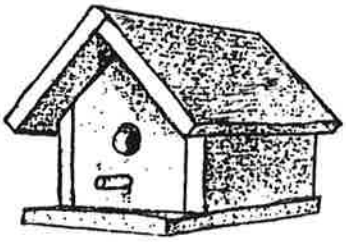
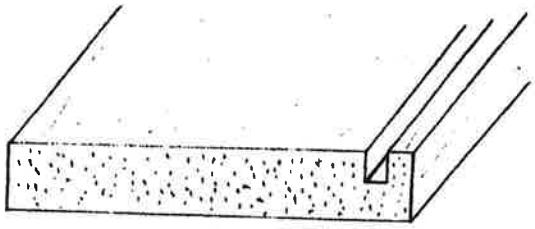
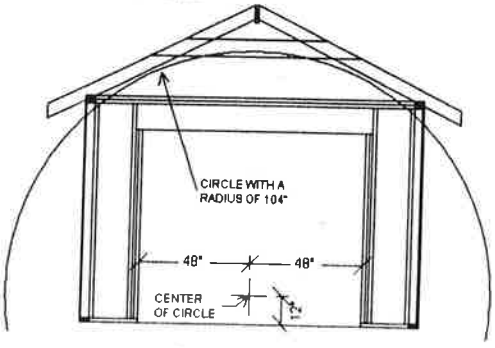
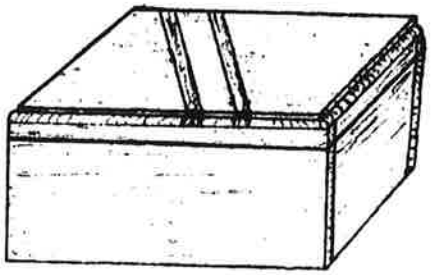
Exploring Woodworking and Construction Technology









Name_____Period_____

Woodshop Safety Rules

1. Safety glasses are required to be worn at **all times** in the woodshop.
2. Long hair must be tied back. Hair, which is long enough to touch the shoulders, must be tied back before using any power equipment.
3. Loose clothing cannot be worn. Jewelry must be removed and long sleeves must be rolled up before operating machines. Open toed shoes/sandals are not safe in the woodshop!
4. Absolutely no running is allowed in the woodshop.
5. Never fight in the woodshop. Even if you believe you are only playing around, this will not be tolerated.
6. Never throw anything in the woodshop. If you are 2 feet away from a trash can, you may **not** toss something into it. **NEVER THROW ANYTHING!!**
7. No electronic devices such as cell phones, I-pods, mp3 players, etc. are allowed in the woodshop. Any such devices will be taken. **They will not be returned until the end of the school day.**
8. Never talk to or distract another student while they are using a power tool.
9. Never use any tool inappropriately. Do not crush pencils in the vises, do not drill holes in the tables, do not cut candy bars with the bandsaw, do not smash scraps with a hammer, do not use scraps of wood as weapons, etc...
10. Tools and materials can be dangerous. Do not handle either unless you have something specific in mind.
11. Do not destroy school property.
12. All safety guards on all tools must be in place and used at all times.
13. Disconnect power before changing blades or belts or making adjustments.
14. Do not leave a machine until all motion has stopped.
15. Clean your area when through.
16. Devote all your attention to the machine or tool you are using.
17. When help is needed on an operation, ask for only enough help to do the job.
18. Do not enter the shop unless an instructor is present.

Woodshop Safety Rules Continued

19. Ask instructor before using any power tools (each time). You must have your glasses on, with your project in hand. You must know what tool you need to use, and you must explain what you need to do.
20. Never ask you use a tool for which you have not passed the safety test.
21. Never steal anything. If there is a scrap you believe to be trash, do not take it without asking.
22. Never touch another students project. If you do, I will assume you have stolen it, and will act accordingly.
23. Make sure you name and period number are written on your project. If your project is in multiple pieces, your name and period number must be written on every piece. Any project I find with no name on it will not be returned. This is to protect you, as projects without names on them get stolen by other students who will claim the project is theirs. If you don't write your name on it, I won't know who's project it is.
24. No student is allowed in the finish room unless they have permission to be there, and they are currently painting or oiling their project. No one may be in the finish room to "help" another student.
25. No student is allowed in the wood or tool storage rooms without having permission. If I find any person in one of these rooms without permission, I will assume that I have walked in on an attempted crime!

[redacted]

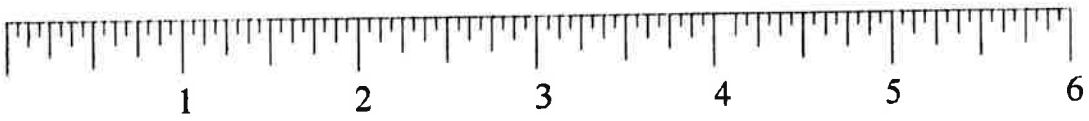
28. Always follow every classroom and safety rule all of the time.
29. ***Any student who makes a weapon out of a piece of wood, such as a spear, a knife, a wooden gun, or anything else which could possible be considered a weapon will be removed from this class by SMT. Students who do this are generally suspended.***

Measuring

History:

When woodworking, we do not use the Metric system, but instead use the Standard, or English system of measurement, meaning we measure in feet and inches, not in centimeters.

In the Standard system of measurement, inches are broken down in to fractions. In this class, we will use rulers which have each inch broken into 16 sections. Each of these sections is $^1/_{16}$ of an inch.



On this ruler, notice that each inch is broken into 16 parts. Also notice that only the inches are numbered. The lines that divide each inch are different lengths, but they are not numbered. If every line were numbered, the ruler would have way too many numbers on it, and would just get confusing.

People often ask why inches are broken into 16 sections, and not 10 or 14 or 19 or anything else. An inch is broken into 16 sections because that is what we end up with if we keep taking half of something.

Before accurate ways to measure and weigh things existed, this was a simple way to divide things into equal portions quite accurately.

Example:

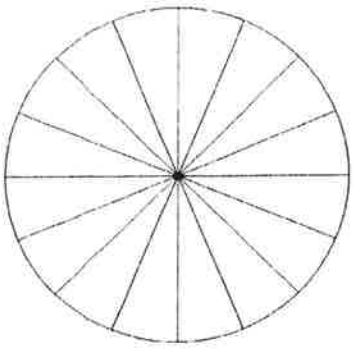
Let's say you had a bucket of rice to sell at a market. If someone came up to you and said, "I would like to purchase $^1/_{10}$ of that rice, it would have been very difficult to measure out exactly that amount of rice without precise measuring devices.

But if you had a simple balancing scale, you could very accurately divide the rice in half. You could then divide each half in half, ending up with $^1/_4$ of a bucket. You could then easily divide each $^1/_4$ in half to get exactly $^1/_8$ of a bucket of rice. By doing this, you could assure the person who was buying your rice that they were getting precisely $^1/_8$ a bucket of rice.

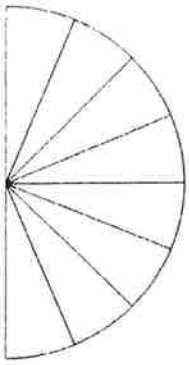
Another way to explain this is to talk about how pizzas are cut up, as shown in the following example.

Pizza Example:

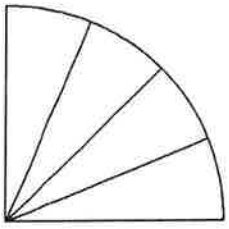
Have you ever noticed that a large pizza is most often cut into 8 or 16 pieces. This is because the person cutting a pizza first cuts it in half. He then cuts each half in half, ending up with quarters. He then cuts each quarter in half ending up with eighths, and then, if the pizza is big enough, cuts each eighth in half, ending up with 16 pieces.



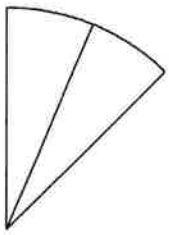
If you have an entire pizza,



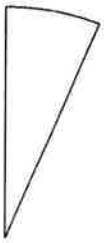
and someone eats half of it, you are left with ½ of a pizza.



If someone then eats half of what is left, you are left with ¼ of a pizza.



If someone eats half of what is left, you are left with ⅛ of a pizza.



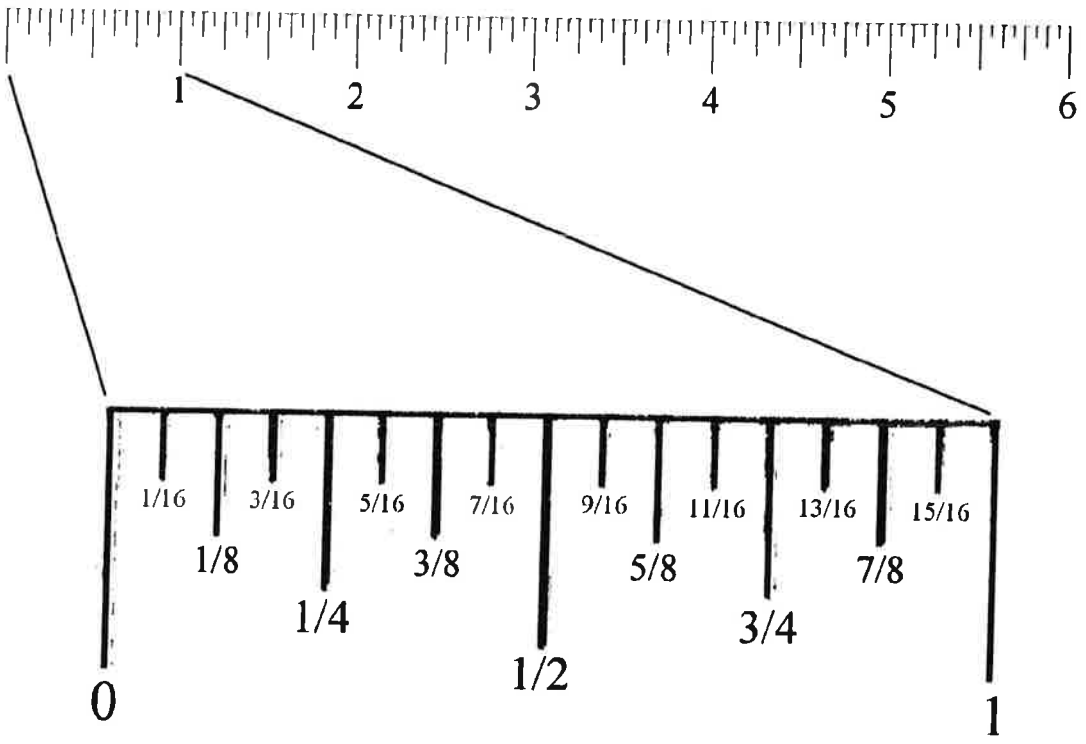
If someone eats half of what is left, you are left with $^1/_{16}$ of a pizza.

This is also exactly how an inch is divided into 16 parts.

How we measure, and how we write measurements:

Here is a ruler which is 6" long.

-Each inch is divided into 16 parts



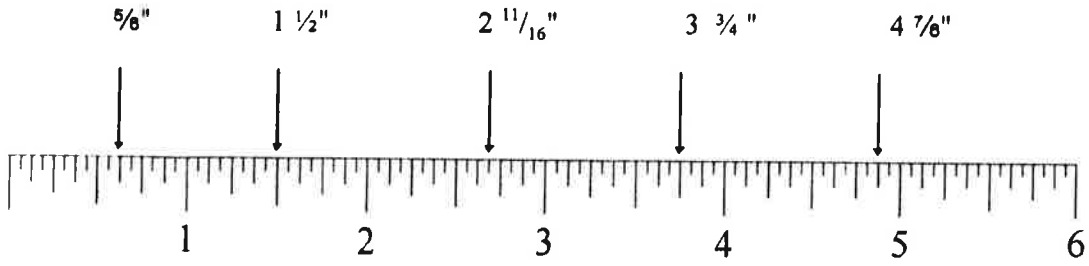
Here is an enlarged picture of the first inch on a ruler.

-Each $^{1}/_{16}$" mark is labeled.

-All fractions are reduced.

If you count over from the beginning of the ruler 5 spaces, you will see that mark labeled as $^{5}/_{16}$". The next mark is not labeled as $^{6}/_{16}$", but is instead reduced down to $^{3}/_{8}$".

Use this page as a reference for the exercises on the following pages.



Notice how the 5 different measurements shown on this ruler are written:

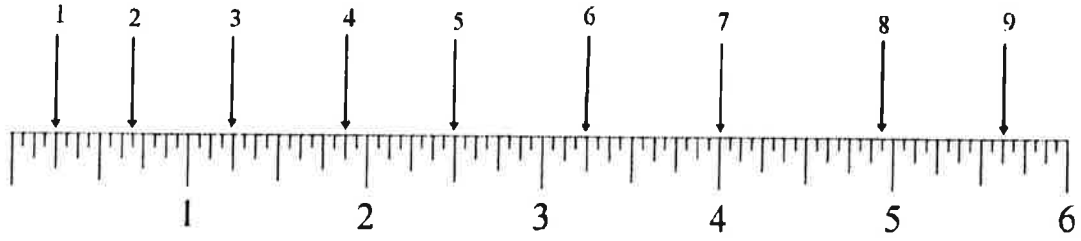
-The first one, 5/8", is 10 spaces over from the beginning of the ruler. It could be written as $^{10}/_{16}$", but we reduce that fraction to 5/8".

-The next one, 1 ½", is 8 spaces past the 1" mark. It could be written as 1 $^{8}/_{16}$", but we reduce it to 1 ½".

All of these measurements are written in the correct way. Use this page as a reference for the following worksheets.

Exercise 1

Correctly write the measurements for the following 9 locations.



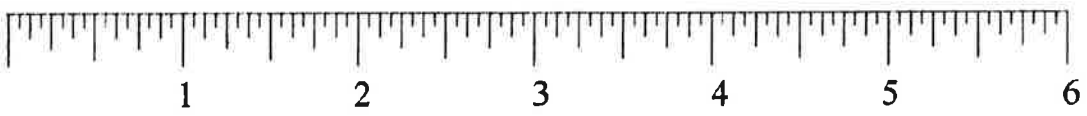
1._____ 2._____ 3._____ 4._____ 5._____

6._____ 7._____ 8._____ 9._____

Exercise 2

On this ruler, make and label an arrow for each of the following measurements.

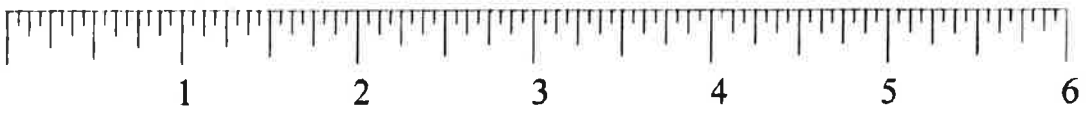
$\frac{3}{8}$"	$\frac{3}{4}$"	$1\frac{1}{8}$"	$1\frac{9}{16}$"	$2\frac{5}{8}$"
$3\frac{3}{4}$"	$4\frac{1}{16}$"	$4\frac{13}{16}$"	$5\frac{5}{16}$"	6"



Exercise 3

On this ruler, make and label an arrow for each of the following measurements.

$\frac{5}{8}$"	$\frac{7}{8}$"	$1\frac{1}{4}$"	$1\frac{11}{16}$"	$2\frac{7}{8}$"
$3\frac{13}{16}$"	$4\frac{7}{16}$"	$4\frac{15}{16}$"	$5\frac{1}{2}$"	$5\frac{3}{4}$"



Related Story

Tom, Dick, and Harry were aimlessly wandering the streets of New York City. They decided that they were very hungry, so they walked into a pizzeria to get some lunch. The pizzas were cut into 16 slices each.

Tom decided he wanted 3 pieces, Dick decided he wanted 2 pieces, and Harry wanted 3 pieces. All together, that would be 8 pieces of pizza, with pepperoni and anchovies, from a pizza cut into 16 pieces. They went up to the counter, and Tom ordered $^{8}/_{16}$ of a pizza.

The guy behind the counter said, "What, do you think you're funny?" He then came out from behind the counter, whacked Tom upside the head with his pizza peel, and told them to get out.

If only Tom had properly reduced his fraction, and asked for half a pizza, they would have been fed, and they would have avoided the whole unfortunate, violent incident.

Questions:

1. Where were Tom, Dick, and Harry? _____

2. What 2 toppings did they want on their pizza? _____

3. When reduced, what would $^{8}/_{16}$ be? _____

4. What did the Tom get whacked with? _____

The Importance of Sequencing

Almost everything that you will do in this shop will need to be done in a specific sequence. As such, the instructions for each of the projects list each step that you must accomplish in the order that you must do them.

There are 4 primary reasons why you must build your projects in a specific order:

1. You need to do things which are actually possible! Some things simply can not be done until you have done something else first.

   An example of this would be nailing together your birdhouse. Obviously, you can't nail the pieces of you birdhouse together if you haven't yet cut them. This is a very obvious example, but serves to illustrate the point.

2. Safety. Certain cuts are safer to do before other cuts are made. Even though you may be able to reverse two steps, I probably put the steps in a specific order so that the cuts would be made in the safest possible manner.

   An example of this is when you cut the pieces of wood for the sides of your hinged box. Although you could cut the pieces to their final, shorter length before cutting them to width on the table saw, it is far safer to cut a longer board on the table saw than it is to cut a short board. This is why we will cut it to width on the table saw before cutting the pieces to their final length with the miter saw.

3. To produce the highest quality work. You can often get far better results by making cuts in a specific sequence. If you don't follow the steps I have given you in their exact order, you may find that your piece of wood will break, or end up being the incorrect shape.

   An example of this is drilling the large hole in the front of your birdhouse. The instructions tell you to do this ***before*** assembling the four sides. If you try to drill this hole ***after*** you assemble the four sides, you are almost certain to break the piece of wood you are drilling in to.

4. It is often much more efficient to do things is a certain order. Although you may be able to accomplish something by doing it a certain way, you may be able to accomplish the same thing more quickly by doing it in a different order.

   An example of this would be caulking your birdhouse. You could paint it, and then caulk it, but you would end up needing to repaint all the areas you caulked. If you caulk first, then paint, you will save a great deal of time.

*So remember: Always follow **every** step in your project instructions in **exactly** the order they are written.*

Sequencing Worksheet

Please answer all questions as thoroughly as possible.

1. Please list the four reasons proper sequencing is important:

1.)_____

2.)_____

3.)_____

4.)_____

Please circle the correct answer.

2. You should **paint / caulk** your birdhouse first.

3. When building your hinged box, you should first:

-cut your boards to width on the table saw.

-or-

-cut your boards to their final lengths with the miter saw.

4. When building your birdhouse, you should drill the large hole in the front of the bird house **before / after** assembling the four sides of the birdhouse.

5. You should assemble the pieces of your birdhouse **before / after** cutting them to size.

6. You should **always / occasionally** follow the steps in the project instructions exactly in the order they are written.

Hand Tool Safety Instructions

There are several general rules which should be considered when using hand tools.

1. Never have any part of your body in a position where a hand tool could cut it. Here are some examples:

   -Never point a chisel toward yourself. If you slip, it could severely wound you. I have seen people slip with a chisel, and cut themselves badly. One person I saw do this required **34** stitches in his wrist.

   -Never have your fingers or thumb in line with a cut you are making with a handsaw. A sharp handsaw could easily cut a finger off in a single stroke!

2. Always have the wood you are cutting with a hand tool securely clamped to a work table, or have it clamped in a vise. If it isn't, you are far more likely to slip with your tool and injure yourself.

3. Always hand a tool to someone else handle first. This is the safest way to pass a tool. Do not let go of the tool until you are certain that the other person has the tool securely. **Never throw any tool ever!**

4. Watch your fingers when using a hammer! You may think you won't miss that nail, but often times when the head of the hammer hits the nail, the hammer deflects off of the nail, and whacks any nearby vulnerable fingers.

5. As when doing anything else in this shop, you must wear safety glasses when using hand tools. People frequently sustain eye injuries when using a simple hammer to hammer in a nail.

6. Hand tools can be used as weapons! If you choose to threaten someone with a hand tool, even if you are joking around, I will assume you were threatening them with a weapon with intent to cause severe bodily harm. SMT will be called, and you will be removed from the class.

7. Always put hand tools back exactly where you got them from.

8. Let Mr. Devine know if any hand tool is broken, or if you suspect it might be. It is unsafe to let someone else use a tool which is defective.

