Marking and Measuring

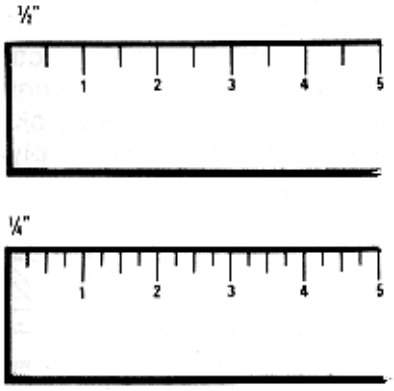
English Measure

If you want to make pieces of a certain size, you will have to measure and mark them before you do any cutting.

Examine a rule and find an inch mark. The mark (") shows inches. Find the number that relates to the inch mark. (1", 2", and so on).

Can you find a long mark that is halfway between the inch marks? This is called the **half-inch mark**. If the half-inch mark is equally divided into two parts, what is the correct name for each of those parts? If these parts are divided in two again, what would those parts be called? If they were divided still one more time, what would these tiny sections be called?

Look at the drawing below. The inch is divided into a number of smaller sections, all of which are labeled. Check your answers against the labels on the drawings.



(Above drawings not to scale)

Let's practice a bit. Find the following points on your rule or square: 2", 5", 7½", 3¼", 6⅛", and 10³⁄₁₆". If you have any trouble, ask your parent or leader to help you.

The unit of measurement larger than an inch is a **foot**. The mark (') shows feet. There are 12 inches in 1 foot. Some 6-foot rules number the inches from 1 to 72. Others number the inches from 1 to 11, the next number being 1 foot; the next numbers are 1-1, meaning 1 foot, 1 inch, or 13 inches.

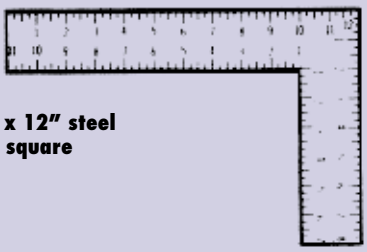
Metric Measure

The metric system, which is coming into wide use, uses a pure base 10 arithmetic. Each one of the counting units is 10 times larger than a smaller one.

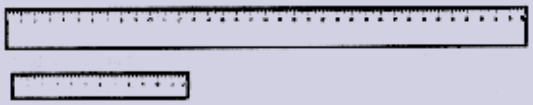
Find a metric rule. The smallest unit of measure on the rule is a **millimeter**. Can you find two of the short marks on your rule that mark the beginning and the end of a millimeter?

Ten millimeters form a **centimeter**. A centimeter is actually about this long (_____). See if you can find the nine marks between the two larger centimeter marks.

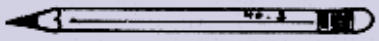
Tools you will need:



An 8" x 12" steel utility square

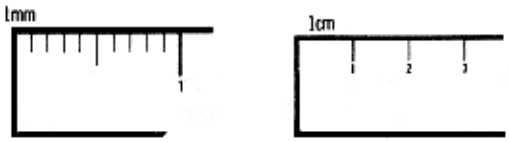


A straight rule, yardstick, folding rule, or steel tape



A No. 2 or No. 3 pencil, kept sharp

These marks divide the centimeter into 10 millimeters.



(Above drawings not to scale)

Ten centimeters form a **decimeter**. A decimeter is not shown in the measurement of most rules. Ten decimeters, or 100 centimeters, form a **meter**. A meter is about 39.37 inches long. One thousand millimeters form a meter.

Measuring Wood

To build things well, you need to measure the correct width and thickness of a piece of lumber. For example, if you buy a piece of 2 x 4 at the lumberyard, you should measure it to see how wide and thick it really is. Remember, the wood may have shrunk due to evaporation. If you do not measure the wood, you might find that you bought a piece that is actually too small for your project.

Let's practice measuring on a piece of scrap lumber. Measure and mark spots ¾", 1⅝", 3½", and 5⅝" from the end. Have your parent or leader check your measurements. Did you use a sharp pencil or a dull pencil to mark the spot? Would that make any difference in how accurate your measurement is?

Hold the edge of the rule on the wood and make your mark at the exact spot. You may have watched a cabinetmaker marking his spot with a knife or scratch awl. Why does he use these tools instead of a pencil? Because his measurements will be more accurate.

If you have to measure a long distance, use a long rule. You increase the chances of a mistake if you move a short rule several times to complete the measurement.

Keep practicing until you can measure a certain distance from the end of the board and accurately mark the spot. The next thing to learn is how to make a line squarely across the board.

Squaring a Line

A square line makes a perfectly square corner with the edge of the board. If you would tip the board on edge so that the line pointed upward and the board was level, this line would look perfectly straight up and down. It would not slant toward either end of the board.

