Layout essentials—*An accurate try square and a marking knife are basic tools for laying out furniture joinery.*

A Basic Layout Kit

Well-made furniture and cabinets start with accurate layout tools

by Horst J. Meister

I was 15 years old when I built my first cabinet. Shortly before my mother's birthday, I overheard her tell my father that she would really like to have a little cabinet for her sewing room. The very next Saturday, I locked myself in the garage with a generous supply of redwood boards, a bent aluminum yardstick, a box of dowels, glue, a crosscut saw and three Snickers candy bars.

The finished piece fell a little shy of my expectations. Believing that square comers were a very desirable feature in furniture, my dad gave me a try square for my 16th birthday. Soon, my woodworking projects improved to the point that people other than my mother liked what I made.

A good try square, a ruler and a marking knife are the fundamental layout tools that few serious woodworkers can get along without. Add a marking gauge or mortising gauge, a bevel gauge, a protractor, and a set of dividers and trammels and you'll have a basic layout kit. Why spend the money? Good-quality layout tools will last a lifetime, and flawed measurements will plague a project through every stage. Even small errors are a detraction if they occur in a prominent place.

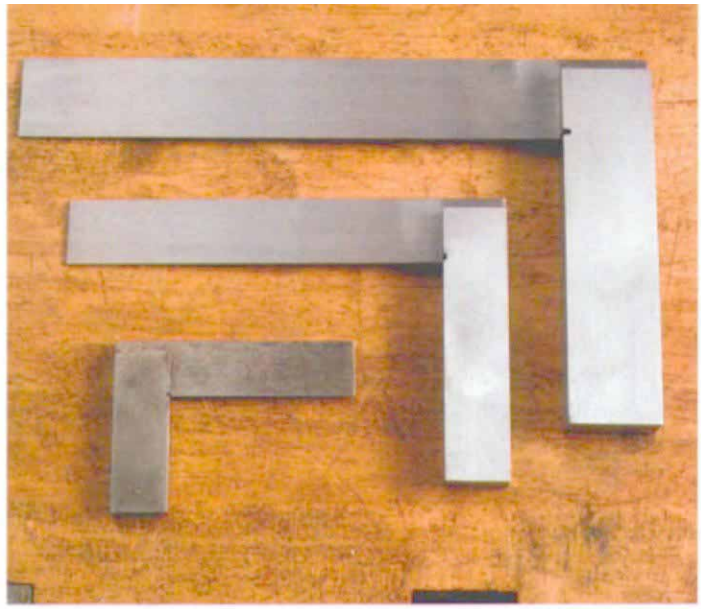
I have obtained excellent results in woodwork using some of the machinist's layout tools that are standard equipment in the tool-and-die industry. And they often cost less than comparable tools specifically designed for woodworkers. They're not as pretty as the best woodworker's tools. However, good looks don't get the job done—accuracy does.

Start with a try square or an engineer's square

The try square is a very simple device. It's just a thin metal blade permanently set at 90° to a thicker wood or metal handle. Its uses are many: You can check the squareness of milled stock, mark square shoulders, lay out joinery or check the accuracy of the miter gauge on your tablesaw or the fence on your jointer. Without a good try square, you can't make anything square. A number of companies make try squares specifically for woodworkers. They vary in price and appearance, but you don't need to spend a lot of money.

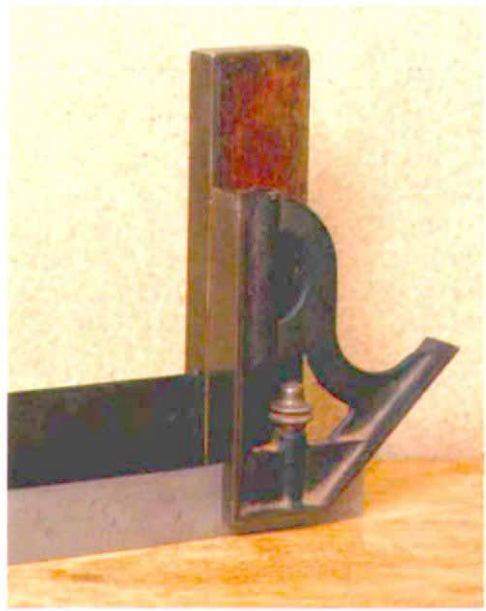
For super accuracy and durability, consider using an engineer's square with a 12-in. blade (see the top photo). The handle and blade are hardened and then silver-soldered together. These squares can't get out of alignment unless you subject them to serious abuse, like pounding on them with a large hammer. In the 12-in. size, most brands are guaranteed to be square to 0.0025 in. (1/400 in.) or less. Chinese engineer's squares are not as good as U.S., English, German or Japanese squares.