9. Never use any tool for any use other than its intended purpose. Doing so will likely ruin the tool, and is likely to be unsafe.

Hand Tool Safety Test

Please complete each statement using the correct word from the box.
Not all words will be used.

CLAMP	PUT BACK	FINGERS	WEAPON	PURPOSE
DECORATION	YOURSELF	HANDLE	PURPLE	BROKEN

1. Never point a chisel toward _____.

2. Always keep an eye on your _____ when using a hammer to avoid hitting them.

3. Always hand tools to someone else _____ first.

4. Securely _____ your wood when cutting it with a hand tool.

5. Always let Mr. Storm know if any hand tool is _____, or if you think it might be.

6. Always _____ tools exactly where you got them from.

7. Never use any tool for anything other than its intended _____. Doing so could break the tool, and be dangerous.

8. Any hand tool could easily be used as a _____. Never even pretend to do so.

Please circle the correct answer.

9. An improperly used hand tool is **likely / unlikely** to hurt you.

10. Safety glasses should **always / never** be worn when using hand tools.

Finish Room Instructions

When using the finish room to paint, stain, or oil your project, there are many guidelines you will need to follow. The finishes you will be using are hazardous substances. Each one needs to be treated carefully, or you will likely cause harm to yourself or others. Please follow these guidelines when using the finish room:

1. You must never be in the finish room unless you have permission to be there. You will only be granted permission to be in the finish room if you are currently applying a finish to your project.

2. Clean up any mess you make! You will need to put back any paint or finish you use, and make sure you clean up any mess you make.

3. When you need to apply a finish, I will supply you with a brush that you will be responsible for. If you do not return the brush to me **properly cleaned** at the end of class, you will be charged $2.00 to replace it.

4. When using your brush, you should only dip the last ½" of the bristles into the paint.

5. You should never dip the brush so far into the paint that paint gets on the part of the brush where the bristles meet the metal part of the brush.

6. After you finish painting, staining, or oiling your project, you must do the following things **in this order**:

   -Put the lid back on the paint can.

   -Put any rags with a flammable finish on them in the red rag can.

   -Clean your brush.

   -Put away your project.

7. Before cleaning your brush, determine what you should use to clean it with. Paints which say **Latex, Acrylic, or Water Based** on the can should be cleaned up with **water.** Finishes such as **Polyurethane or other oil based finishes** should be cleaned up with **paint thinner.**

8. Because many of the finishes you will use could hurt your eyes, you are required to wear safety glasses in the finish room.

9. **If you do not follow all of these rules, you will not be allowed to use the finish room. You will have to finish your projects at home with your own supplies**.

Finish Room Safety Test

Please complete each statement using the correct word from the box. Not all words will be used.

METAL	CLEAN UP	PERMISSION	POLYURETHANE
ACRYLIC	½ INCH	LATEX	WATER BASED
RAG CAN	ALLOWED	2 INCHES	SAFETY GLASSES

1. You must have _____ from the instructor before you are allowed to enter the finish room.

2. You should never dip your brush into the paint can so far that you get paint on the part of the brush where the bristles meet the _____.

3. You should only dip your brush in far enough to get paint on the last _____ of the paint brush bristles.

4. There are three things which might be stated on a paint can which indicate that the paint should be cleaned up with water. These three words or phrases are:

   1.)_____

   2.)_____

   3.)_____

5. You must always wear _____ when using the finish room.

6. You must _____ any mess you make in the finish room.

7. If you do not follow all of the rules for using the finish room, you will not be _____ to use the finish room any more.

8. Any rag with a flammable finish on it must be placed into the red _____ when you are finished with it.

Please circle the correct answer.

9. Safety glasses should **always / never** be worn when using the finish room.

Power Tool Safety Instructions

In this section of this book, there are instructions for the safe use of the machines in this shop. Each tool section includes several things:

1. A description of what the tool is used for.

2. A list of safety concerns specific to the use of this tool.

3. A picture of the tool with the most important parts labeled.

4. The safety test for that tool. You must completely fill out these tests. These are the same tests as the ones you will be required to take in class, though the questions are in a different order.

5. A story which illustrates some of the safety concerns associated with that tool. You must read these stories and answer all of the questions which follow them.

For each of these tools, we will do the following:

1. I will tell you to complete the section for a certain tool as homework.

2. The next class, I will give a short presentation on the safe use of the tool.

3. The following class, we will begin the class by taking the test for that tool. If you get a **100%** on that test, and if you have completed that section of your workbook, you will be allowed to use that tool. **Please study for these tests so that you can easily get a 100%.**

At the beginning of the semester we will try to cover the first 4 tools by the end of the second week. **Because of this, you will have more homework at the beginning of the semester than at any other time**. It is worth it, however, because the sooner we can cover this material, the sooner you will be able to use these tools.

Any of these tools has the capability to remove your fingers, your eyes, and in some cases, they could kill you. Take them seriously. I will not allow you to use any tool if I am not extremely confidant that you will use it safely!

Drill Press

Function:

To drill holes in wood.

Why we use it:

The Drill Press is able to drill holes in wood far more accurately than a hand held drill. Because we clamp the wood to the table of the drill press, we are able to accurately control:

-The precise location of the hole.

-The exact depth of the hole.

-The exact angle at which we will drill the hole.

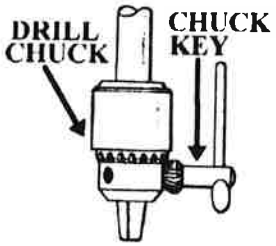
Safety Concerns:

-Because the Drill Press produces a great deal of torque, or rotational energy, we must **securely clamp the piece of wood to the drill press table**. If we don't, the wood will likely spin out of control, damaging the wood, the drill bit, and potentially the operator.

-It is extremely important to **tie back long hair**. If long hair is not tied back, it could catch on the drill press as the shaft is rotating. This could pull in the operator causing a severe injury.

-All **loose clothing must be removed** before using the drill press. Failure to do so could result in the clothing getting caught in the drill press, which could pull the operator in and cause a severe injury.

-The **drill bit must be securely mounted in the drill chuck. The drill chuck is tightened using the chuck key.** This must be done before operating the drill press. If the drill bit is not secure, it could come loose and damage the wood, the bit, and potentially the operator.



-After tightening the drill bit, it is extremely important that you **remove the chuck key.** Failure to do so could be very dangerous, as the chuck key could fly out and injure someone.

-If the piece of wood clamped to the table comes loose, you must **immediately turn of the drill press and take a step back.** Once the wood comes loose, it could fly off the table, causing an injury to the operator.

Safety Concerns (continued):

-You should **never wear gloves** when using the Drill Press, or any other machine in the shop. A loose glove could get caught in a tool and drag your hand in, causing a severe injury.

-Small drill bits will generally require the Drill Press to be set at a faster speed, whereas larger drill bits will require the machine to be set at a slower speed. However, in this class **only the instructor will change the speed of the Drill Press.**

Types of Drill Bits and their Uses:

Twist Bit

The Twist Bit is most often used for drilling small holes in wood or metal. It produces a decent hole, but not an extremely clean hole.

Spade Bit

The Spade Bit is an inexpensive bit used for drilling larger holes in wood. It drills quickly, but won't produce a very clean hole.

Forstner Bit

The Forstner bit is used for drilling larger holes in wood. It will produce the cleanest hole of any drill bit. These bits are quite expensive.

Multi-spur Bit

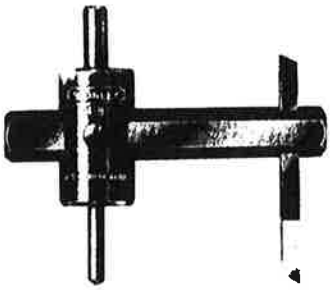
The Multi-spur bit is a type of Forstner bit, but has teeth to help it cut more quickly. It produces a clean cut.

Hole Saw

Hole Saw bits are used for cutting holes in wood. They produce a decent cut, and they cut quickly, as they only cut at the perimeter of the circle, so very little wood is actually turned into sawdust.

Circle Cutter

The Circle Cutter is an adjustable bit which can cut circles of various sizes. This bit must be used only on a drill press, and it produces a clean cut.

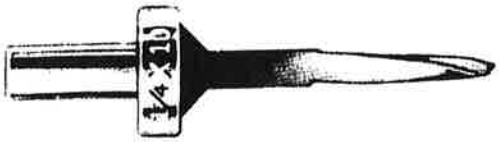


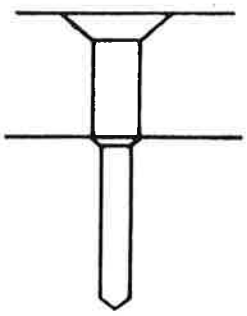
Countersink Bit

The Countersink bit creates a pocket into which the head of a screw will sit. It is by using a bit such as this that a screw head can be set below the surface of the wood.

Combination Drill Bit/Countersink Bit

This bit will drill a hole in one step that allows a screw to be installed so that it is set below the surface of the wood. Shown below is a picture of the hole this type of bit will drill.

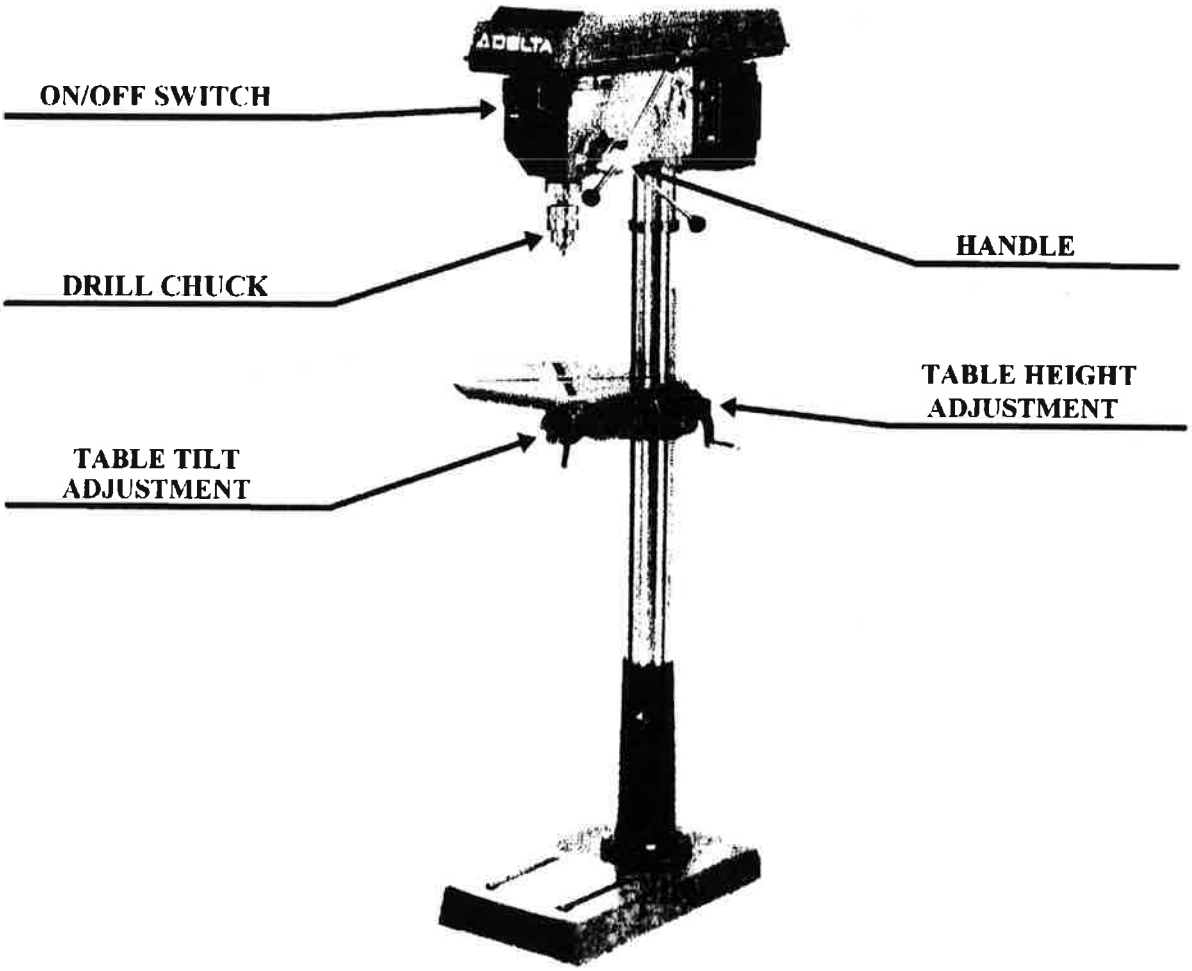




Additional Information:

-When drilling a hole using the Drill Press, the hole will turn out best if a scrap piece of wood is clamped underneath the piece of wood you are drilling a hole in. Doing this will prevent the wood you are drilling into from splintering as the drill bit exits the bottom side.
-If you are unsure about the speed of the Drill Press, ask the instructor to check it and adjust as needed.

DRILL PRESS PARTS



Drill Press Safety Test

Please complete each statement using the correct word from the box.
Not all words will be used.

CHUCK KEY	DRILL BIT	CLAMP	INSTRUCTOR
TIE IT BACK	TURN OFF	GLUE	STEP BACK

1. You must securely _____ your piece of wood to the table before using the drill press.

2. If you have long hair, you must _____ before using the drill press.

3. Before turning on the drill press, make sure the _____ is tight using the chuck key.

4. Before turning on the drill press, make sure the _____ has been removed.

5. If the piece of wood you are drilling comes loose from the clamp, you must do 2 things:

   1.) _____ the drill press.

   2.) _____ from the drill press.

6. Only the _____ will change the speed of the drill press.

Please circle the correct answer.

7. Gloves should **always / never** be worn when using the drill press.

8. It is **acceptable / unacceptable** to wear loose clothing at the drill press.

9. Smaller drill bits generally require a **faster / slower** speed. Larger drill bits generally require a **faster / slower** speed.

10. Safety glasses should **always / never** be worn when using the drill press.

Drill Bit Worksheet

Please correctly label each Drill Bit.

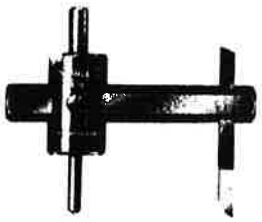
1._____

2._____

3._____

4._____

5._____



6._____

7._____

8._____

Related Story

It seemed as if the snow would never stop. School had been cancelled four days in a row because of the weather, and George was getting extremely frustrated, as he desperately wanted to finish his woodworking project before his mother's birthday on Saturday. As he sat watching the school cancellations on TV, he eagerly hoped that today, Friday, after four long, unbearable days, he would finally have the opportunity to get into school and finish his project. When the weatherman finally stated that it would be warmer today, and that no schools in the area were being cancelled, George was absolutely ecstatic.

In order to finish his cutting board, all he had to do was drill a hole in the handle, and apply the oil finish. He had plenty of time to do those things, so he was extremely excited about being able to give his mother her birthday present on time. After what seemed like an eternity of sitting through French class, it was finally time to head to the woodshop, where he could complete his project. As soon as he entered the classroom, he pestered Mr. Storm, asking if he could get to work. Mr. Storm assured him he would have plenty of time to complete his project, but he first had to listen to a safety presentation about the Table Saw. George hated safety presentations, as they interfered with his work time, and as such, he never listened to them. After what seemed like five hours, though the clock said it had only been twelve minutes, George was finally able to get to work. He rushed to the Drill Press to drill the hole in his cutting board handle.

At the Drill Press, he quickly placed his cutting board on the table and turned on the machine. He forcefully plunged the drill bit into his cutting board, without even bothering to clamp it to the table. It entered the board in the wrong place, and immediately the cutting board started to spin with the drill bit. George leaned in to try and stop it, at which point his long flowing hair, which was not tied back, became caught on the drill bit. It pulled his head towards the spinning cutting board, which wacked him on the cheek, giving him a large cut . He frantically reached for the OFF switch hoping to save his head, but couldn't seem to locate it. Fortunately, Mr. Storm had seen him go to the Drill Press without his hair tied back, and immediately started to head in that direction. He arrived just in time to turn off the Drill Press and save George from a more severe injury.

George's cutting board was badly damaged from the incident, as was his face. His mother did not receive her birthday present, but instead had to go to the hospital to be with George as he had the gash in his cheek stitched up.

Questions:

1. Name 2 safety rules George violated when he went to use the Drill Press:

   1.) _____

   2.) _____

2. Did George's lack of patience help him to be more productive? _____

3. How many days had school been closed? _____

4. What day of the week did this story occur on? _____

Band Saw

Function:

To make curved and irregular cuts in wood.

Why we use it:

The band saw is an excellent tool for making curved cuts in wood. Because the blade travels only in one direction, the wood you are cutting is not likely to jump around as you cut it, as it sometimes does when using a jig saw or a scroll saw.

Also, because the blade is one long continuous loop, we can cut wood up to 10" thick with this tool.

Safety Concerns:

-When using the band saw, it is important that you **lock the blade guard in place so that it is no more than $^1/_4$ inch above the wood** you are cutting. The guard should not be higher than this for a few reasons:

-Having it too high exposes more of the blade, which is dangerous.

-The guard also holds the blade in place. If it is too high, the blade will be much less stable, which will result in an inferior cut.

-The blade is more likely to be twisted and break if the guard is too high.

-When you are done with the band saw, you should **do these 2 things before leaving the machine:**

-Wait for the blade to come to a complete stop.

-Lower the blade guard down to the surface of the table.

-You should always **keep your fingers at least 2 inches away from the moving blade**. If they are closer than this, they could get thrown into the moving blade if the wood catches or if you slip while making your cut.

-**Never stand to the right of the band saw table.** Also, never allow anyone else to stand to the right of the table. If the blade should break, it is likely to shoot off of the table in that direction. If someone is standing there, they could be severely wounded, perhaps even eviscerated.

Safety Concerns (continued):

-You should **never back out of a cut you are making while the blade is moving.** Doing so could cause these problems:

-It could burn or splinter your wood.

-It could pull the blade of the wheels.

-It could bend or break the blade.

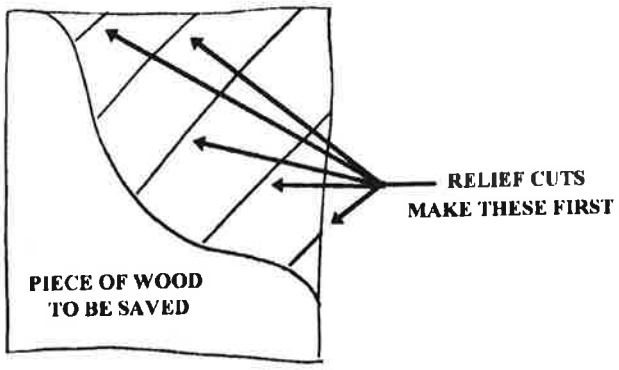
-**If the blade starts to bind, do not force the wood to complete the cut.** Instead, turn off the machine and figure out why the blade is binding.

-**If the blade starts to make a clicking sound** it is likely because the blade has a crack in it. If this happens, you should **immediately do these 2 things**:

-Turn off the machine.

-Tell the instructor.

-**When cutting a sharp turn on the band saw**, the blade can bind, bend, or even break. To help prevent these things from happening, **it is necessary to make relief cuts** in the wood. By making these cuts first, small pieces of wood are cut loose from the wood as it is being cut. This is an example of relief cuts:



-**Never touch the two adjustment knobs** which adjust the blade tension and the angle of the top wheel. If you move these knobs, the blade could come off the wheels.