To square a line, you may use a tri-square, steel combination frame, utility square, or framing square.

Hold the handle of the square firmly against the edge of the board. Mark along the blade or the other part of the square with a sharp-pointed pencil. Make only one mark with the pencil. Don't go over it a second time.

Just to see what happens, try holding one end of the handle of the square about ⅛" away from the edge of the board. What does this do to the direction of the line?

When squaring a line, use your utility square to see that the line is straight.

Some beginning woodworkers like to make lines across the edges and the back of the board as well. You could try this and see if it helps you make a straighter cut with your saw. To mark an edge, hold the handle of the square tightly against the face of the board with the blade of the square over the edge. Mark along the edge of the square.

To make the square line across the back of the board, hold the square handle against the same edge as when you made the mark on the face or the top side.

CAUTION! Remember to:

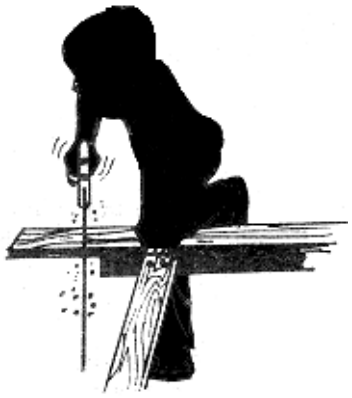
1. Make sure the end you measure from is square to begin with.
2. Examine the end of the board. If you see cracks or other defects, re-square beyond the damaged area.

Things you can do

- Practice squaring lines on a piece of 2 x 4 until you can make two perfect squares on the surface of the board.
- Measure a piece of 2 x 4. Mark down how wide and how thick it is. Start from the opposite side of the wood and make your measurement again. Is your measurement the same?

Cutting Wood

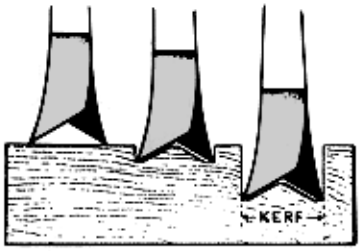
Are you ready now to practice making a square cut with a hand saw along the marks that you drew on the board? Before you do any actual cutting, make sure you read this section very carefully.



When sawing a large board, use both your hand and your knee to brace it while you cut, or use a clamp.

If you look closely at the end of your piece of board, you will notice that it is made up of a collection of extremely fine fibers grown together. You could compare these fibers to broom straws that have been glued together.

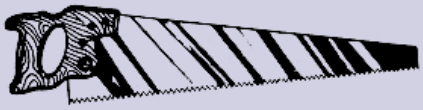
The **crosscut saw** is a tool used to cut across the fibers of the wood. The teeth of a crosscut saw are filed and bent so the teeth act as a row of knife points on each side of the saw. The teeth are bent slightly as they go along, the first one to the right, the second to the left, and so on. This bending of the saw teeth is called "setting." This design makes the saw cut a strip wider than the blade so the saw can move back and forth easily.



Sharp points cut wood fibers. The kerf is the slit made by a saw.

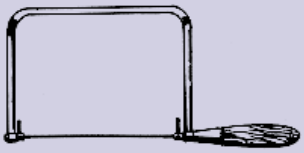
Top view of crosscut saw teeth.

Tools you will need:



A crosscut hand saw (20" or 22" – 10 or 11 point hand saw) to cut off boards crosswise and to cut plywood in any direction

A rip saw is recommended for cutting with the grain, not to cut end pieces.



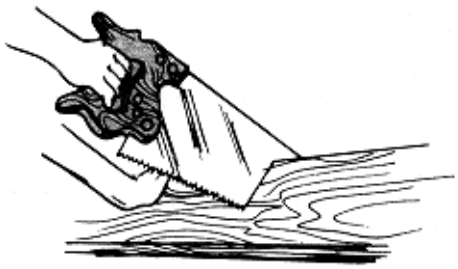
Coping saw for cutting curves in thin wood

Safety goggles to keep sawdust and chips out of your eyes

What would a carpenter or cabinetmaker say about making a true and square cut? He or she would say to hold the saw straight up and down, or "square" with the board. What would happen if you held the saw at an angle so the top of the saw would slant to the left or right? Try it, just to see!

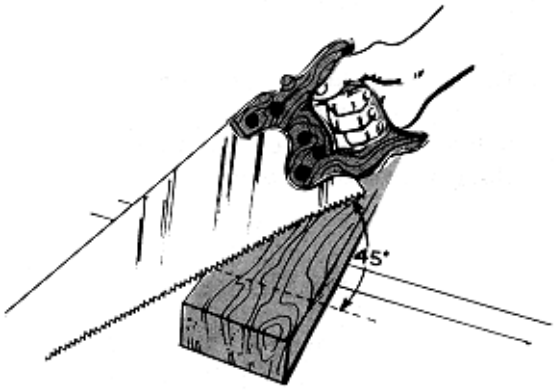
Saw on the waste side of your line. If you saw right on the line, your board may be too short.

