic/Business/Entrepreneurial Literacy	<input type="checkbox"/> Civic Literacy	
<input type="checkbox"/> Health/Safety Literacy	<input checked="" type="checkbox"/> Environmental Literacy		
21st Century Skills (Check those that students will demonstrate in the above activity.)			
LEARNING AND INNOVATION	INFORMATION, MEDIA & TECHNOLOGY SKILLS	LIFE & CAREER SKILLS	Productivity and Accountability
<u>Creativity and Innovation</u>	<u>Information Literacy</u>	<u>Flexibility and Adaptability</u>	<u>Accountability</u>
<input type="checkbox"/> Think Creatively	<input type="checkbox"/> Access and Evaluate Information	<input checked="" type="checkbox"/> Adapt to Change	<input type="checkbox"/> Manage Projects
<input type="checkbox"/> Work Creatively with Others	<input type="checkbox"/> Use and manage Information	<input type="checkbox"/> Be Flexible	<input checked="" type="checkbox"/> Produce Results
<input type="checkbox"/> Implement Innovations		<u>Initiative and Self-Direction</u>	<u>Leadership and Responsibility</u>
<u>Critical Thinking and Problem Solving</u>	<u>Media Literacy</u>	<input type="checkbox"/> Manage Goals and Time	<input type="checkbox"/> Guide and Lead Others
<input type="checkbox"/> Reason Effectively	<input type="checkbox"/> Analyze Media	<input checked="" type="checkbox"/> Work Independently	<input type="checkbox"/> Be Responsible to Others
<input type="checkbox"/> Use Systems Thinking	<input checked="" type="checkbox"/> Create Media Products	<input checked="" type="checkbox"/> Be Self-Directed Learners	
<input type="checkbox"/> Make Judgments and Decisions	<u>Information, Communications and Technology (ICT Literacy)</u>	<u>Social and Cross-Cultural</u>	
<input checked="" type="checkbox"/> Solve Problems	<input type="checkbox"/> Apply Technology Effectively	<input type="checkbox"/> Interact Effectively with Others	
<u>Communication and Collaboration</u>		<input type="checkbox"/> Work Effectively in Diverse Teams	
<input type="checkbox"/> Communicate Clearly			
<input type="checkbox"/> Collaborate with Others			

Teacher Preparation: (What materials and set-up are required for this lab?)

Materials

- Graphing paper, straight edges, pencils, copies of pages 276-279 (parts of a flat diagrams) of the Backstage Handbook text, and copies of the Summative Assessment Sheet.

Set-Up Required:

- Have example model flats available and samples of 1x3.

Lab Organization Strategies:

Leadership (Connect to 21st Century Skills selected):

- Students will discuss their process with each other during the independent practice portion.

Cooperative Learning:

- For this lab, students will work together to do the subtraction and adding fractions required to make a cut list for a flat.

Expectations:

- Students will help each other during the independent practice but will complete the Summative Assessment Sheet on their own.

Timeline:

- Review of prior learning, demonstration of 1x3 dimensions, and explanation of the parts of the flat models will take 5 minutes. Guided practice of making a cut list will take 2 minutes, independent practice 3 minutes, and the Summative Assessment Sheet another 5 minutes.

Post Lab Follow-Up/Conclusions:

Discuss real world application of learning from lab

- What are the practical uses of each type of flat for plays and musicals? How does building a flat correctly impact actor safety?

Career Applications

- Any which require problem-solving or basic construction principles.

Optional or Extension Activities

- After successfully passing the Summative Assessment Sheet, students are ready to begin the *Modeling Broadway versus Hollywood Flats* lab. Later, they will use their cut lists to actually build real stock flats for the stage.

ASSESSMENT SLIP

1. Sketch in the framing design and draw arrows with the parts of flat labels to each rear elevation in the diagrams below:

2x6 Broadway Flat:



2x6 Hollywood Flat:



Top Rail
Skin
Stiles
Toggle
Keystones (B'Way Only)
Cornerblocks (B'Way Only)
Bottom Rail

2. Make the cut list under each 2x6 flat:

Example: 2 @ 6' 7" from 1x3

- ____ @ ____ from ____
- ____ @ ____ from ____
- ____ @ ____ from ____
- ____ @ ____ from ____
- ____ @ ____ from ____
- ____ @ ____ from ____

Example: 1 @ 4'x8' from ¼" Lauan

- ____ @ ____ from ____
- ____ @ ____ from ____
- ____ @ ____ from ____
- ____ @ ____ from ____