-**Never open the doors which cover the drive wheels.**

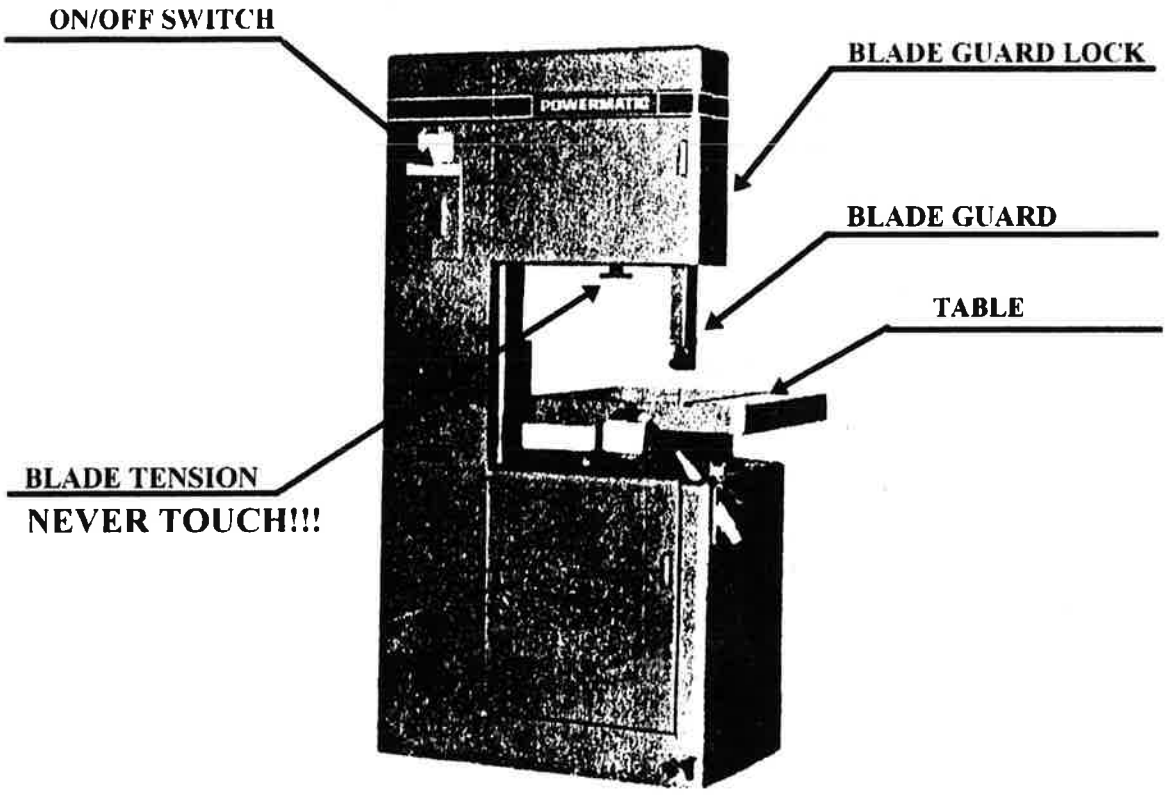
Additional Information:

•

-When making a cut on the band saw, cut to the outside of your line, leaving a small amount of material which you will be able to sand away. This will allow you to more precisely create your piece of wood.

-If you are making a cut in a board, and you want to save both pieces of wood, cut exactly on your line, and do not back up if you stray from your line.

BANDSAW PARTS



Band Saw Safety Test

Please complete each statement using the correct word from the box.
Not all words will be used.

RELIEF	2 INCHES	RIGHT	STOP	BLADE GUARD
1/4 INCH	BACK OUT	LOWER	½ INCH	INSTRUCTOR

1. The blade guard should never be more than _____ above the wood you are cutting.

2. You should not _____ of cuts you are making while the band saw is running. Doing so could splinter your wood, burn your wood, or pull the blade off of the wheels.

3. Before turning on the band saw, you must adjust the height of the _____ and lock it in place.

4. After you are done with the band saw, you must do 2 things before leaving the machine:

   1.) Wait for the blade to come to a complete _____.

   2.) _____ the blade guard down to the surface of the table.

5. Always keep you fingers at least _____ from the moving blade.

6. Never stand, or allow any other person to stand to the _____ of the table.

7. Sharp turns can break the blade, so when making sharp turns, you should first make _____ cuts.

8. If the blade begins making a clicking sound, you should turn off the machine, and notify the _____, as the blade may be cracked.

Please circle the correct answer.

9. You *will* use the handle that locks the blade guard in place. Touching the other adjustment knobs is **allowed / forbidden**.

10. Safety glasses should **always / never** be worn when using the band saw.

Related Story

The manner in which she misinterpreted what she had seen was extremely frustrating for Harry. Why would she see an innocent hug as "cheating," and why did she need to throw her hot chocolate on him? Needless to say, Harry was in no mood to be making a birdhouse today. Why should he even care if birds have houses anyways, and why should the responsibility of housing birds fall upon his shoulders?

As he grabbed his piece of wood to finish cutting it on the band saw, he had too many distractions, such as the unpleasant sensation of having pants soaked with hot chocolate, to even notice that the blade guard was about three inches above the table. He turned on the band saw and quickly made the first cut in his piece of $^{5}/_{8}$" pine. He picked up the scrap and tossed it towards the garbage can, missing it and hitting Lawrence, who was at the belt sander. Lawrence was not at all pleased by being hit, and without hesitation told Harry what he thought about it, and included an insult about his wet pants. Harry, even more distracted than before proceeded to make his second cut.

This cut went right through a knot hole, which caused the blade to bind. Harry just pushed harder to complete his cut, but as soon as his cut was complete, because he was pushing so hard, his hand slipped into the moving blade, of which a full three inches was exposed. The band saw cut half way through his index finger on his right hand before he could even pull away from the moving blade.

As he was on his way to the hospital, even more full of contempt for all the birds in the world, his girlfriend called him on his cell phone to apologize for throwing hot chocolate on him. She had spoken with Jill, and realized that all she had in fact witnessed was an innocent hug. Harry just wondered what getting a whole bunch of stitches would feel like, and wondered if his finger would even be able to be saved.

Questions:

1. Name 2 safety rules Harry violated when he went to use the band saw:

   1.) _____

   2.) _____

2. How high should the blade guard have been set? _____

3. Do we know the name of Harry's girlfriend? _____

4. What did the person who used the band saw before Harry do wrong? _____

   _____

5. Who did he hit with his scrap of wood? _____

Miter Saw

Function:

To accurately make crosscuts in wood.

Why we use it:

The miter saw is the best tool to use to make virtually any crosscut in wood. It is far more accurate than the radial arm saw.

The miter saw also has the ability to crosscut a board at an angle. The blade can also tilt, allowing you to crosscut a piece of wood with a bevel cut.

Any time you need to accurately cut across the grain of a straight piece of wood, the miter saw is probably the tool you will want to use.

The miter saw is also commonly referred to as the chop saw.

Safety Concerns:

-**The board you are cutting on the miter saw needs to be flat and straight**. If it is not, you first should make your board flat and straight using the jointer, the table saw, and the planer.

-**Your board must be held firmly against the fence when making a cut** with this tool. If it is not, it will jerk back towards the fence, and the saw will be forced toward you.

-Like the radial arm saw, this saw also moves along a track arm. **You must make sure the saw is all the way at the back of the track arm before turning on the saw**. If it isn't, it could be touching your board when you turn it on. This could result in the saw jerking forward, the board jerking backwards, and an injury occurring.

-**You must keep your hands and fingers, including your thumb, at least 6" away from the path of the cut**. If they are closer, they could easily get thrown towards the blade, resulting in an injury.

-Your board needs to be long enough so that you are able to securely hold it against the fence while cutting it. For this to occur, and in order to keep your hands a full 6" from the path of the cut, **your board should be at least 8" long**.

-This saw will force its way toward you as you cut, so **you must hold the saw securely and control it in order to make a slow, controlled cut.**

Safety Concerns (continued):

-**Make sure there are no scraps of wood or piles of sawdust against the fence before you place your board on the table**. If there are, they will prevent your board from being firmly against the fence where it needs to be.

-**Do not try to rip (cut with the grain) a board on this saw**. It is dangerous, and will do a lousy job. The table saw is a much better tool to use to rip a board.

-This saw moves not only back and forth along the track arm, but also moves up and down. In order to safely make cuts with this saw, you should **follow the following sequence of moves for each cut you make:**

-While putting pressure back on the saw to prevent it from moving toward you, **lower the saw down in to your board**. Make sure it is all the way down before proceeding to the next step.

-While firmly holding the saw down, **slowly pull the saw toward you** as far as it needs to go to complete the cut.

-**Release you finger from the power switch**.

-**Wait for the saw blade to stop, then push the saw to the back of the track arm**.

Additional Information:

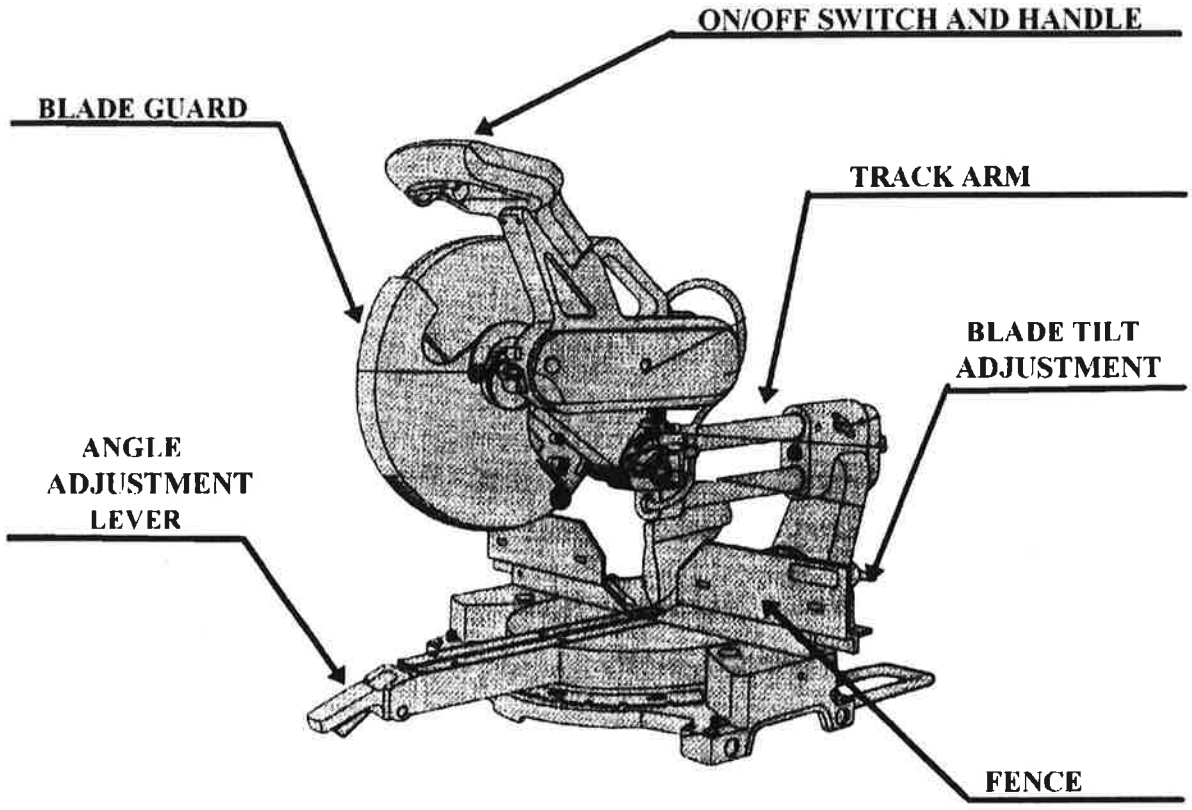
-When using this saw, you must apply pressure toward the back of the saw when you push the blade into the wood. If you don't you will find that the saw will want to move toward you before it moves down.

-When students first use this saw, they will often cut only half way through the board, as they do not push down hard enough before pulling the saw toward them.

-Do not try to cut a board that is too short, especially when cutting at an angle, as the saw will easily grab the board and throw it, sometimes at somebody else, and sometimes at you!

-Remember that your thumb sticks sideways out from your hand. Make sure it is at least 6" from the path of the blade. Having a thumb cut off is one the most common injuries from this saw.

MITER SAW PARTS



Miter Saw Safety Test

Please complete each statement using the correct word from the box.
Not all words will be used.

RELEASE	6 INCHES	DOWN	FENCE	TOWARD
8 INCHES	BACK	WARPED	FRONT	CONTROL

1. Your board must be placed firmly against the _____ when making a cut on the miter saw.

2. Never cut a board that is _____ with this saw. Your board must be flat and straight.

3. Do not cut any boards which are less than _____ long on the miter saw.

4. Always keep you fingers at least _____ from the path of the cut.

5. When making a cut with this saw, you will first push the blade _____ into the wood.

6. Next you will pull the blade _____ you.

7. Next you will _____ your finger from the power switch.

8. Finally, you will return the saw to the _____ of the track arm.

9. You must _____ the saw and prevent it from lurching toward you. It is important to make a slow, controlled cut.

Please circle the correct answer.

10. Cutting a board with the grain, or making a rip cut in a board with this saw is **allowed / forbidden**.

11. This saw is designed for making accurate **rip cuts / cross cuts** in wood.

12. Safety glasses should **always / never** be worn when using the miter saw.

Related Story

Alan was meticulous. He followed every step and every rule exactly as he was supposed to. When he would build something, every dimension was exactly perfect. Photographs of his projects were used to show other students how things were supposed to be done. Alan was also genuinely kind, and believed that everyone around him was as responsible and trustworthy as he was. He never questioned anyone's intentions or actions.

When he was at the miter saw cutting all of the pieces of wood for his project, everything was going exactly as he had planned it. Each piece of wood was exactly the right size, and every cut was perfect. He was throwing away his scraps after every cut, and making every cut exactly as he was supposed to. When he saw George go running by, Alan didn't question George's actions, as he assumed George was responsible enough to know what he was doing. Earlier in the day when he saw George dancing on the cafeteria table while eating a *Milky Way* bar for lunch, Alan thought to himself what a unique person George was.

When George went running by again, this time slipping on a pile of sawdust, it was apparent that George was not acting responsibly. After George slipped on the saw dust and fell, sliding into Alan, causing Alan to slip while making a cut on the miter saw, it was apparent that George was behaving in a very dangerous manner. When Alan's index finger on his left hand slipped into the moving miter saw blade as he slipped, cutting the tip of it off, and spraying blood in a most unsightly manner, the consequences of George's inappropriate behavior became glaringly obvious.

Alan was able to get his finger sewn up fairly well, and will recover, though his fingertip is a little crooked, and some of the sensation will not return. The consequences of this incident may be more difficult for George to recover from.

Questions:

1. What should Alan have done differently? _____

   _____

2. What safety rule was George violating? _____

3. Which finger was cut on the miter saw? _____

4. To whom did this finger belong? _____

5. What did George have for lunch? _____

Table Saw

Function:

To accurately cut wood in several different ways.

Why we use it:

The table saw is the most important tool in any woodworking shop. It can be used for many different types of cuts, and it is extremely accurate.

In this class, we will use the table saw primarily for two different purposes:

-To accurately cut a board parallel with the grain. This is called a **rip cut.**

-To make wide grooves in wood. These grooves are called either **rabbets or dados**, depending on how they are located on the board.

We will rarely use the table saw to make crosscuts in this class. To make crosscuts, we will be using the **miter saw**. The miter saw is almost always a better tool for making crosscuts.

Without question, the table saw is the most dangerous tool in this shop. Most severe amputations, primarily lost fingers, happen on the table saw. Because of this, it is incredibly important to fully understand how this tool works, and how to use it safely.

There is also a serious risk for wood to kick back on the table saw. If wood kicks back, it can come towards you at speeds of over 100 miles per hour, which can injure, or kill you. Because of this it is very important to understand why kick back occurs, and how to avoid it.

There will be two safety tests for the table saw. The first will cover the safe procedures for making rip cuts, and the second will cover the safe procedures for making rabbets and dados.

Safety Concerns:

-**When using the table saw, the blade guard must always be in place** whenever it is possible to do so. Some cuts, such as dado cuts, require that the guard be removed, but those cuts must be done ***exactly*** as the instructor tells you, and the riving knife must be installed.

-**You must keep your fingers at least 4" from the blade at all times**. If you can't make a cut without keeping your fingers at least 4" away from the blade, you must use a push stick. If you can't keep your fingers at least 4" from the blade even with a push stick, you may not use the table saw for that cut.

Safety Concerns (continued):

-**The table saw blade should be adjusted so that it is $^1/_4$" above the piece of wood you are cutting.** If it is higher than this, it creates a greater risk.

-**Make sure the saw has come to a complete stop before moving the blade guard, making an adjustment, or removing any scraps of wood from around the blade.**

-**Your piece of wood should be at least 6" long to safely cut on the table saw**. If it is shorter than this, you may not use the table saw to make that cut.

-**You may not cut a warped or twisted board on the table saw.** Before cutting a board on the table saw you must make sure it is straight and flat. You will do this by using the jointer and the planer.

-**You must never stand directly behind the blade or piece of wood you are cutting**. Instead stand slightly to one side so that if a kickback should occur, the wood will be less likely to hit you.

-**You must hold your material very firmly when using the table saw**. If you don't it will be more likely to catch on the blade and kick back.

-**Make sure the rip fence is securely locked before making a cut**. If the rip fence moves as you are making your cut, many very bad things will occur!

Safety Concerns Specific to Rip Cuts:

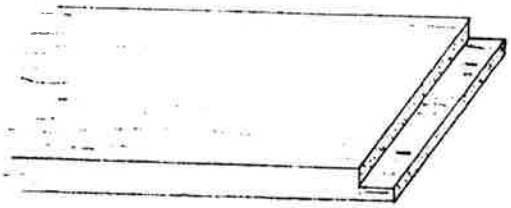
-**When ripping a board, the rip fence must be perfectly parallel to the blade**. If it is not, the wood will bind between the rip fence and the blade and kick back will likely occur.

-**Push your piece of wood all the way past the blade, letting it fall onto the floor. DO NOT leave a piece of wood on the table near the blade while the saw is still running.**

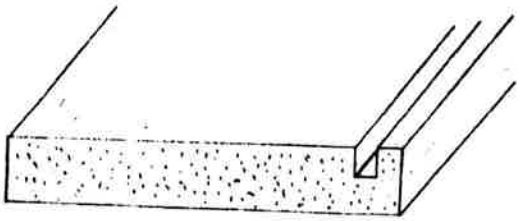
-**Do not reach over the blade to lift you board off of the table after making your cut**. Instead, let the board fall off of the table onto the floor.

-**The edge of your board which is in contact with the rip fence must be perfectly straight**. This is done with the jointer.

Safety Concerns Specific to Cutting Rabbets & Dados:



Rabbet



Dado

Rabbets are cuts which are basically notches at the end of a board. We make this cut using a table saw set up with a special blade which cuts a very wide path through the wood. Because the cut does not go all the way through the board, we can't use a typical safety guard when making these cuts. Instead, we use a block of wood mounted to the fence over the blade. This block, which we call the **safety block**, does two things:

-It helps to hold your board down on the table as you make your cut.

-It covers the blade so that if you slip, you are less likely to make contact with the spinning blade.

Dados are grooves cut in a piece of wood. We will usually make these cuts using the table saw with a regular blade, with the blade raised only slightly above the surface of the table. Once again, because the blade does not cut all the way through the board, a typical safety guard can not be used. When making a dado, you must use the saw set up ***exactly*** as the instructor shows you. The blade will be exposed, but it will be very close to the rip fence. You will use a push stick as needed to keep your fingers at least 4" from the moving blade.

Some specific rules to remember when cutting a rabbet:

-**The safety block must be in place when making a rabbet**.

-**When cutting a rabbet, you must use the miter gauge to hold your board. Never try to make a rabbet using only the rip fence as your guide.**

-**After pushing your board across the blade, do not pull it back over the blade while the saw is still running.**

Some specific rules to remember when cutting a dado:

-Even though the blade does not go all the way through the wood, **never place your hand or your push stick directly over the blade.**

-**Make sure your pieces are firmly against the rip fence**. If they are not, kickback can occur.

Understanding Kick Back:

Kick back on the table saw usually occurs for one of two reasons:

-If the blade and the rip fence are not parallel, the piece of wood will get pinched between them, and the pressure of the blade will force the wood back. This is why it is so important to be certain that the rip fence is adjusted correctly.

-If you leave a piece of wood on the table after you make a cut, it can catch on the back of the spinning saw blade. The wood will be lifted up by the blade, and then it will fall on top of the spinning blade. The teeth on the top of the spinning blade catch the wood and throw it, at a speed of approximately 110 miles per hour. This is obviously very dangerous, which is why you must push your board all the way off of the table.

Both types of kickback occur more easily with a lighter weight piece of wood, such as $^1/_4$" plywood. Because it is so light, the wind from the blade will cause the wood to float up, after which it will move into the blade, and be thrown. Once air born, it flies very fast, and very far, slicing through whatever, or whoever, is in its way.