Remember, each time you cut the wood you remove some of it. The wood that is removed should be to the outside of the line.



Youth grip

Sometimes you may have to hold the saw flat so the teeth come into contact with the entire surface of the board at the same time. This may be necessary when using a miter box or other guiding device. When you do not have to do this, raise the handle of the saw so the saw blade is at about a 45-degree angle with the surface of the board on ordinary lumber. When sawing plywood, a flatter angle (about 15 degrees) is best.

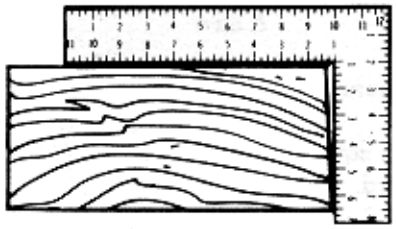


45° angle for lumber and 15° for plywood

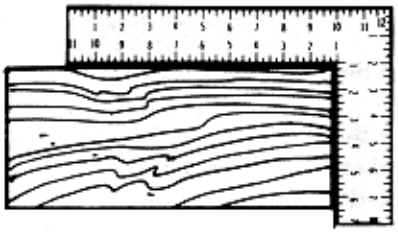
Try cutting a board in this manner.

Do you have a true, accurate, square cut? Did you push down on the saw? The weight of the saw will make it cut fast enough. Did you hold the cut-off piece so it did not fall on the floor? If it is not held, the last little uncut portion of wood may break off. What could happen to the nice corners of your piece of wood if it fell on the floor or the ground?

How would you use your square to check the accuracy of the saw cut? Hold the handle of the square tightly against the board and the blade of the square along your new cut. If you can see light between the square and the board, the cut is not square (See the illustration on this page.) Remember to check both crosswise and edgewise of the board.



Poor cut



Square cut

Safety Notes

Hey Kids! Did you know...

1. **A saw cuts very quickly. Handle it so that the teeth will not touch your skin.**
2. **Protect the saw by storing it in a safe place.**
3. **Prevent cutting your thumbs! Use a squared piece of wood to keep the saw on the cutting line.**
4. **Sawdust can be very slippery. Sweep it up after you cut.**
5. **Keep the saw sharp. It cuts much better and takes less work to do the job.**

How to Make a Saw Guide

Materials:

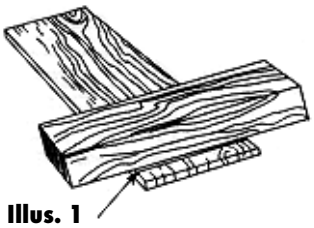
- A 2 x 4, about 12 inches long
- A board ¾" thick and 15–16 inches long (or other lumber to be cut)

Tools

- Hammer or block of wood
- Pencil
- Two C-clamps
- Saw

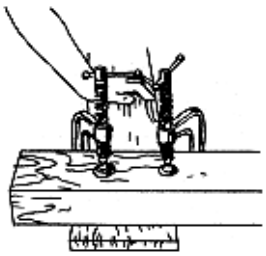
Instructions

1. Make a square line across the board.
2. Position the 2 x 4 saw guide:
   a. Place the 2 x 4 flat on the board surface close to the marked line (Illus. 1).



Illus. 1
2 x 4 close to the line

   b. Place the clamps in position with slight pressure. (Illus. 2). Be sure to have the thumbscrews up! (If they are down, you may hit them while sawing.)



Illus. 2
C-clamps in position—thumbscrews up

   c. Use a hammer or block of wood to tap the 2 x 4 gently until it lines up along your pencil line.
   d. Now tighten the clamp enough to hold the 2 x 4 in place.

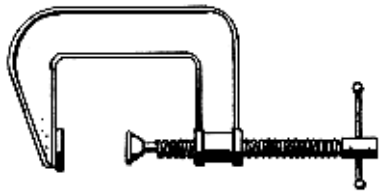
Illus. 3
Keep saw against 2 x 4

3. Place the flat side of the saw blade against the 2 x 4. Pull the saw backward for a few short strokes to start the cut. Keep the saw rubbing against the 2 x 4. (Illus. 3).
4. After the cut is started, continue sawing. Move the saw slowly back and forth. Use little or no downward pressure on the saw.

Using a 2 x 4 and C-clamp Saw Guide

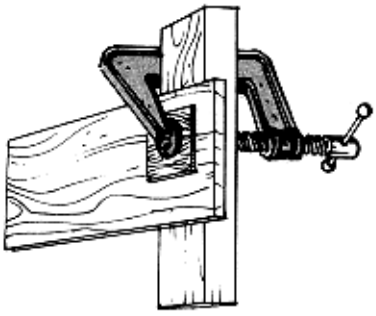
Are you having problems keeping your hand steady enough to make an accurate cut all the way through the wood? Would something to guide your saw help to improve your cuts? Maybe a piece of 2 x 4 held in position along your line would help you make a better saw cut. Clamp this piece of 2 x 4 to a board, and make a saw guide. Directions and illustrations on how to make a saw guide are featured on this page. Or ask your leader or your parent to help you make a **jig**.