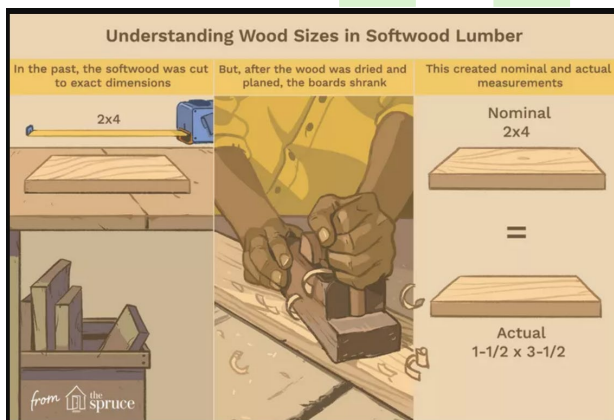
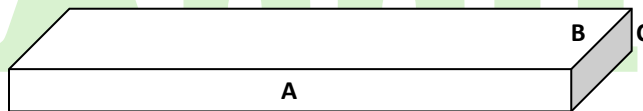
Lab Instructions - Student Handout:

Step 1: Gather Materials & Supplies

- 1 sheet of graph paper
- 1 straight edge
- A pencil

Step 2: Use the “Parts of a Flat” pages 276 & 279 from the Backstage Handbook. Vocab: **Nominal/Actual Size, Face, Rail, Stile, Toggle, Cornerblock, & Keystone.**

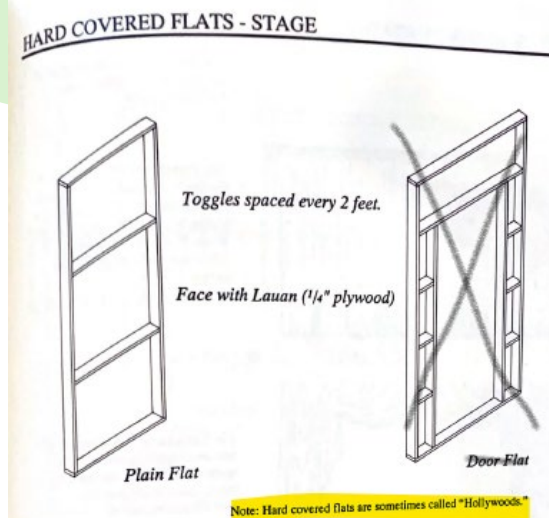
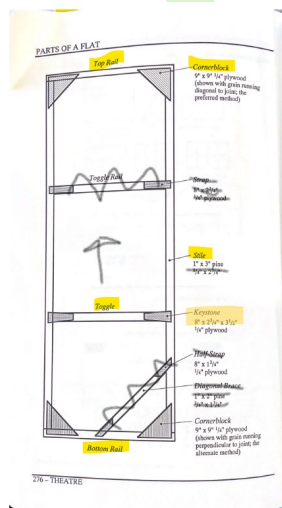
A = Length (whatever you cut it to!) **B** = Width of 1x3: 2.5” **C** = Height (thickness) of 1x3: ¾”



Common Dimensional Lumber Sizes

	Nominal Size	Actual Size
	1 x 2	3/4 x 1-1/2"
	1 x 3	3/4 x 2-1/2"
	1 x 4	3/4 x 3-1/2"
	2 x 2	1-1/2 x 1-1/2"
	2 x 4	1-1/2 x 3-1/2"
	2 x 6	1-1/2 x 5-1/2"
	2 x 8	1-1/2 x 7-1/4"
	2 x 10	1-1/2 x 9-1/4"

the spruce



NOTE: Our 1"x3" Pine comes in the now standard actual size ¾" x 2 ½", NOT ¾" x 2 ¾" as the Broadway flat's stile is labeled on page 276. If building stock, we space toggles every 2 feet as depicted. If building for shorter-term, we may use only one toggle and cut the depicted Broadway flat's Toggle Rail + Straps and Diagonal Rail + Half Straps to save time and resources. While Broadway flats can be "soft-cover" made out of stretched muslin and painted, our stock of Broadway flats are hard-cover with ¼" Lauan to make them more durable long-term.

Step 3: Use your straight edge to draw two rectangles 8 squares wide by 16 squares tall. Each rectangle will represent a 4' x 8' flat with every 2 squares representing 1' (approximately 1/2" scale).

Step 4: Inside each rectangle, use your straight edge to draw a **rear elevation** of the Top/Bottom **Rails, Stiles, and 1 Toggle**. Remember to draw the frame pieces **WIDER** on the Broadway Flat and **NARROWER** on the Hollywood Flat. Label each part, including the skin (your

Step 5: On the Broadway Flat only, add the 4 **Cornerblocks** and 2 **Keystones**, as depicted on page 276 in the Backstage Handbook. Label these parts.

Step 6: Create a bullet point list of every piece of material needed to build each part of the flat under each flat diagram using the following format:

- **quantity @ length from material name**

Example:

- **2 @ 7' 10 1/2" from 1x3 pine**

Remember! The orientation of the frame (on **width** versus **height**) changes the dimensions of your cuts, even though both lists are for 4' x 8' flats!

- For **Broadway** flats, you have to subtract the **width** of the Top Rail and Bottom Rail from the length of the Stiles (and Toggle).
- For **Hollywood** flats, you have to subtract the **height** (thickness) of the Top Rail and Bottom Rail from the length of the Stiles (and Toggle).

<https://wa-appliedmath.org/>