The main rules to remember to avoid kick back are:

-Hold the wood firmly.

-Make sure it stays in complete contact with both the table and rip fence at all times, especially after it passes the blade.

-Push your board all the way off the table.

-Make sure the rip fence is adjusted correctly.

-Don't stand directly behind the blade or wood.

Additional Information:

Once you learn to use the table saw correctly and safely, you will be able to build far better projects. It is truly an invaluable tool to have. Just be certain to take it seriously, and if you have any questions about its safe use, never hesitate to ask these questions.

The table saw can be used for many other types of cuts that we will probably not make in this class. We will use it only for rip cuts, rabbets, and dados. Crosscuts will be made on the miter saw.

Small pieces of wood which may chip off of your board as you are cutting it will fly from the table saw at tremendous speed. Small scraps will very likely hit your safety glasses on a regular basis. ***Even idiots who normally don't wear safety glasses will put them on when using a table saw!***

Additional Information Specific to SawStop brand Tablesaws:

All of the tablesaws you will be using in this class are SawStop brand tablesaws. SawStop brand tablesaws have several unique safety features which you need to understand before using these tablesaws.

SawStop saws have a mechanism which is supposed to stop the saw blade from spinning and retract it in to the saw immediately if there is any contact made with the blade by a finger or by anything else that is conductive. This safety mechanism is active until the blade had completely stopped spinning. Because of this, it is extremely important that you **DO NOT TOUCH the saw blade or the blade guard before the blade has stopped spinning.**

Even if you think the blade has stopped spinning, you must look at the lights on the switch to make sure. **If the green light is still blinking, YOU MAY NOT TOUCH the blade or blade guard.**

Be aware that **if you touch the blade with something such as a tape measure** before the green light stops blinking, **the brake will fire.**

If you cut a board with a nail, it will likely cause **the brake to fire**.

If you cut a board which is wet, it will cause **the brake to fire.**

Anytime the brake fires, it costs us $150.00! Having such a safety feature is wonderful, but **if you do something foolish which could and should have been avoided, you will be charged the cost of replacing it!**

Also, the power switch on SawStop saws have a very large red switch, and a small switch to the right of the large switch. **YOU WILL ONLY USE THE LARGE RED SWITCH!!! DO NOT TOUCH THE SMALL SWITCH!!!**

If you are patient and do everything as you are supposed to, there should be no reason for the brake to fire!

TABLE SAW PARTS

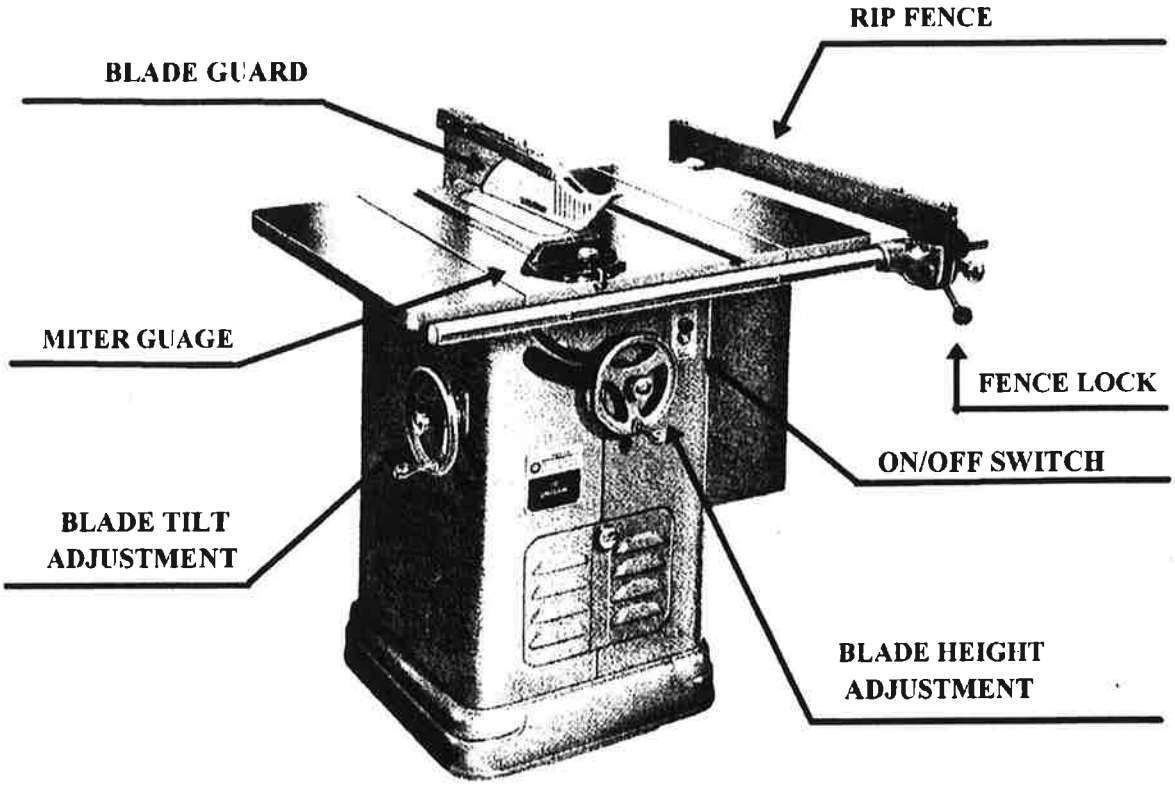


Table Saw Safety Test (Rip Cuts)

Please complete each statement using the correct word from the box.
Not all words will be used.

STOPPED	6 INCHES	KICKBACK	BEHIND	PUSH STICK	ON
GREEN	4 INCHES	FIRMLY	$^1/_8$ INCH	JOINTER	OFF

1. The saw must be completely _____ before making any adjustments, moving the blade guard, or removing any small scraps of wood from around the blade.

2. You must never move the blade guard or touch the blade until the _____ light has stopped blinking.

3. The blade should be set so that it is _____ above the wood you are cutting.

4. The wood you are cutting must be at least _____ long to safely cut on the table saw.

5. Always keep your fingers at least _____ from the moving blade.

6. Use a _____ whenever needed in order to keep your fingers at least 4" from the blade.

7. The rip fence must be parallel to the blade. If it isn't, _____ will likely occur.

8. Always make sure to _____ hold down your wood when using the table saw.

9. Your board must be flat and straight to cut it on the table saw. If it isn't, you must first straighten it using the _____.

10. Do not stand directly _____ the blade or piece of wood you are cutting. This is to help avoid an injury if kickback should occur.

11. Push your board all the way _____ the table when making a rip cut. Failure to do so could result in kick back.

Please circle the correct answer.

12. Safety glasses should **always / never** be worn when using the table saw.

Table Saw Safety Test (Rabbets and Dados)

Please complete each statement using the correct word from the box.
Not all words will be used.

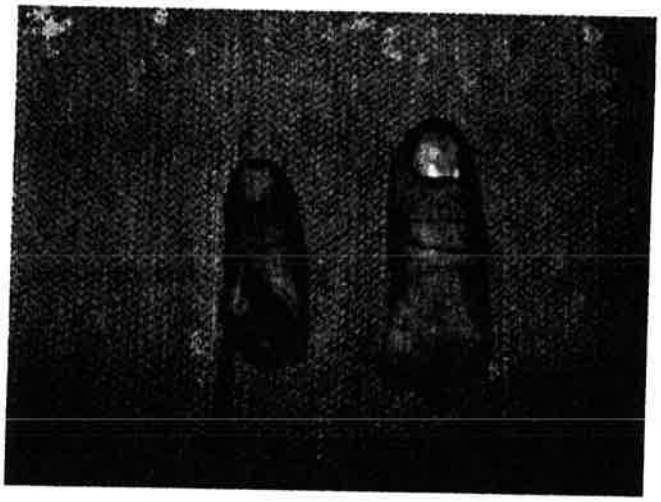
STOPPED	BLADE	4 INCHES	BEHIND	WARPED
SAFETY BLOCK	LOCKED	2 INCHES	MITER GAUGE	PICKLE

1. Always have the _____ properly in place when cutting a rabbet.
2. The saw must be completely _____ before making any adjustments.
3. Make sure the rip fence is securely _____ in place.
4. Never cut a rabbet using only the rip fence as a guide. You must also use the _____ to securely hold your wood correctly.
5. The wood must be straight. You must never try to cut _____ material on the table saw.
6. After pushing your board across the blade, do not pull it back over the _____ while the saw is still running.
7. Do not stand directly _____ the blade or piece of wood you are cutting. This is to help avoid an injury if kickback should occur.
8. Always keep your fingers at least _____ from the moving blade.

Please circle the correct answer.

9. You should always hold your wood **firmly / loosely** when using the table saw.
10. You **should / should not** stand directly behind the blade when using the table saw.
11. You must wait for the green light to **start / stop** blinking before you move the blade guard or touch the saw blade.
12. Safety glasses should **always / never** be worn when using the table saw.

Related Story



DON'T SCREW AROUND WITH THE TABLE SAW!

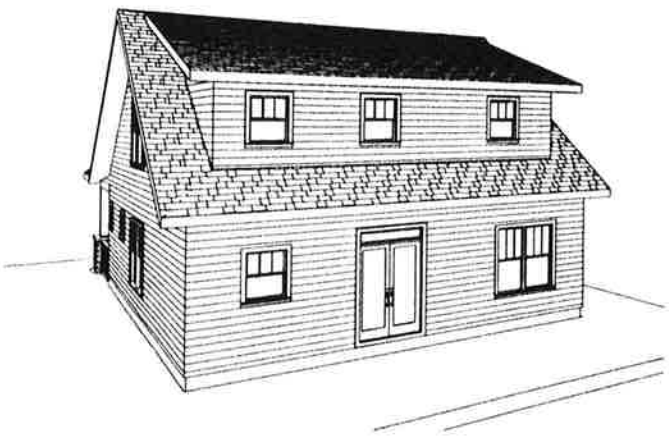
IF YOU FIGHT THE TABLE SAW, I CAN GUARANTEE THAT THE TABLE SAW WILL WIN!

Construction Technology - An introduction to Framing

Lester and Gertrude Plumbean live in a lovely little house out in the country where they have lived for 23 years. Here is a picture of the front of their home.

The house has three bedrooms, two of which are on the second floor of the house. The bedroom that Lester and Gertrude have been using for the last 23 years is on the upstairs level of the home. This was fine for them until one day Lester suffered a tragic industrial accident at his place of employment. After the accident, in exchange for a cash settlement, Lester signed a confidentiality agreement, and so we will never know the specifics of the accident. The end result, however, is that Lester is now confined to a wheelchair, and as a result, is no longer able to climb the stairs in his home.

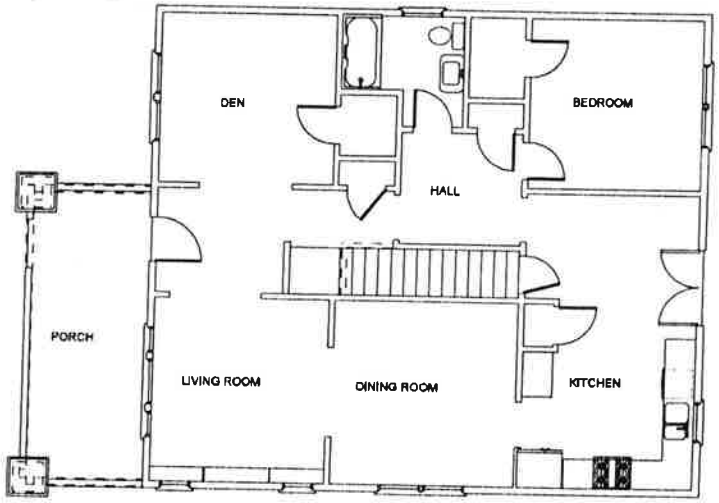
The Plumbeans now stay in the bedroom on the first floor of their home, which is fine except that it is rather small, and there is not an adequate view of the yard for Lester to watch the birds, squirrels, deer, rabbits, snakes, alligators, and other wildlife. Because of this, they would like to add an addition to their house. This addition will increase the size of the bedroom, and it will also add a sunroom with windows on three sides from which Lester can pass his days in comfort viewing the exciting wildlife as it passes by. And as a result of the cash settlement from his injury, they have the money to take on this project without having to try and get a loan, which in this credit market would be virtually impossible, especially with the decreasing home values in their neighborhood.

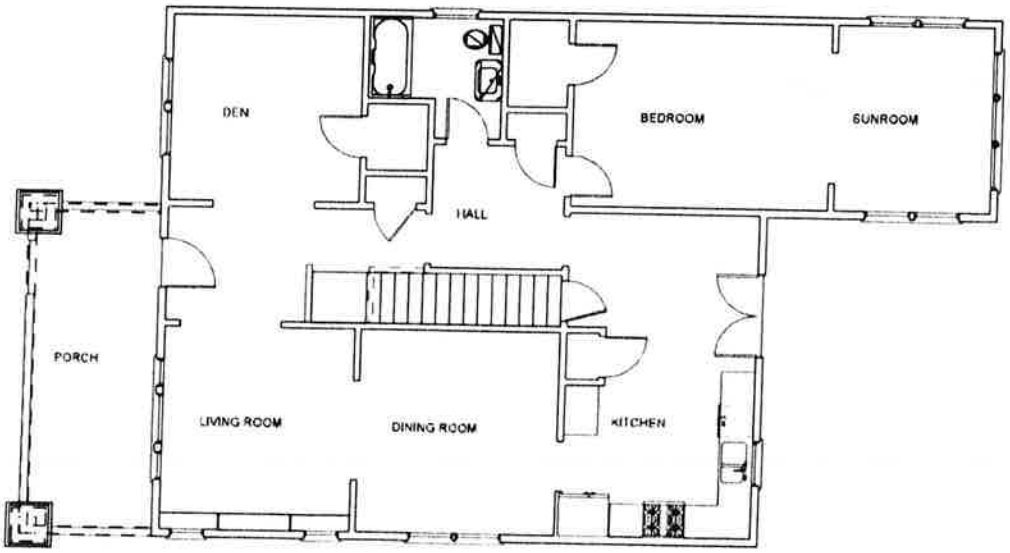


This is a picture of the back of their house as it currently looks,

and here is a picture of what they would like the back of their house to look like.

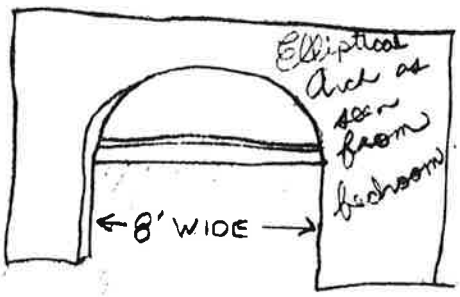
Here is a picture of the main level floor plan as it currently looks,

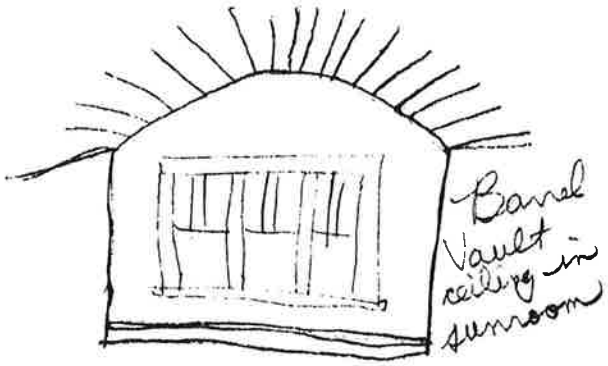




and here is a picture of the new floor plan.

Although Lester would be content with a simple addition, Gertrude has some specific desires that she would like incorporated into the new addition. First, she would like the opening between the bedroom and the sunroom to be a 8 foot wide elliptical arch. She provided this sketch to help the architect understand what she wanted.





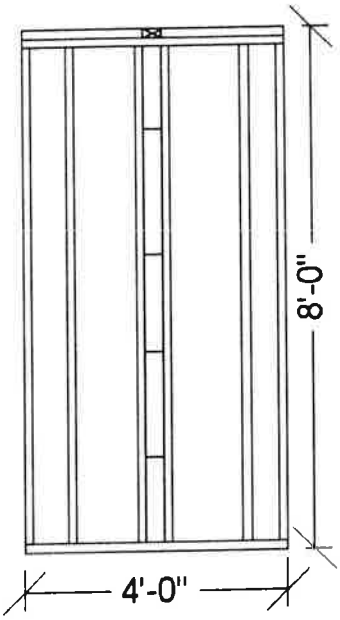
Additionally, she would like the ceiling in the sunroom to be a barrel vault ceiling covered with cedar beadboard. This is the sketch she provided the architect with to help him understand her wishes.

The architect took her sketches and drafted the plans for their addition. The permitting process took considerably longer than anticipated due to a question as to whether or not the increased square footage of their home would be more than the current electrical system could handle. They had to have an analysis done by a licensed electrician, which they submitted to their county permitting office. After reviewing the analysis, which took considerably longer than anyone anticipated it would, the county has determined that the current electrical system is adequate, and so they have issued the permit.

Because it took so long to get the permit issued, Gertrude has started to question whether or not she still likes the idea of having the elliptical arch opening, and whether or not she will like a barrel vault ceiling. The contractor they have hired to build the addition is very excited about building the arch and ceiling, and so he asked his friend, Mr. Storm, a High School Woodshop teacher, to build a full size mock-up of these details in his school's workshop so that Gertrude can see what it will look like. Mr. Storm agreed, and so in their workshop, his students will be building a small 4' x 12' section of the proposed addition which will include the elliptical arch, 2' of the bedroom with a flat ceiling, and 2' of the sunroom with the barrel vault ceiling.

Wall # 1

We will begin by marking on the floor where each of the walls will be located. We will then be building one of the short sections of wall. This wall will be 4' long, and 8' tall. When completed, we will stand it up and attach it to the floor. Here is a picture of what it will look like:

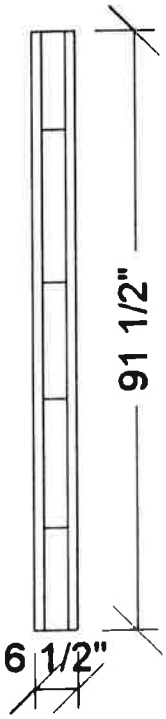


To build this wall we will begin by preparing the base plate. We will:

-Cut the base plate to length (48")
-Mark the locations of the studs on the base plate
-Install the anchor bolts into the floor which will hold this section of wall
-Drill the holes in the base plate for the anchor bolts

Next, we will cut six 2x4's 91 ½" long. We want them 91 ½" long because we want our final wall to be 96" tall, but that 96" measurement will include 1 base plate, and 2 top plates. Each plate is 1 ½" thick, so we deduct that amount from the 96" to get our stud length.

1 ½" x 3 = 4 ½"
96" - 4 ½" = 91 ½"



Once we have all 6 studs cut, we will make our first top plate. It will be the same length as the base plate. We will:

-Cut the plate to length (48")
-Mark the locations of the studs

We will now assemble this section of wall. In addition to the 6 studs and 2 plates, we will need three pieces of 2x4's about 16" long. These can usually be made from scraps, and do not need to be an exact length. We will:

-Assemble the corner stud where this wall intersects with the other wall. This will require 2 studs and the 3 blocks of wood. It should look like this:

-Nail each of the studs to the base plate
-Attach the top plate to the other end of the studs
-While the wall is still on the floor, nail $^{7}/_{16}$" O.S.B. (**O**riented **S**trand **B**oard) sheathing to the exterior face of the wall. The O.S.B. will be flush with the bottom of the wall, and for right now will extend 1 ½" above the top of the wall.