You also could make an accurate square cut using a **miter box**. Ask your leader to show you this tool. If you work with a miter box, hold the piece of wood to be cut tightly against the back of the miter box. Do not try to twist the saw. Let it slide back and forth freely. If the miter box has metal saw guides, keep the saw teeth from touching them.



C-clamp

To prevent clamps from denting the wood, place a thin piece of scrap lumber between your good board and the clamps, as shown below.



Thin piece of scrap under clamp

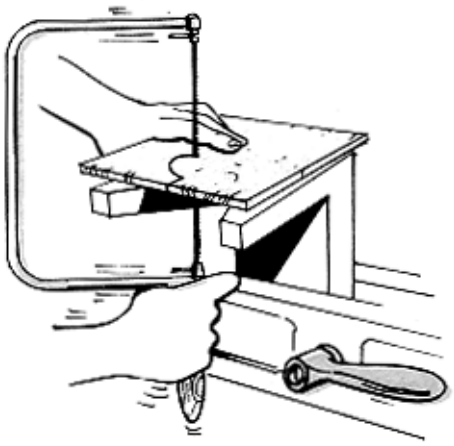
Safety Notes

- **Do not let the C-clamps fall on your feet.**
- **After use, place your saw where it will not be bumped by other tools.**
- **Do not touch the C-clamps with the saw.**

Cutting Curves

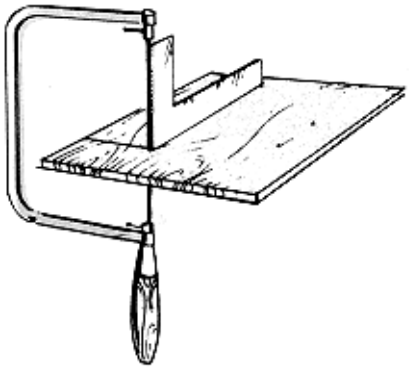
The coping saw is used commonly for cutting curves in wood. It is a small, inexpensive saw with a narrow blade.

The blade is held in place by spring action of the frame. You bend the frame of some saws to put in the blade. On other saws you loosen or tighten the blade by turning the handle.



Coping saw in upright position

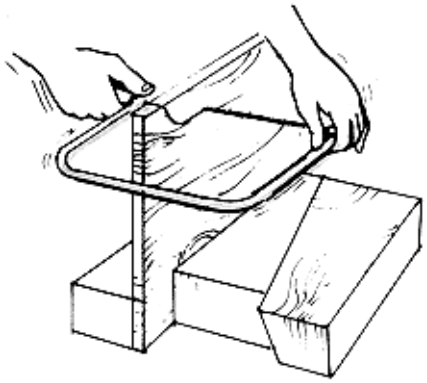
As the saw cuts, it tears and breaks fibers on one side of the board. This happens where the teeth come out of the wood on the cutting stroke. Place your pencil mark on the good side of the board. The wood fiber tears will be on the back side. The fiber tearing can be reduced by firmly pressing transparent or masking tape over the area where the teeth come out of the wood.



Saw square with the surface

If you position the blade with the teeth pointing toward the handle of the saw, you will be less likely to break your blade. It will be cutting on the pull stroke instead of the push stroke.

For wood that is ¼" or less in thickness, use a blade with 15 or 20 teeth per inch. This is called a fine tooth blade. On wood ¾" thick, use a blade that has 10 teeth per inch. This blade is a coarse tooth blade.



Coping saw in horizontal position

The coping saw can be used to cut a hole in a small piece of wood. The frame of the saw must go around the outside of the board to do this. Have your leader help you bore a hole through the wood with an auger bit or a twist drill. Remove the saw blade from one end of the saw. Put the saw blade through the hole, and then put the saw blade into the handle again. A utility saw, compass saw, or keyhole saw is used frequently for this purpose.

Things you can do

- Saw two pieces of wood, one with the saw straight up and down, the other with the saw at a 45-degree angle. Use your square to check your cuts. Write down in your notebook how the two cut pieces are different, and which cut looks better.
- Make a saw guide, as shown in the illustration on page 9.
- If you have a coping saw, show how you can cut out a curved section in a piece of wood or how you can cut a hole from the center of a board. When cutting a hole, remember to bore a hole through the wood with a bit or drill. Take the saw blade off the handle and put it through the hole by itself before reattaching the handle
- See “Coping Saw Puzzle” in the Working Plans.