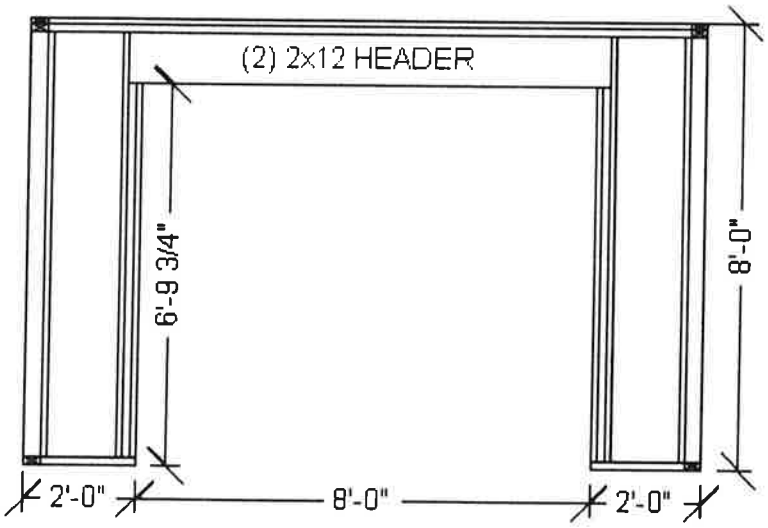
Once the wall is assembled, we will stand it up, aligning the holes in the base plate with the anchor bolts in the floor. We will secure the wall by installing washers and nuts onto the anchor bolts.

Wall # 2

We will repeat these same steps to build the other short wall, making sure we put it in the correct location as shown on the plans.

Wall # 3

We will now build the longer wall which connects the 2 shorter walls. We will build it with a rectangular opening for the doorway, and will add the elliptical arch later. It will look like this:



To build this wall we will begin by preparing the top plate. We will:

-Cut the top plate to length (137")
-Mark the locations of the studs on the top plate

Next, we will cut our 2 section of base plate for this wall. Each section of base plate will be 20 ½" long. To prepare these we will:

-Cut the 2 sections of base plate to length (20 ½")
-Mark the locations of each of the studs on the base plates

Next, we will cut the rest of the framing for this wall. We will need:

-5 studs 91 ½" long
-4 trimmer studs 80 ¼" long
-2 pieces of 2x12 which will be 102" long for the header.
-1 piece of ½" plywood about 96" long and 10" wide

We will now assemble the wall following these steps:

-Nail 2 trimmer studs to 1 of the full length studs. We will make 2 of these.
-Assemble the header
-Attach the header to the triple studs we just created
-Attach all of the studs and header to the top plate.
-Attach the studs to the 2 sections of base plate.

We will now install this wall following these steps:

-Stand up the wall.
-Nail it to the 2 short walls.
-Attach it to the floor.
-Check to make sure both small walls are plumb, then brace this wall.

Because the Plumbeans live in a high wind area, the engineer has specified that this wall be a shear wall. This means it must be sheathed with $^{7}/_{16}$" O.S.B. in order to help stabilize the building when the wind blows. So we will nail $^{7}/_{16}$" O.S.B. to one side of this wall.

Double Top Plate

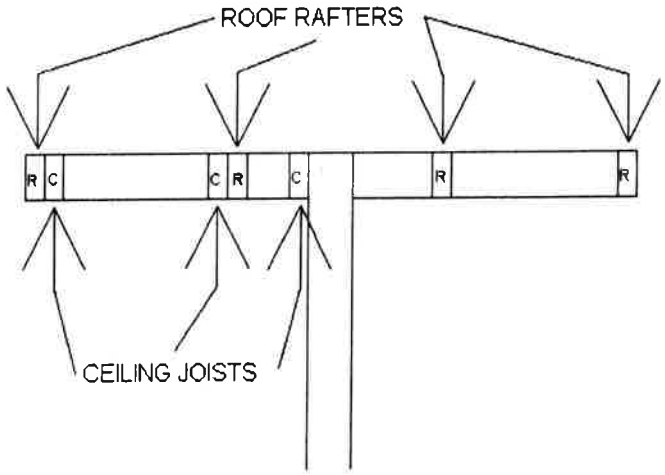
We will now install a second top plate on the tops of the walls. We will need to cut 5 pieces of 2x4:

-1 piece 144" long
-5 pieces 22 ¼" long

We will first install the long piece over the long wall. As we do, you will notice that it extends over the top of the 2 shorter walls. This helps to tie the walls together, which increases the strength of the building.

Next we will install the 5 shorter pieces over the shorter walls.

Now we will mark the locations of the ceiling joists and of the roof rafters on the tops of the 2 short walls. We will use this diagram to guide us:

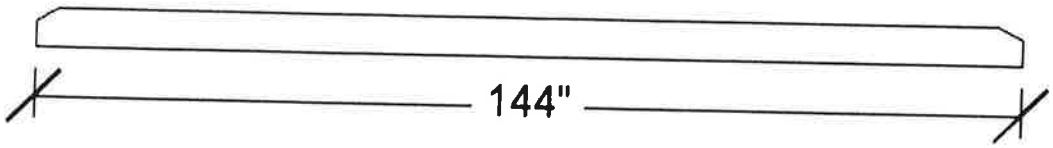


Ceiling Joists

We will now cut and install the ceiling joists on the side of the wall which is going to have a flat ceiling. We will need:

-3 pieces of 2x6 which will be 144" long.

We must also cut off the corners of the ceiling joists as shown in the diagram below:



We do this so that they will not be higher than the tops of the roof rafters.

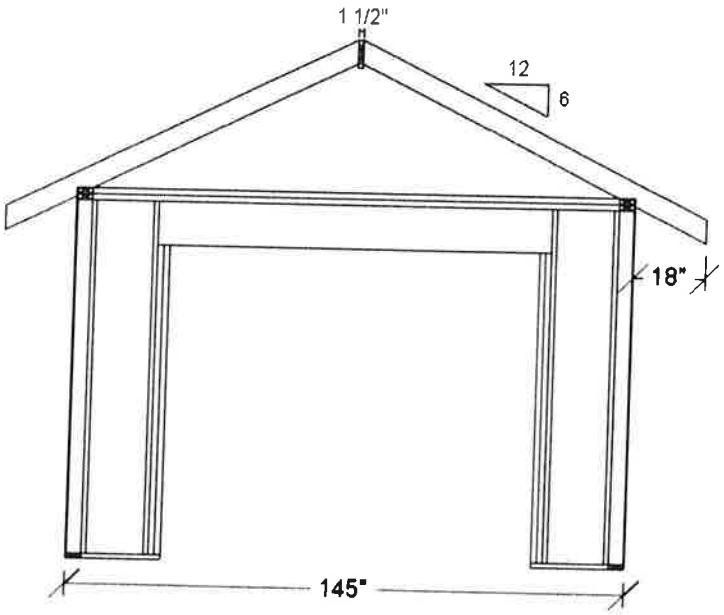
Next, we will install these 3 ceiling joists.

Roof Rafters

We will now cut the roof rafters. To know what the roof rafters will look like, we must first determine several things:

-How wide is our building, including sheathing? (145")
-What will the roof pitch be? (6 in 12)
-How far is the roof supposed to overhang the exterior walls? (18")
-How wide is the Ridge Board? (1 ½")

This diagram illustrates the answers to these questions:

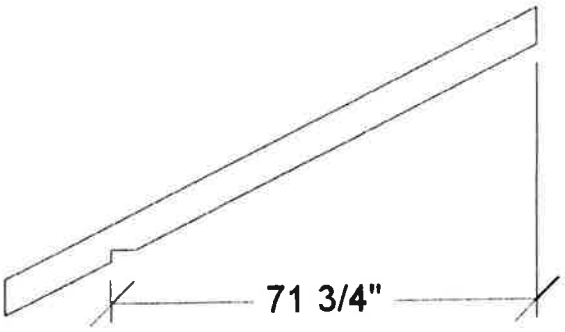


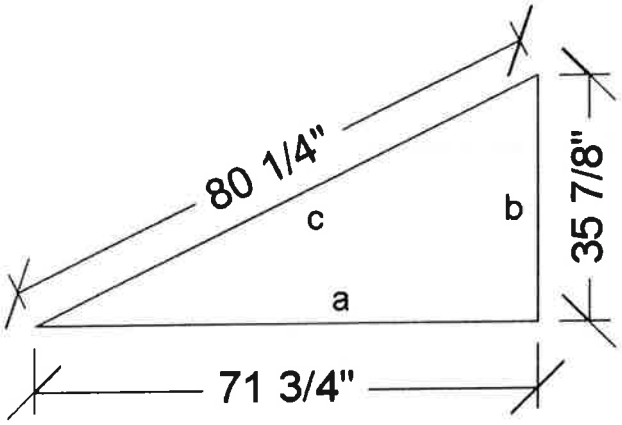
Once we have the answers to these questions, we can calculate the length of the roof rafters. To do this we will use Pythagorean's Theorem, which states that in a right triangle, the sum of the square of the two sides is equal to the square of the hypotenuse. This formula is written as follows:

$a^2 + b^2 = c^2$

In order to figure this out we must first look at a diagram of one of our roof rafters to understand what measurements we will need. We must first determine the location of the **Birdsmouth Cut**, which is the notch in the rafter where it rests on the wall. We know:

-The building is 145" wide
-We subtract 1 ½" (the width of the ridge board) and end up with 143 ½"
-We divide that in half and end up with 71 $^{3}/_{4}$". This represents the horizontal distance between the edge of the building and the edge of the ridge board.





In the triangle to the left, this measurement is shown as "a". Measurement "b" is determined by taking measurement "a", dividing by 12, and then multiplying by 6, since our roof pitch is 6 in 12. What a "6 in 12" roof pitch means is that for every horizontal 12", the roof will rise 6". So "b" equals:

$b = (a \div 12) \times 6$
$b = (71\ ^{3}/_{4} \div 12) \times 6$
$b = 35\ ^{7}/_{8}"$

We will find the distance "c", using Pythagorean's Theorem:

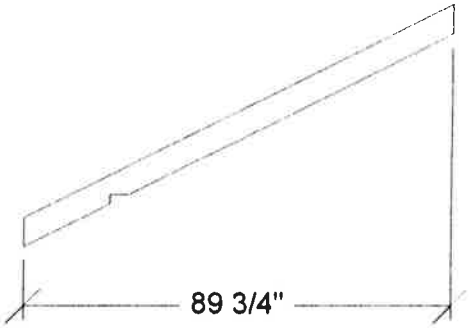
$a^2 + b^2 = c^2$
$71\ ^{3}/_{4}{}^{2} + 35\ ^{7}/_{8}{}^{2} = c^2$
$5148.0625 + 1287.015625 = c^2$
$6435.078125 = c^2$
$80.219 = c$

So, "c" will equal 80 $^{1}/_{4}$".

We repeat these steps to determine the total length of the rafter as shown in this picture:

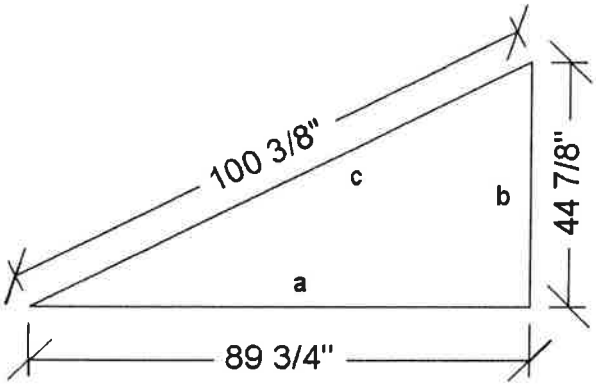
In this case, measurement "a" is the previous measurement "a", plus 18", the depth of our overhang.

$a = 71\ ^3/_4 + 18$
$a = 89\ ^3/_4$



We determine measurement "b" the same way we did before.

$b = (a \div 12) \times 6$
$b = (89\ ^3/_4 \div 12) \times 6$
$b = 44\ ^7/_8$

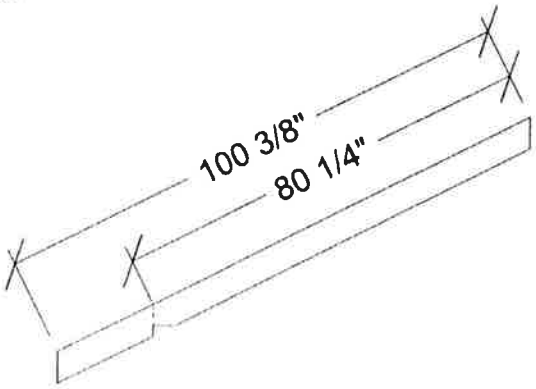


We will again use Pythagorean's Theorem to determine "c".

$a^2 + b^2 = c^2$
$89\ ^3/_4\ ^2 + 44\ ^7/_8\ ^2 = c^2$
$8055.0625 + 2013.765625 = c^2$
$10068.828125 = c^2$
$100.344 = c$

So, "c" will equal $100\ ^3/_8$"

And our rafter will look like this:



We will now transfer these measurements onto our rafter and cut it. We will then trace our rafter onto 7 more boards and cut 7 more rafters.

Our ridge board will be a 48" long 2x8. We will mark the locations of the rafters on the ridge board in the same locations as on the top plates. We will then install the rafters.

Roof

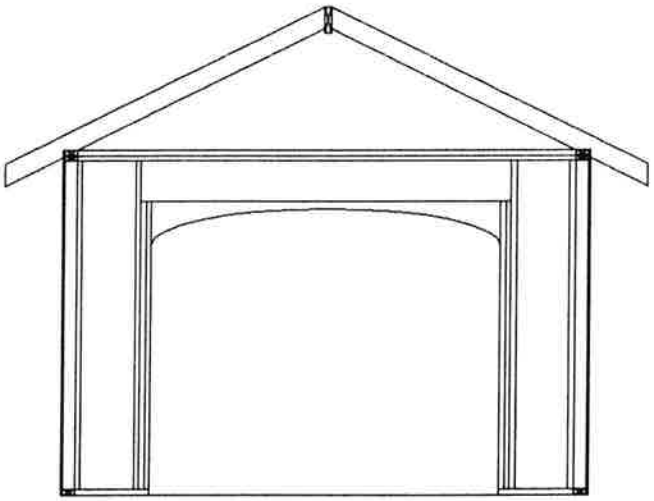
We will now install the roof decking. It will be $^{7}/_{16}$" O.S.B., which we install horizontally with **8d nails** and one **roofing clip** between each rafter.

Once the roof decking is installed, we will apply **15# felt** with staples.

Next, we will nail on the roofing shingles. We will install each one with **4** roofing nails. At the ridge, we will install **Cap Shingles**. We make the cap shingles by cutting a full shingle into 3 pieces.

Elliptical Arch

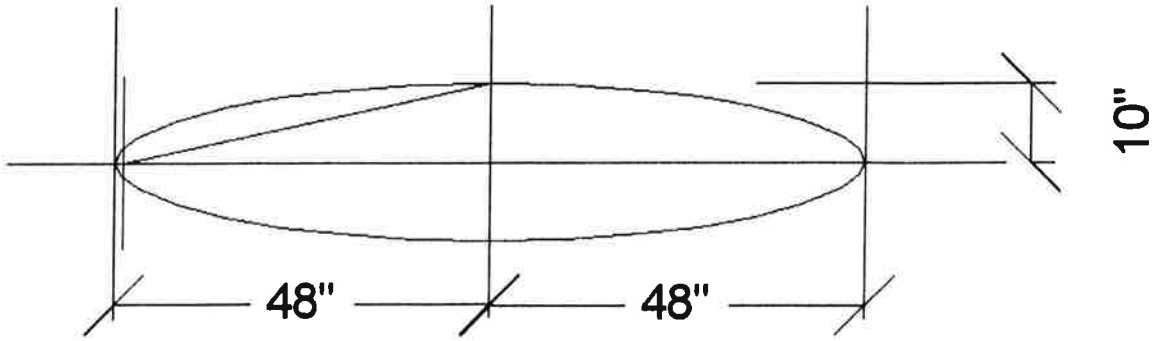
Now for the real fun! We need to frame in the elliptical arch, as illustrated in this picture:



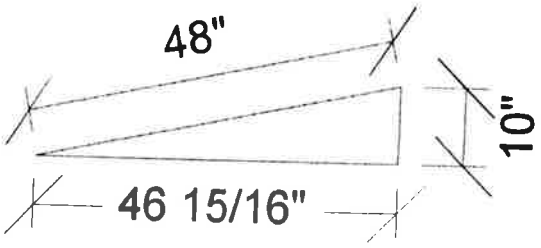
The arch will be made of 2 pieces of O.S.B. cut into ellipses with 3" wide blocks of wood between them.

The architect told us, just before leaving the country for 3 months, that "the ellipse by which this arch is defined will have a major axis of 96", and a minor axis of 20." And so, we must draw that ellipse onto our O.S.B.

Curiously, the two focal points of a specific ellipse can be determined using Pythagorean's Theorem! Take a look at the ellipse shown below:

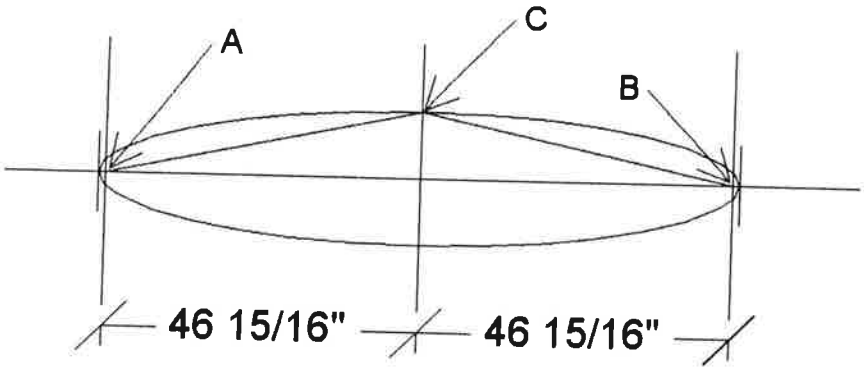


When we look at the triangle formed within this ellipse, with the hypotenuse being the length of the longer radius, 48", we can determine where both focal points of the ellipse are to be placed.

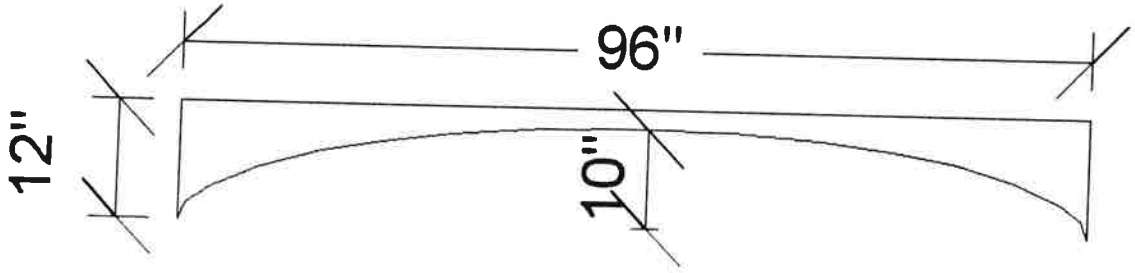


We will label the two focal points "A" and "B". If we stretch a piece of string around these two points, as well as point "C", which represents the location where the vertical axis intersects the top of the ellipse, this string will be the correct length to draw our ellipse.

If we put a nail at points "A" and "B", place our loop of string around these nails, and a pencil at point "C", we can draw the ellipse we need.



We will then cut out our elliptical arch from the O.S.B., trace it onto another piece of O.S.B., and cut out a second one. They will look like this:



We will then nail a bunch of 3" wide blocks between them, and we will have created our elliptical arch. The drywall people, who are very skilled and have a fine product called **Flexbead,** will be easily able to finish our arch.

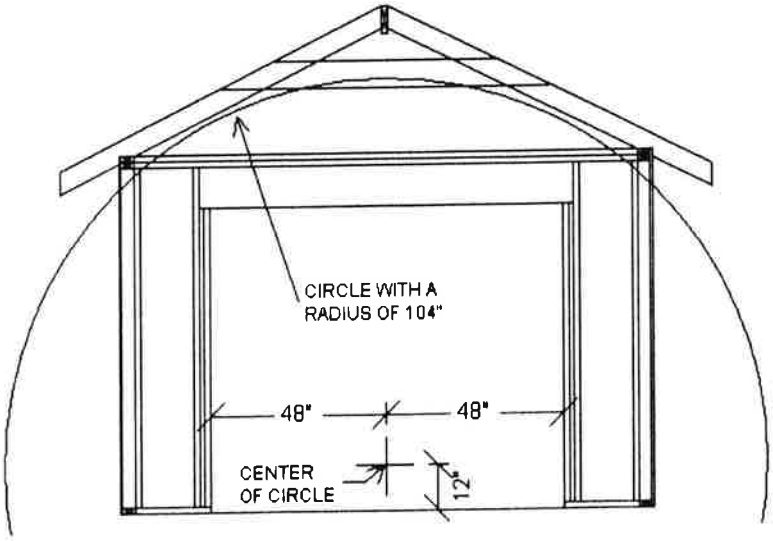
Barrel Vault Ceiling

We will now cut the **Collar Ties** and blocks which will form our barrel vault ceiling. Our architect told us that "The circle which defines the barrel vault ceiling shall have a radius of 104", and the center of said circle shall be located 12" above the level of the subfloor and shall be centered in the doorway opening." As you may have figured out by now, our architect happens to be a rather odd obsessive compulsive person who speaks in a very theoretical manner, assuming that the people building his structures have a completely mathematical view of the world as does he. If asked how the builder would actually build this arch, he would simply imply that such tedious details are beneath him, as it is his job to create the vision, and the physical labor is left to the workers.

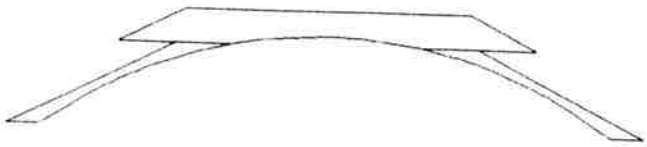
On a side note, the reason he has left the country for three months is because he and another builder had an altercation on a job site regarding the manner in which the builder chose to build a built in shower bench. The architect claims that he specifically noted on the plans that the bench was to be 18" above the floor of the shower, and so the builder built the bench 18" above the subfloor as the shower was being framed in. Unfortunately, once the mortar bed for the shower floor was poured, and the tile was installed on the shower floor, the bench ended up being only 15" high. The homeowner was perfectly happy, as she was only 4' 11" tall, and the lower bench suited her, but the architect, it a fit of furious rage accused the builder of being an "incompetent, uneducated hack with no more ability to build things than a brain damaged beaver," adding that even though the homeowner was happy, she would likely die someday, and the next owners of the house would find the bench completely unsuitable.

The builder became very upset at the architects comments, as did the homeowner. It a momentary lapse of reason, the builder grabbed a framing nailer and nailed the collar of the architect's shirt to the wall, with the architect still in it of course, and proceeded to scream obscenities at him until the architect broke down crying and begging for the builder to spare his life.

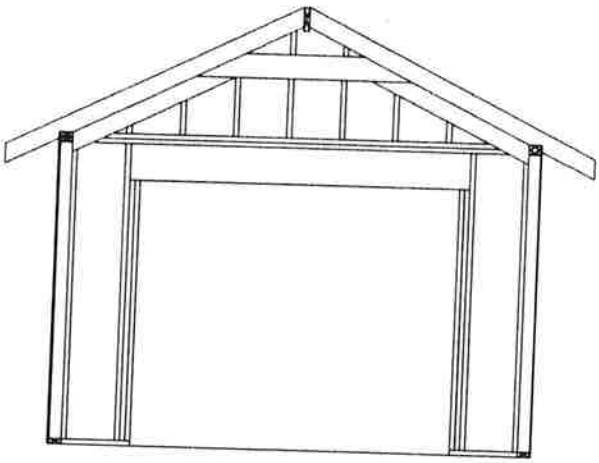
After the police reports were filed, and the authorities left, the architect decided that he needed a prolonged vacation, and so he went to Spain, where he hopes to recover from the incident. This is why the architect is currently unavailable to answer any questions which we might have.



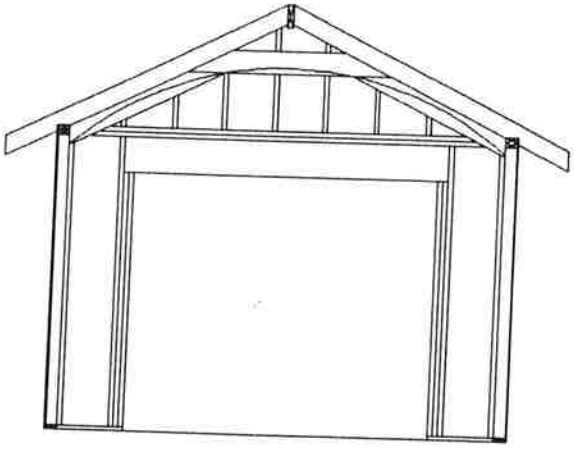
Getting back to our barrel vault, this picture illustrates the circle that will define our barrel vault ceiling:



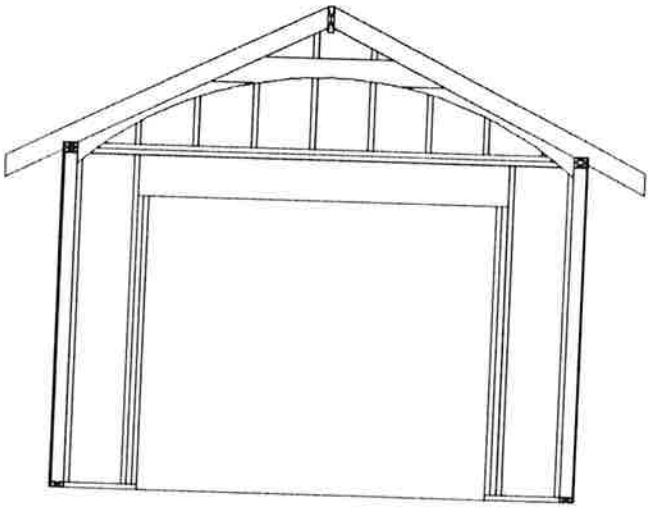
This picture shows the three pieces that will make up each arch: the **Collar Tie**, and the two other blocks.



We will cut one set of these pieces without the curves cut, and attach them temporarily to the wall above the door opening. It will look like this:



We must now make a compass with a radius of 104". We will temporarily attach a 2x4 across the door opening about 10" above the floor. In the center of that board, 12" above the floor, we will nail a long board, the end of which will be 104" long. Using this board as a compass, we will draw the arch onto our 3 pieces of wood which will make the arch.



We will then take down these 3 pieces, cut them with a **jigsaw**, and then make two more sets of them. We will install all three sets, and the barrel vault will be framed! It will look like this.

The Rest of the Project

The framing of our project is now complete. We can now have Mrs. Plumbean come into the classroom and decide if she likes how it looks. If she does, the builder can begin building the addition for the Plumbeans. He will probably start soon, but he has to have a reasonably flexible schedule because he has been asked to appear as a character witness in the trial of the other builder, a buddy of his with whom he goes motorcycle riding on the weekends, who assaulted our architect.

If this were the actual house, many more subcontractors would come in and finish this project, including plumbers, HVAC (Heating, Ventilation, Air Conditioning) contractors, electricians, insulators, drywall hangers and finishers, flooring installers, trim carpenters, and painters. For a fine explanation briefly explaining this process, read the chapter ***Building a New House*** in the book ***What Do People Do All Day?***, by Richard Scarry.

Framing Worksheet for Pages 110-112

Please answer all questions

1. How long have the Plumbeans lived in their house? _____

2. Why will we never know how Mr. Plumbean was hurt? _____

_____

3. How many walls in the sunroom will have windows? _____

4. Name 3 animals which might be seen in the backyard? _____

_____

5. List 2 reasons why they would probably be unable to get financing for this project?

   1. _____

   2. _____

6. What 2 features did Mrs. Plumbean draw?

   1. _____

   2. _____

7. Why did they need an electrician in order to get their permit? _____

_____

_____

8. What will we be building in our shop? _____

_____

_____

9. What are the dimensions of what we are building? _____ by _____

Framing Worksheet for Pages 113-115

Please answer all questions

1. How big will wall #1 be? _____ by _____

2. How long will the base plate be? _____

3. How long will the wall studs be? _____

4. Why are the studs 4 ½" shorter than the wall? _____

_____

_____

5. What does O.S.B. stand for? _____

6. On wall #3, how long will the top plate be? _____

7. How long will the base plate pieces be? _____

8. How many base plate pieces do we need? _____

9. How long are the trimmer studs? _____

10. How many trimmer studs will we need? _____

11. Why must wall #3 be sheathed with O.S.B.? _____

_____

_____

12. Why does the long piece of second top plate extend over the two short walls?

_____

_____

_____

Framing Worksheet for Pages 116 -118

Please answer all questions

1. How long will the ceiling joists be? _____

2. Why will we cut off the corners of the ceiling joists? _____

   _____

   _____

3. How wide is our building? _____

4. What will the roof pitch be? _____

5. What does the term "roof pitch" mean? _____

   _____

   _____

6. What is the distance from the upper end of the rafter to the birdsmouth cut?

   _____

7. What is the total length of the rafter? _____

8. What is the depth of our overhang? _____

9. Look at the triangle on page 105. If side "a" was 100" long, how long would side "b" be, knowing that our roof pitch is 6 in 12? _____

10. How long would side "c" be? Use Pythagorean's theorem & show work below.

Framing Worksheet for Pages 119-120

Please answer all questions

1. What will we use for the roof decking? _____

2. What size nails will we install the roof decking with? _____

3. After the roof decking, what will we apply next? _____

4. How many nails will we use to install each roofing shingle? _____

5. How do we make cap shingles? _____

   _____

6. According to what the architect told us, how long will the major axis of our ellipse be? _____

7. How long will the minor axis of our ellipse be? _____

8. How will we determine where the focal points of our ellipse will be?

   _____

   _____

   _____

9. How many ellipses will we need to cut out to create our arch? _____

10. What material will the ellipses be cut out of? _____

11. What will we nail between our ellipses? _____

    _____

Framing Worksheet for Pages 121-122

Please answer all questions

1. According to our architect, what will the radius be for the circle which will define our barrel vault ceiling? _____

2. Why did the shower bench end up being the wrong height?

_____

_____

3. What did the architect call our builder? _____

_____

_____

_____

4. What did our builder do to our architect? _____

_____

_____

5. How tall was the homeowner of the house where this incident occurred?

_____

6. How will we make a compass with a radius of 104"? _____

_____

7. How high off of the floor will we attach the end of our compass? _____

8. How many sets of these curved pieces of wood must we make? _____

9. What tool will we use to cut the curves? _____

Projects

In this section of this book, there are instructions for building each of the projects you are required to build in this class. For each project you build, you must follow these instructions **exactly**.

You must **completely** fill out the plan sheet for each project. All of the information needed to fill out each plan sheet is included in the project directions. **You must calculate the cost of materials for each project**, and should refer to the instructions on how to do so shown on the next page.

I will require you to actually read the instructions for each project you build so that you understand what you are building. I will also require you to follow the steps in exactly the order they are listed. Please refer back to the section of this book on ***Sequencing*** if you need to remember why it is so important to follow instructions in a specific order.

If you come up to me and ask me, "What do I do next, Mr. Storm?" I will shrug my shoulders and tell you to go read the instructions. If you come up to me and ask me something such as, "Mr. Storm, the instructions say that I need to drill the hole in the front of my birdhouse using the drill press. Can you make sure it is set up correctly, and once it is, may I use it?" I will be extremely delighted to help you.

I will insist that you try to figure out what you should do next, and how it should be done before I assist you. If you truly are not able to figure out what to do next, at least try to figure out what seems to be causing confusion for you. Please ask questions which are as specific as possible.

The skills that you will learn, and the tools that you will learn to use, will be used again in the other projects you will make. Every step is important, and every tool you use is important. **If any step or tool were not important, I would not ask you to do that step or use that tool.**

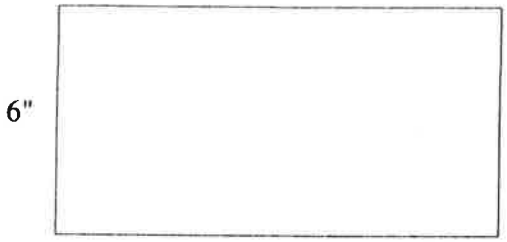
One last word of encouragement before you begin making your projects: By the end of the semester, most students look back at the beginning of the semester and laugh at the difficulties they had when making their first projects. As long as you keep trying, you will do well with each of these projects.

How to Calculate Cost of Wood

1. Find the area of the wood by multiplying width x length.

Note: You should round all fractional numbers up to the next whole number

Example:



Area = W x L
Area = 6" x 12"
Area = 72 square inches (sq. in.)

2. Convert that number into Board Feet (BF):

Formula:

BF = sq. in./144
BF = 72/144
BF = .5

3. Determine the cost of the piece of wood. Different species of wood have different costs. For this example, let's say we are using a wood that costs $6.00 per board foot. Therefore the cost of this piece of wood would be:

Cost = price per BF x number of BF
Cost = $6.00 x .5
Cost = $3.00

So in this example, the first piece of wood would cost $3.00. You must repeat this step for each piece of wood, and add up the total to determine the cost of all the wood for your project.

Remember, for the projects that you are required to make in this class, the wood is provided for you, but if you make a mistake and ruin a piece of wood, you must pay for the piece to replace it!

Making a Push Stick

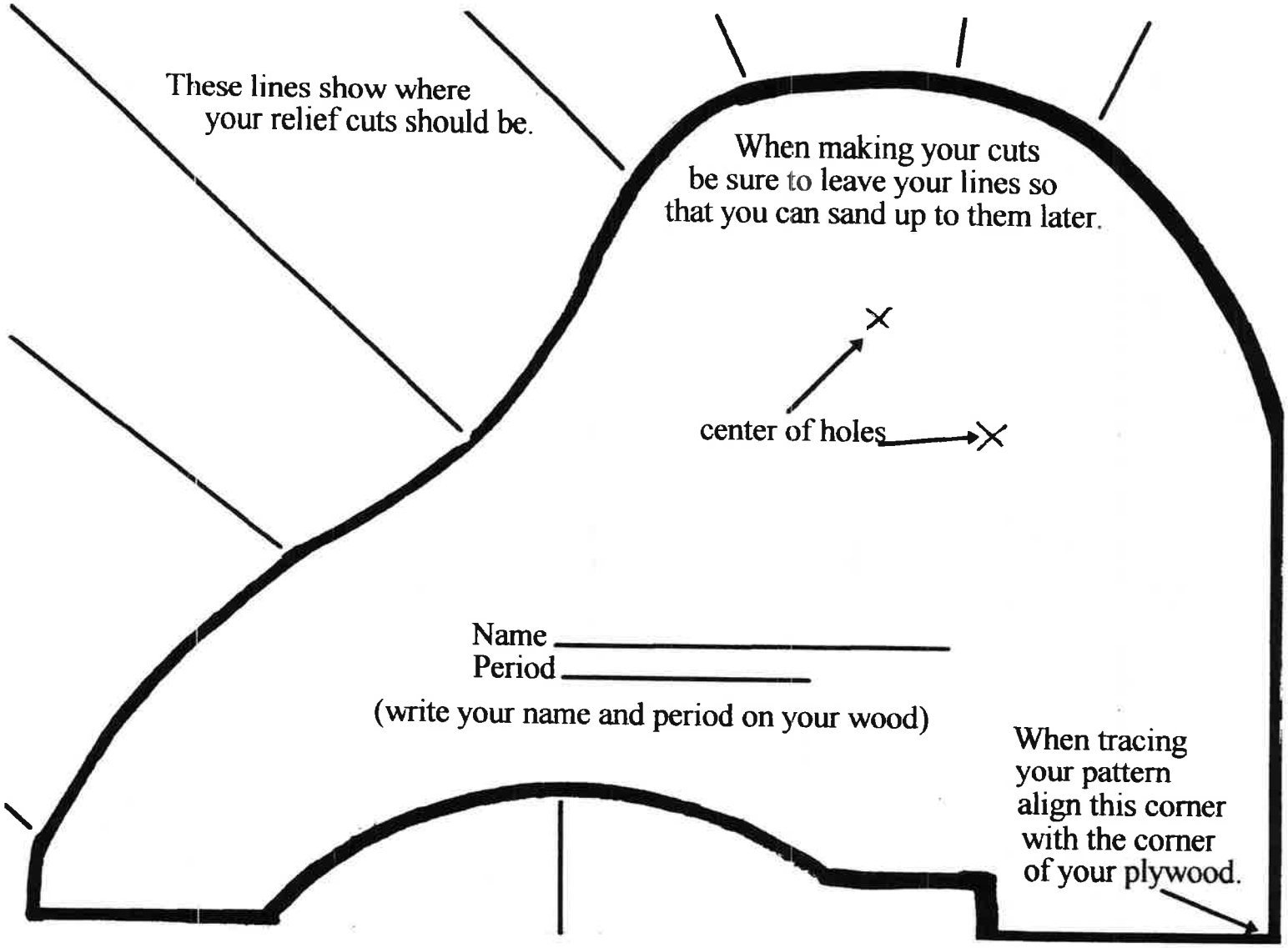
This project will consist of making a push stick. You will make this project in order to learn how to safely and correctly use the **drill press**, the **band saw**, the **disc & belt sander**, and the **spindle sander**. All of these tools have the potential to be extremely dangerous, and so it is extremely important that you pay very close attention to the safety demonstrations given for these tools, and that you always follow all of the rules for using these tools very carefully. You will also learn some interesting woodworking techniques as you build this project, which you will be able to apply to your future projects.

Material List

Item	Cost
-1 piece of wood	50¢

Steps for Making a Push Stick

1. Cut out pattern.
2. Get piece of wood.
3. Trace pattern onto wood, including locations of 2 holes, and locations of relief cuts.
4. Write name and period on wood in pencil.
5. Using drill press, drill 2 holes 1 ½" in diameter where x's are.
6. Using the band saw, make relief cuts. Remember: Do not back out of relief cuts with the blade still moving.
7. Using the bandsaw, cut out shape. Remember to leave lines so you can sand up to them later.
8. Sand edges with the disk & belt sander.
9. Sand the tight curves and the inside of the holes with the spindle sander.


These lines show where
your relief cuts should be.
When making your cuts
be sure to leave your lines so
that you can sand up to them later.
center of holes
Name
Period
(write your name and period on your wood)
When tracing
your pattern
align this corner
with the corner
of your plywood.

Building a Bird House

This project will consist of building a bird house. To make this project, you will begin by using hand tools, such as hand saws and a hammer and nails. As you pass your tool safety tests and are allowed to use power tools, you will use several power tools to complete your birdhouse.

You will use the **bandsaw**, the **belt & disc sander**, the **drill press**, the **spindle sander**, and a **brad nailer**. All of these tools have the potential to be extremely dangerous, and so it is extremely important that you pay very close attention to the safety demonstrations given for these tools, and that you always follow all of the rules for using these tools very carefully.

You will also learn some important woodworking techniques as you build this project, which you will be able to apply to your future projects.

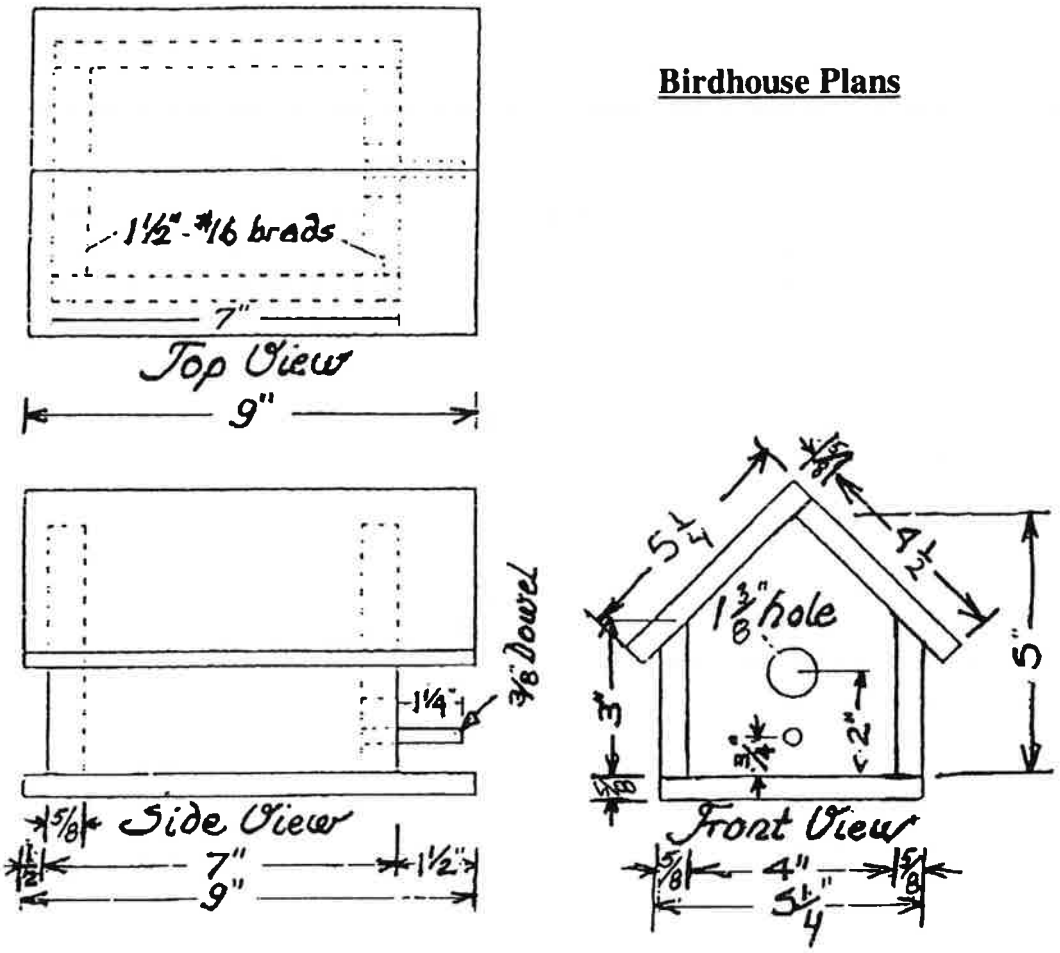
This project will be graded with the following criteria in mind:

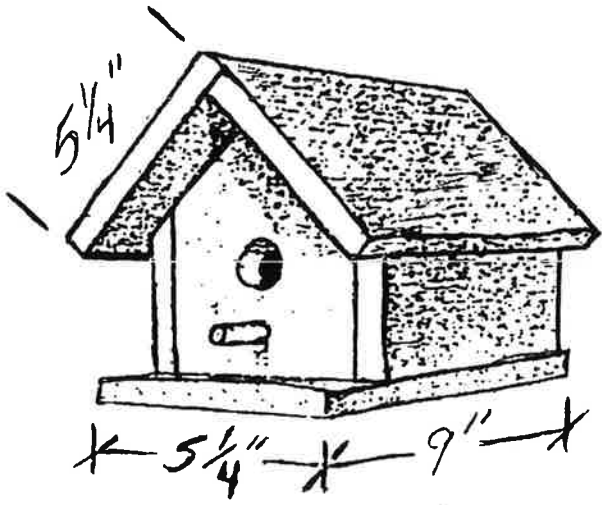
-Plan sheet filled out correctly and completely, including cost of materials.
-All dimensions should be as specified on plans.
-Joints are all clean and tight.
-Nails are all punched below surface of wood.
-Properly sanded.
-Properly caulked.
-Properly painted.
-Overall appearance.
-Completed by due date.

Material List

Item	Cost
-Pieces of pine -2 pieces 5¼" x 9" -2 pieces 3" x 7" -1 piece 4 ½" x 9" -2 pieces 4" x 5"	$1.00 per square foot
-1 piece of ⅜" dowel 2" long	25¢

Birdhouse Plans





Summary of Steps for Building a Bird House

1. Completely fill out plan sheet.
2. Make a full size paper pattern for each piece of the birdhouse.
3. Trace pattern pieces onto your wood.
4. Cut out your pieces of wood.
5. Sand your pieces of wood to their exact sizes.
6. Drill a 1 ½" hole in one end piece.
7. Plane the correct angle on the two side pieces.
8. Nail together the two sides and the two end pieces.
9. Sand those four pieces.
10. Attach the roof and the base pieces.
11. Sand the entire birdhouse.
12. Install ⅜"dowel.
13. Caulk all joints.
14. Paint birdhouse.

Detailed Steps to Building a Bird House

1. Completely fill out plan sheet, including sketches, tools required, step by step procedures, and materials needed. For this birdhouse, we will be using ⅝" pine. On your plan sheet:

-Draw 3 sketches: front view, side view, and full perspective view.

-List all of the tools you think you will need to build this project.

-List the 14 steps required to build this project.

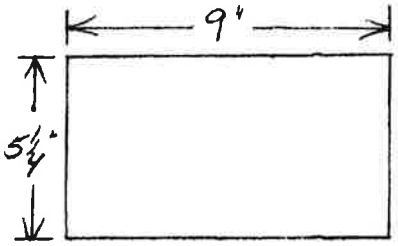
-List all of the materials needed to build this project.

-Calculate the total cost for this project. Refer to ***How to calculate the cost of wood*** instructions to do this.

2. Make a full size paper pattern for each piece of the birdhouse. Be sure to label each piece as you cut it out, and be sure to write your name on each piece. You will need patterns for the following pieces:

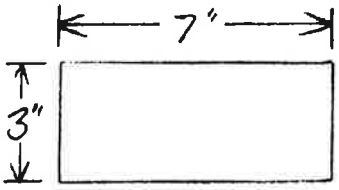
Bottom: 5 ¼" x 9"

One needed



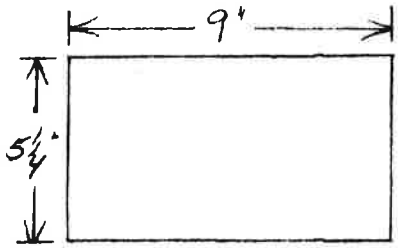
Sides: 3" x 7"

Two needed, but you only need to make one pattern.



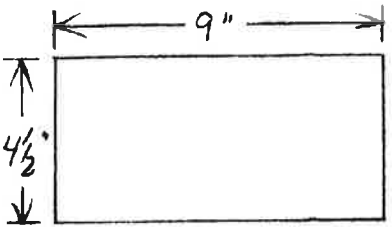
Roof piece 1: 5 ¼" x 9"

One needed



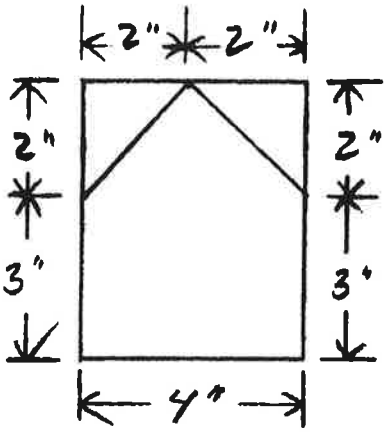
Roof piece 2: 4 ½" x 9"

One needed



End pieces: 4" x 5" with corners cut as shown

Two needed, but with holes in one piece only. You only need to make one pattern piece.



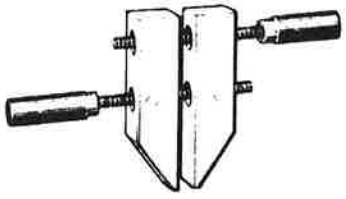
After you draw pattern pieces, with dimensions labeled, and your name and period on each pattern piece, get Mr. Storm's approval before cutting them out.

3. After cutting out pattern pieces, show Mr. Storm. Upon approval, you will receive your wood. Trace pattern pieces onto your wood.

Always keep your pattern pieces next to the edge of your board so that you don't need to make a cut on all four sides for every piece.

4. Cut out your pieces of wood. Make all of your crosscuts with a hand saw. If you have been checked off on the Bandsaw, you may make the other cuts using the bandsaw.

When cutting your board with a handsaw, clamp the board to a work table with a **wooden screw clamp.**



If you have not yet been checked off on the bandsaw, make all of your cuts with a handsaw. Either way, you must make all of the square cuts with a hand saw! **Cut the pieces outside of the lines so that you can sand them to the exact size required.**

5. Sand all of your pieces to their exact sizes using the **belt & disc sander**. Be very careful to not sand off too much wood, thereby making your pieces of wood too small.

6. Using the drill press, drill the large hole on the front piece of the birdhouse. The access hole will be 1 ½" in diameter, and it will be 2" o.c. from the bottom of the front piece. **DO NOT drill this hole in both ends of the birdhouse**. Doing so will create an unpleasant draft which will prevent any birds from choosing this as their home in our chilly and windy winter months. **You must be checked off on the drill press to complete this step.**

7. Using a hand plane, plane the top edges of the side pieces to a 45 degree angle.

8. Using a **hammer** and nails, assemble the four side pieces of the birdhouse. Use 2 nails at each joint, and be sure to assemble them as shown on the plan. After you assemble these pieces, use a hammer and a **nail set** to properly set all nails below the surface of the wood.

Having one piece clamped in a vise as you nail on the other piece is very helpful.

9. After assembling those 4 pieces, you must sand all the surfaces of the birdhouse on the disc & belt sander.

10. Finish assembling the rest of the birdhouse:

-First, you should nail together the 2 roof pieces. When you do this, make sure you assemble them as shown on your plan.

-Attach the base piece. Make sure you have the correct overhang at the front and back of the birdhouse. It should stick out 1 ½" past the front of the birdhouse, and it should stick ½" past the back of the birdhouse.

-Attach the roof assembly, making sure it has the same overhangs as the base piece.

For this step, you may use the pneumatic **brad nailer**. Mr. Storm will give detailed instructions on how to use this tool, but be very aware that this tool is a gun, and so **you must follow all rules regarding this tool very carefully, or you will never be allowed to use it again.** Make sure all nails are properly set using a hammer and a nail set.

11. Finish sanding your birdhouse. Begin by sanding all the joints on the **disc & belt sander**. Next sand the entire birdhouse with a **palm sander** at the sanding table.

12. You must now drill a ⅜" hole in the front of the birdhouse. This hole should be ¾" o.c. from the bottom of the front piece of the birdhouse. You will drill this hole using a **cordless hand held drill** with a ⅜" drill bit.

Next, cut a piece of ⅜" dowel 2" long using a handsaw. Using a small amount of glue, insert the dowel into the hole.

13. Caulk all of the joints of your birdhouse as needed. The more careful you are in building your birdhouse, the less caulk you will need.

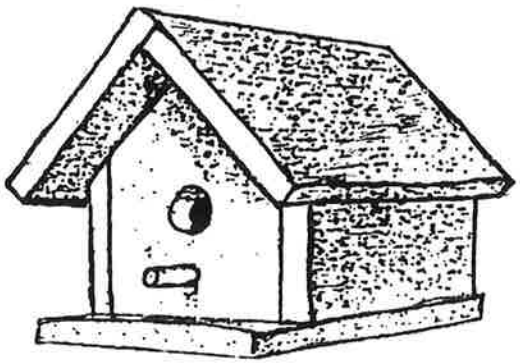
14. Paint your birdhouse. Before you paint your birdhouse, you will be issued a paintbrush for which you are responsible. You must be certain to properly clean your brush after each use, or you will be charged to replace it.

Your Birdhouse should be painted with 2 coats of paint. Do not paint the bottom of your birdhouse, but make sure your name is written on the bottom of the birdhouse.

After you paint it, please put it inside the cabinet in the finish room for it to dry.

Also remember that if you fail to properly clean up the finish room when you are done, you will not be permitted to use the finish room in the future.

After completing your birdhouse, fill out a project evaluation form, and submit to Mr. Storm for a grade. Please allow two business days for your project to be graded!



Home Sweet Home

And remember, this isn't just a house you have built, it is a home. A home for a very lucky bird, and perhaps the birds' family to love and enjoy. Take pride in your work, and it will be appreciated by all the birds that come and go through the years. I will be able to see if you took pride in your work, and that perception will be reflected in your grade.

Project Plan Sheet

Project Name **Birdhouse**

Student Name _____ Period _____

Starting Approval

Sketches with Dimensions

Front View Side View Full Perspective View

Tools & Equipment needed	Step by Step Procedures
	1.
	2.
	3.
	4.
	5.
	6.
	7.
	8.
	9.
	10.
	11.
	12.
	13.
	14.

List of Materials

Pieces of Wood

Name of Piece	Material	Dimensions	Number of Square Inches
Bottom			
Side 1			
Side 2			
Roof Piece 1			
Roof Piece 2			
End Piece 1			
End Piece 2			

Total:_____

Convert total number of square inches into square feet.

_____ ÷ 144 = _____

Square inches — Square Feet

Determine cost of wood.

_____ × _____ = _____

Square feet — Cost per sq. ft. — Total cost of wood

Additional Materials

Item	Cost
⅜" Dowel - 2" long	

Total Cost of Project

Add total cost of wood to costs of additional materials. Enter total Here.

$

Remember: If you ruin a part, you must pay to get a new piece of wood.

Building a Cutting Board

This project will consist of building a cutting board. To make this project, in addition to the tools you are already familiar with, you will need to learn how to safely use the **radial arm saw, miter saw,** and the **planer.** All of these tools have the potential to be extremely dangerous, and so it is extremely important that you pay very close attention to the safety demonstrations given for these tools, and that you always follow all of the rules for using these tools very carefully.

You will also learn some interesting woodworking techniques as you build this project, which you will be able to apply to your future projects.

No two cutting boards will look alike, so this project has a great deal of opportunity for you to express your creativity!

This project will be graded with the following criteria in mind:

-Neatness of joints between your pieces of wood.
-Final appearance of cutting board compared with the one shown on your plan sheet.
-Attention to detail in all cutting and sanding operations.
-Overall appearance and functionality of final product.

Material List

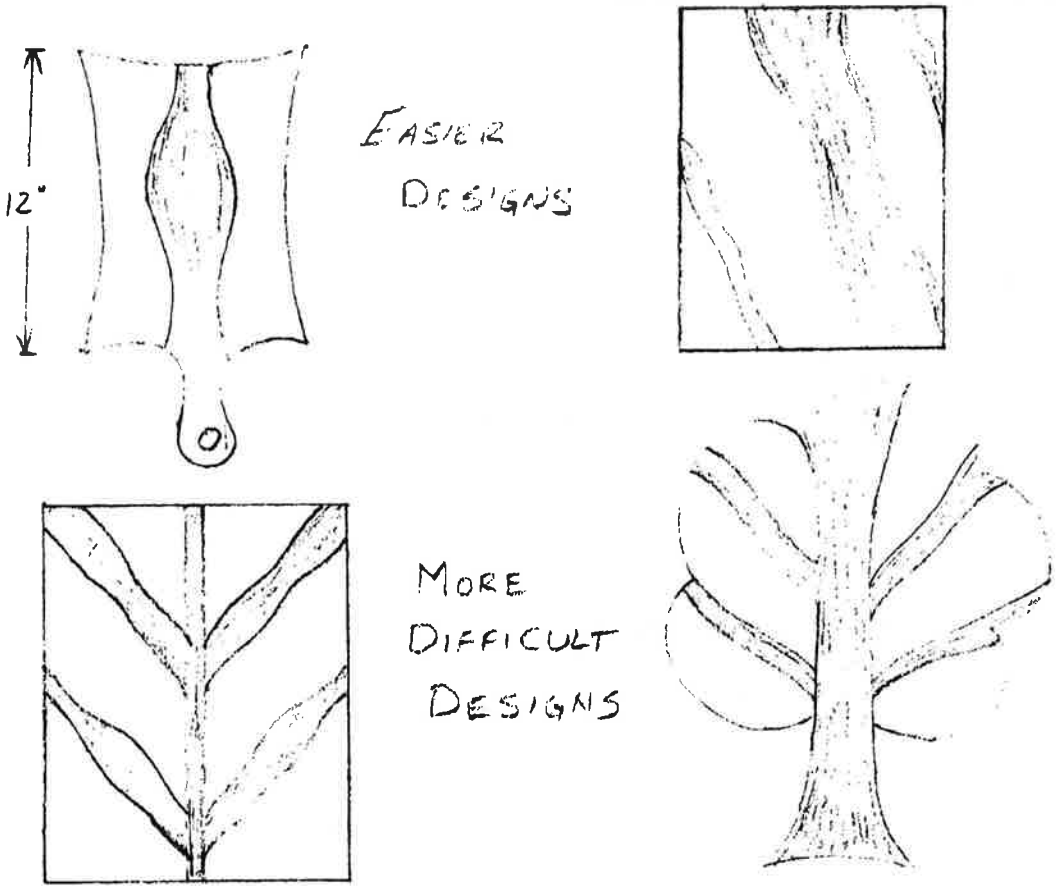
Item	Cost
-Pieces of hardwood (quantity and sizes will vary)	Varies
-Strips of veneer.	10¢ each

Summary of Steps for Building a Cutting Board

1. Draw small sketches of possible designs.
2. Draw a full size picture of your design.
3. Cut out rectangles of paper - one for each piece of wood you will need.
4. Completely fill out a plan sheet, including list of materials and total cost of materials.
5. Get your wood and cut pieces to length.
6. Glue pieces of wood together, overlapping with newspaper between them.
7. Draw lines on wood where bandsaw cuts will be made.
8. Cut on lines with bandsaw. **DO NOT BACK UP WHILE CUTTING!**
9. Separate pieces of wood.
10. Glue pieces together with a piece of veneer between pieces.
11. Scrape and sand off excess glue and paper.
12. Plane board smooth and flat.
13. Cut board to final shape.
14. Sand entire board until there are **no** visible sanding or cut marks.
15. Apply oil finish (vegetable oil)

Detailed Steps to Constructing a Cutting Board

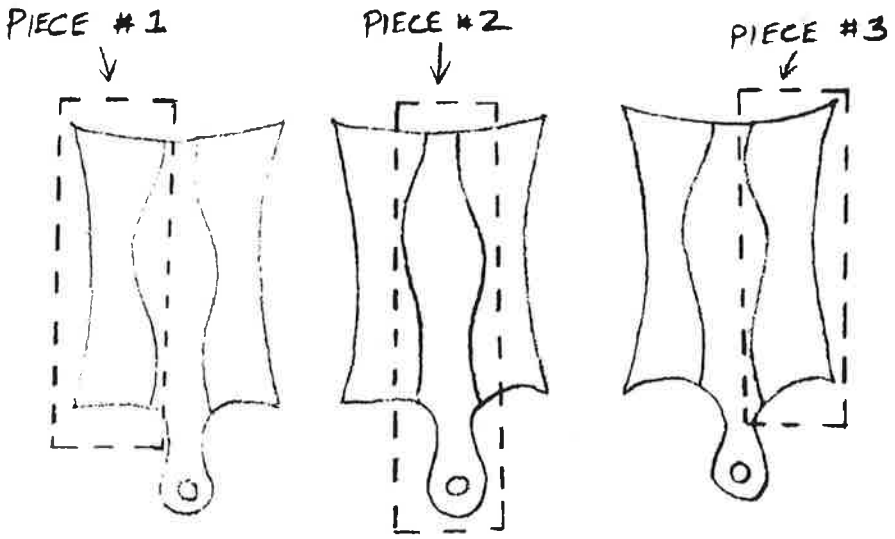
1. Draw some small sketches of what you would like your cutting board to look like. Shown below are some possible examples.



There is a great deal of opportunity with this project to create a very creative design, but after you draw your pictures, you must show them to Mr. Storm before proceeding so we can both decide if the designs that you have drawn can actually be built! You will then choose the one you want to make.

2. Draw a full size picture of your cutting board. Your cutting board should be about 12" long and 10" wide, plus any handle that it may have.

3. Cut out rectangles of paper - one for each piece of wood you will need. You do this in order to determine the size of each piece of wood required to build your cutting board. Each rectangular piece must be large enough so that it completely overlaps the joint between it and the piece next to it. See example below.



4. Completely fill out a plan sheet, including list of materials and total cost of materials. Every cutting board is unique, and so every list of materials will be different. You must use your paper pattern pieces to make your materials list and determine the total cost. See the ***How to Calculate Cost of Wood*** instruction sheet for details on how to do this.

After you have completed your plan sheet, you must have it signed by Mr. Storm in order to proceed.

5. You must now find your pieces of wood and cut them to length. For a cutting board, you should use hard woods such as maple, walnut, cherry, hickory, or any other wood which is very hard and has a tight grain pattern. Woods such as pine or cedar are not acceptable for use in a cutting board.

When looking for wood, follow these steps:

-First, look in the burn boxes to see if anyone put any pieces of wood there that you can use for your cutting board.

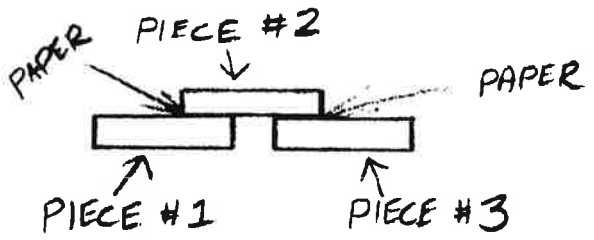
-Next look in the white wood storage cabinet to find pieces that will work. **Please put any pieces you do not use back in the exact location you took them from!**

-If you can't find the pieces you need in these locations, you will need to get Mr. Storm's permission to go into the wood room and select your wood.

-If you can't find any pieces large enough, you may have to glue two pieces of wood together in order to create a larger board.

Once you have selected your boards, cut them to the correct lengths. Cut longer boards down to size using the **radial arm saw**. Cut shorter boards to size using the **miter saw**. **You must show your wood to Mr. Storm and get his permission before cutting any of your wood.**

6. Glue pieces of wood together, overlapping with newspaper between them. Make sure they overlap the correct amount. Here is a picture of how a 3 piece cutting board would be glued together:



Please follow these steps:

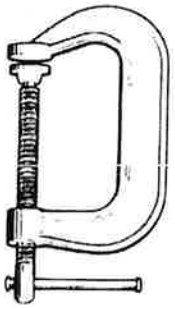
-Bring your full size picture, your pieces of wood, and a sheet of newspaper over to the glue table.

-Place your full size picture down on the table first.

-Lay out your pieces of wood as you believe they should be assembled.

-Have Mr. Storm check your layout.

-Once we are all certain that everything is correct, glue them together with the newspaper between them. There must be glue on both sides of the newspaper.



-Clamp them together using **C-clamps**. You will use **2** at each joint, so a 3 piece cutting board will require 4 clamps, a 4 piece cutting board will require 6 clamps, and a 5 piece cutting board will require 8 clamps. **Have your clamps ready before you begin to glue.**

-Make sure your name and period is clearly written on your project!

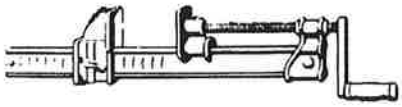
7. After your glue is dry (the next class), draw the lines where you want to cut the wavy lines on the bandsaw. These lines must not go off of the edges of either board you will be cutting through. **Check with Mr. Storm before making these cuts.**

8. Cut the wavy lines on the bandsaw. Stay on your lines as you make these cuts. **If you wander off of your lines, you must not back up in the cut you are making.** Instead, just work your way back to your line, and continue.

9. After you have finished your bandsaw cuts, separate your pieces of wood using a hammer and a stiff putty knife. They should actually come apart fairly easily, as the newspaper will actually split. Make sure the pieces fit together as you intended.

10. Glue your pieces together with a piece of veneer between each of the pieces. The veneer is important, as it will help the pieces fit together much better. Make sure to put glue on both sides of the veneer.

When clamping these pieces together, the large, black **bar clamps** underneath the glue table work best.



11. After your glue is dry (the next class), remove all the glue and as much paper as possible off of your cutting board. Use scrapers, chisels, and a **portable belt sander** as needed.

When belt sanding, it is not necessary to make your board completely flat. You only need to remove excess glue and paper so that we don't ruin the planer blades when doing the next step.

12. Using the **Planer**, plane your cutting board to its final thickness. Do not take off more than is needed, as your cutting board may end up too thin. If your cutting board is wider than 15", or if it has wood grain going in different directions, you must use the **Dual Drum Sander** for this step.

13. Cut your cutting board to its final shape using the appropriate tools. This is usually done with the band saw and if there are any holes in it, the drill press. **Before you make these cuts, draw lines where you intend to cut your board and show Mr. Storm.**

14. Sand until perfectly smooth, so that no saw marks or sanding marks are visible. Begin by sanding the edges on the belt & disc sanding machine. Then sand the entire board with a palm sander at the sanding table. Finally, hand sand the entire project. Always sand projects up to 220 grit sandpaper.

15. Finish your cutting board with an oil finish. You must use the finish Mr. Storm instructs you to use. You must never use any finish which would be poisonous, as food will be in direct contact with your cutting board.

After you complete your cutting board, fill out a project evaluation form, and submit to Mr. Storm for a grade. Please allow two business days for your project to be graded!

Project Plan Sheet

Project Name **Cutting Board**

Student Name _____ Period _____

Starting Approval

Sketches with Dimensions

Tools & Equipment needed	Step by Step Procedures
	1.
	2.
	3.
	4.
	5.
	6.
	7.
	8.
	9.
	10.
	11.
	12.
	13.
	14.
	15.

List of Materials

Pieces of Wood

Name of Piece	Material	Dimensions	Number of Square Inches

Total:_____

Convert total number of square inches into square feet.

_____ ÷ 144 = _____

Square inches — Square Feet

Determine cost of wood.

_____ × _____ = _____

Square feet — Cost per sq. ft. — Total cost of wood

Additional Materials

Item	Cost
Strips of Veneer	

Total Cost of Project

Add total cost of wood to costs of additional materials. Enter total Here.

$

Remember: If you ruin a part, you must pay to get a new piece of wood.

Building a Hinged Box

This project will consist of building a 6" x 10" wooden box with a hinged top. To make this project, in addition to the tools you are already familiar with, you will need to learn how to safely use the **Table Saw, Jointer,** and the **Router.** All of these tools have the potential to be extremely dangerous, and so it is extremely important that you pay very close attention to the safety demonstrations given for these tools, and that you always follow all of the rules for using these tools very carefully.

This project will be graded with the following criteria in mind:

-Accuracy of all dimensions as specified.
-Tightness of joints.
-Attention to detail in cutting, routing, and sanding.
-Accurate placement of hinges.
-Neat installation of hinge hardware - no stripped or broken screws.
-Neatness of application of the finish.

Material List

Item	Cost
-2 pieces of wood 4 ½" x 17" x $^3/_4$"	Varies
-1 piece of wood 6" x 10" (This will probably be made up of multiple smaller pieces)	Varies
-1 piece of $^1/_4$" plywood 5 $^1/_4$" x 9 $^1/_4$"	50¢
-2 hinges	50¢ each
-8 screws	10¢ each
-Oil finish	50¢

Summary of Steps for Building a Hinged Box

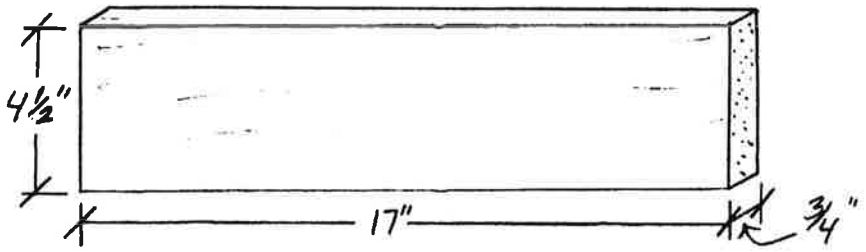
1. Fill out Plan Sheet
2. Get two pieces of solid wood approximately 17" x 4 ½" x ¾"
3. Plane boards to $^{5}/_{8}$" thick
4. Joint one edge of each board smooth
5. Rip boards to 4" wide
6. From your 2 pieces of wood, cut 2 pieces 10" long, and 2 pieces 5 ½" long
7. Cut a rabbet in both ends of the 10" long pieces
8. Cut a dado in all four pieces
9. Cut the plywood for the bottom of the box
10. Glue the four sides together with the bottom installed
11. Make the top piece of the box
12. Glue the top of the box on
13. Sand the entire box smooth
14. Put a decorative profile around the top of the box
15. Cut open the box
16. Attach hinges
17. Apply a finish

Detailed Steps for Building a Hinged Box

1. Completely fill out plan sheet including the cost of materials. All the information you need to fill out your plan sheet is contained in these directions. Read through these directions, and carefully extract the information you need for your plan sheet. Ask Mr. Storm for assistance only after searching for the answer in these directions.

2. Once your plan sheet is complete and has been approved by Mr. Storm, you may get the wood for the four sides of your box. You may use any solid wood for this project. You will need:

-2 pieces of wood *approximately* 17" long x 4 ½" wide x ¾" thick.



You will cut these pieces from longer boards using the **Radial Arm Saw**. From these pieces of wood, you will make four smaller pieces of wood by following the next four steps

It is also possible that you will create these pieces of wood by gluing together several smaller pieces of wood. This generally makes for a stronger and more attractive box.

3. Using the **Planer**, plane your two pieces of wood down to *exactly* $^{5}/_{8}$" thick. Make sure to take as little as possible off the first side so that you can plane both sides of your boards.

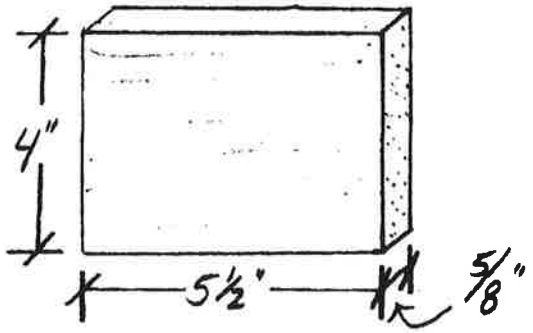
4. Using the **Jointer**, joint one edge of each of your boards. Before doing this you must have taken your jointer safety test, and received a 100% on it.

5. Using the **Table Saw**, rip both of your boards down to be *exactly* 4" wide. Before you do this, you must have taken your table saw safety test, and received a 100% on it.

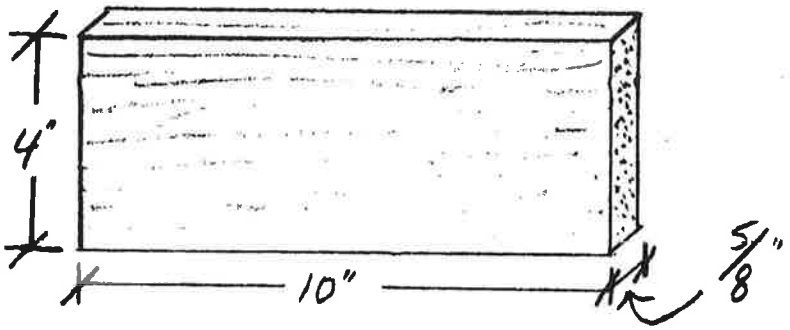
6. Using the Sliding Compound Miter Saw, from each of your boards cut one piece 5 ½" long, and one piece 10" long. **It is very important that you DO NOT cut two pieces which are 5 ½" long from one board, as the remaining board will not be long enough from which to cut two 10" pieces.**

After you make these cuts you should have:

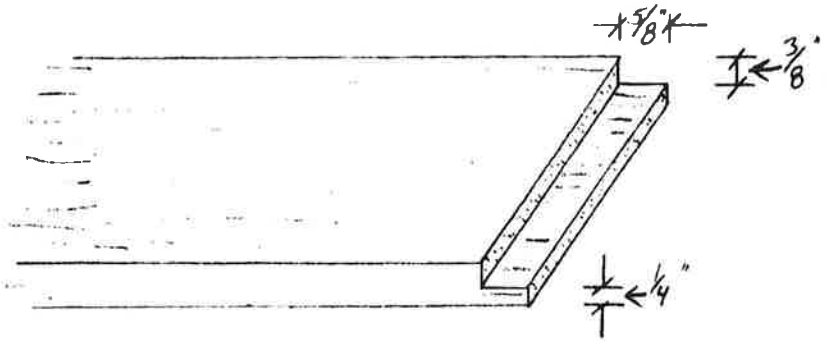
-2 pieces 5 ½" long x 4" wide x $^5/_8$" thick



-2 pieces 10" long x 4" wide x $^5/_8$" thick



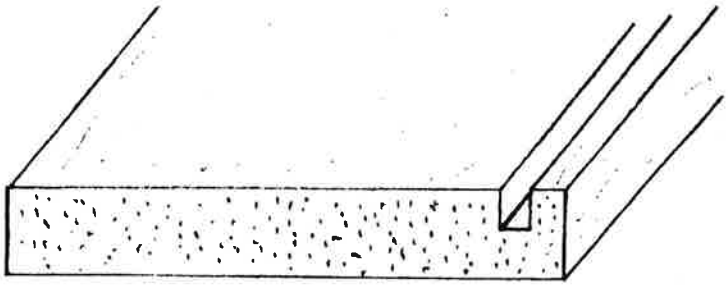
7. Next, you will need to cut a **Rabbet** in both ends of the two 10" long pieces. To do this you will use the **Table Saw** set up with the **Dado blade**. Each rabbet should be $^5/_8$" wide, which is as wide as your wood is thick. Also, it should be $^3/_8$" deep. To do this, the blade should be set so that it is $^3/_8$" above the surface of the table, and the fence, with the wooden fence attached, should be $^5/_8$" from the far point of the blade. Once you have the saw set up correctly, check with Mr. Storm to confirm that it is correct. Each of the 4 rabbets you create should look like this:



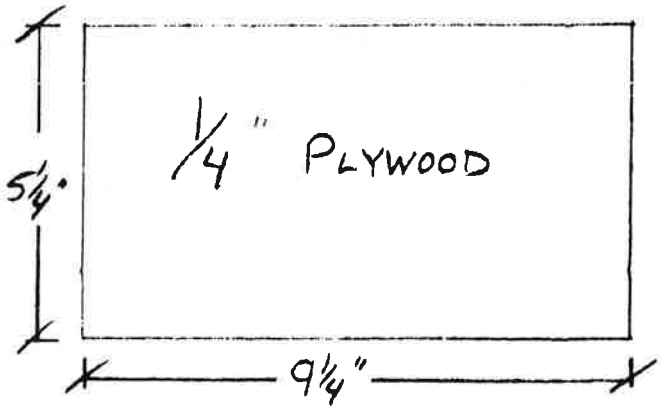
8. Now you will cut a **Dado**, which is essentially a groove, in the four pieces of wood. This groove will hold the plywood bottom of your box. You will make your plywood bottom out of ¼" plywood. The exact type of plywood you use will vary depending on the type of wood you have chosen to make your box from, and the exact thickness of these plywoods vary. Because of this, it is important to select your plywood prior to cutting the dado so that you can make sure you cut your dado the correct width.

You will make this cut on the **Table Saw** set up with the regular blade. Set the blade height so that it is $^{5}/_{16}$" above the table, or slightly less than the rabbet blade was set. For the first cut, have the space between the blade and the fence be ¼". Make this cut on all 4 of your pieces.

Next, move the fence about $^{1}/_{8}$" farther from the blade. This will vary depending on the actual thickness of your plywood. Make this cut on all 4 of your pieces. When done, your plywood should fit snugly, but not tight. It should look like this:

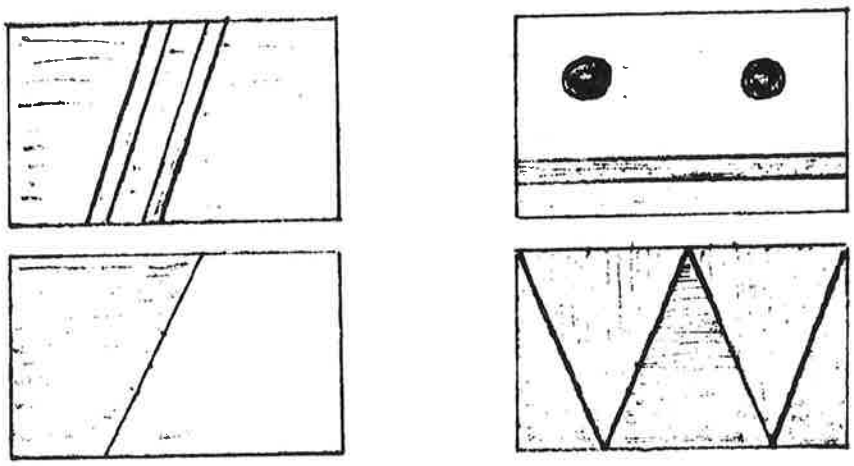


9. Cut your plywood to the correct size using first the Table Saw to rip it to the correct width, and then with the Sliding Compound Miter Saw to cut it to the correct length. It should be 5 ¼" wide and 9 ¼" long, but you should check to make sure that is how big your piece needs to be, because if any of the dimensions of the pieces of wood you have cut so far are different from what the directions say, your plywood bottom will be different as well. If all your dimensions are correct, it should look like this:



10. Glue the four sides of your box together with the bottom installed. Once you clamp it, make sure the pieces all fit together tightly, and that it is perfectly square. Use a framing square to check.

11. Next, you will make a top piece for your box. It should be 6" wide and 10" long. It can be a solid piece of wood, or it can have any geometric pattern you wish to create. Some examples of what you might do are shown below.



If you make a top with multiple pieces, you will need to glue it and plane it as you did with your cutting board.

12. Once your top it completed and planed to an even thickness, glue it to the top of your box. This will create an enclosed box which in its current state cannot be opened. When you glue it together, **DO NOT put anything inside your box!!!**

13. The next class, you will sand your box so that it is perfectly smooth with no visible sanding or saw marks.

14. Next, you will use a **Router** to put a decorative profile around the top of your box. Before you do this you must pass the router safety test with a score of 100%. Always move the router around the box in a counter-clockwise direction.

15. Next, we will cut open your box. This will be done on the **Table Saw**, but because it is a dangerous series of cuts which must be performed without the guard, Mr. Storm will make this cut for you.

16. After you finish sanding all surfaces of your box up to 220 grit sandpaper, you will attach the hinges on your box. **This step is actually one of the most difficult steps in building your box, so please take your time.**

-First, mark the locations of the screw holes on your box.

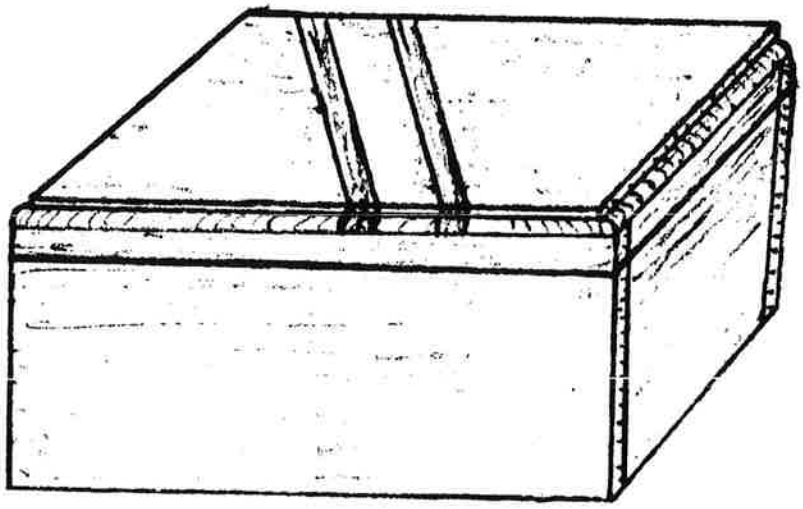
-Using a center punch and a hammer, make an indentation where each screw will be located.

-Next, you will drill holes in those locations. You must be very careful when doing this to make certain you don't break the drill bit, and that you don't drill too deep, thereby putting a hole through your box.

-Next you will attach your hinges with the screws provided. Use a hand screwdriver, not a drill, and **be patient.**

17. Put a finish on your box. Use a wipe on type of oil finish, which will be provided. Apply two coats, sanding lightly between coats with 400 or 600 grit sandpaper.

Once your box is completed, fill out the self evaluation sheet and submit it for a grade. Please refer back to the criteria on which this project will be graded as listed on the first page of these instructions.



Project Plan Sheet

Project Name **Hinged Box**

Student Name _____ Period _____

Starting Approval

Sketches with Dimensions

Top View

Full Perspective View

Tools & Equipment needed	Step by Step Procedures
	1.
	2.
	3.
	4.
	5.
	6.
	7.
	8.
	9.
	10.
	11.
	12.
	13.
	14.
	15.
	16.
	17.

List of Materials

Pieces of Wood

Name of Piece	Material	Dimensions	Number of Square Inches
Piece 1			
Piece 2			
Top Piece			

Total:_____

Convert total number of square inches into square feet.

_____ ÷ 144 = _____

Square inches — Square Feet

Determine cost of wood.

_____ × _____ = _____

Square feet — Cost per sq. ft. — Total cost of wood

Additional Materials

Item	Cost
¼ Plywood	
2 Hinges	
8 Screws	
Oil Finish	

Total Cost of Project

Add total cost of wood to costs of additional materials. Enter total Here.

$

Remember: If you ruin a part, you must pay to get a new piece of wood.