Combination squares (see the photo at right) have their uses. Because the blade is adjustable, it can fit into a tight place or reach that extra inch a try square can't. Despite these advantages, they're not entirely suitable for use as a try square for two reasons. First, the bearing surface of a standard 90° combination-square head is



Engineer's squares are sturdy and accurate. *They're useful for checking machine fences and blades because their wide handles make them stable on edge.*

Use a bevel gauge for layout tasks beyond 90°. *With few variations, the design has remained the same for a hundred years. The Starrett No. 47 on the left has been in production since 1891.*



Combination squares just don't measure *up. The handle is shorter than that on a try square, giving less support when marking a line.*

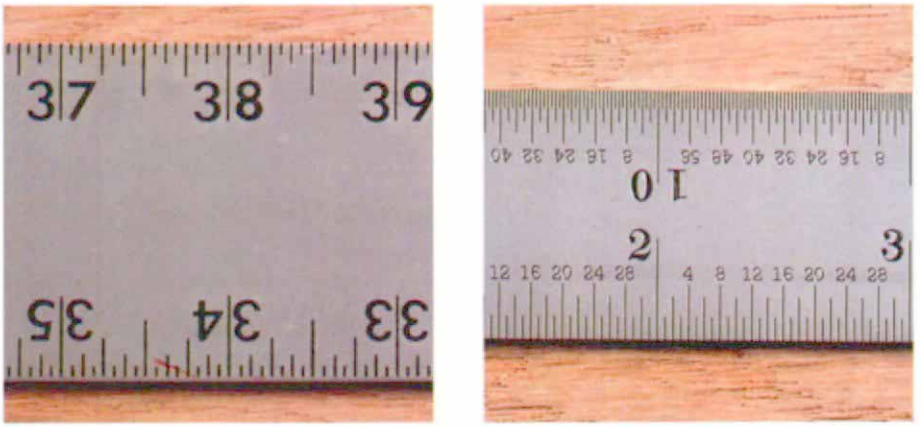
Photos except where noted: Strother Purdy

Flawed measurements will plague a project through every stage.

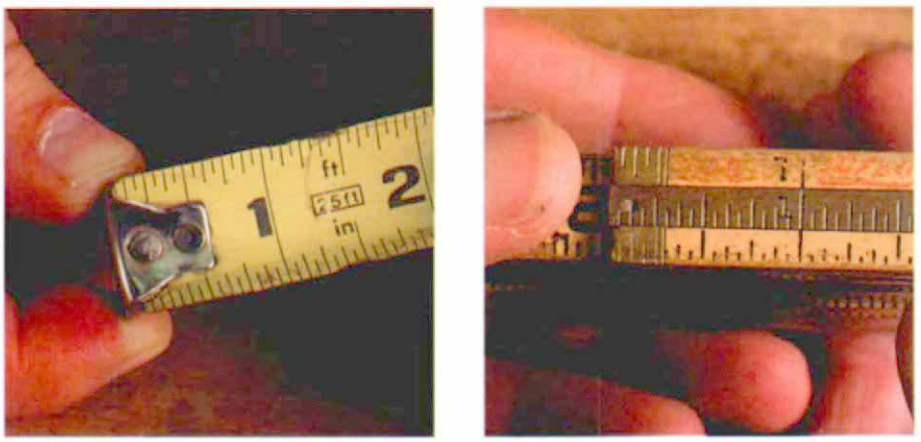
shorter than that of an engineer's or try square's handle, which is typically 80% as long as the blade. The extra length gives better leverage against cutting pressure on the blade while marking. The relative shortness of the combination square's head makes it easier for you to push the blade off the desired line. Second, the blade and head on a combination square will wear against each other over time and eventually go out of square.

Next, an accurate metal ruler

A good ruler should have fine, crisp graduations that are cut into the metal and contrast with their background. Aluminum rulers with usable graduations are available for a reasonable price at most hardware stores. However, aluminum is a soft metal, which is easily scratched or bent. When used for scribing lines, sharp marking knives will nick the edge of an aluminum ruler.



Choose a ruler for its longevity and accuracy. The painted graduations on the soft aluminum ruler (left) will not fare well with use, but the etched graduations on the steel ruler (right) are more precise and will last a long time.



Where exactly is 1⅜ in.? *Time and use have taken their toll on this steel tape measure (left) and this folding rule (right). Not designed to last, the graduations have worn from the edges of both. The tape measure's hook bends easily, and the rivets wear loose. Use a precision ruler when accuracy counts.*

For a few dollars more, you can buy a machinist's ruler, which is a far superior tool (see the top right photo below). Available in lengths from 6 in. to 48 in., these scales are made of hardened stainless steel and have very accurate graduations. Starrett, Brown & Sharpe, Rabone Chesterman and Mitutoyo rulers have finely cut graduations accurate to within a few thousandths per foot. A set, consisting of a 6-in., an 18-in. and a 36-in. ruler with fractional graduations, will handle most measurement tasks.

Steel measuring tapes are convenient, reasonably priced and handy. However, they're not accurate enough for cabinet work. The rivets that fasten the sliding hook to the end of the tape wear with use, making the tape less and less accurate (see the bottom left photo). Most measuring tapes have painted graduations that may wear off. And folding rules have many of the same drawbacks, most notably painted graduations and joints that can bind on sawdust or small shavings. Precision rulers have few of these limitations, but they can't measure long distances.

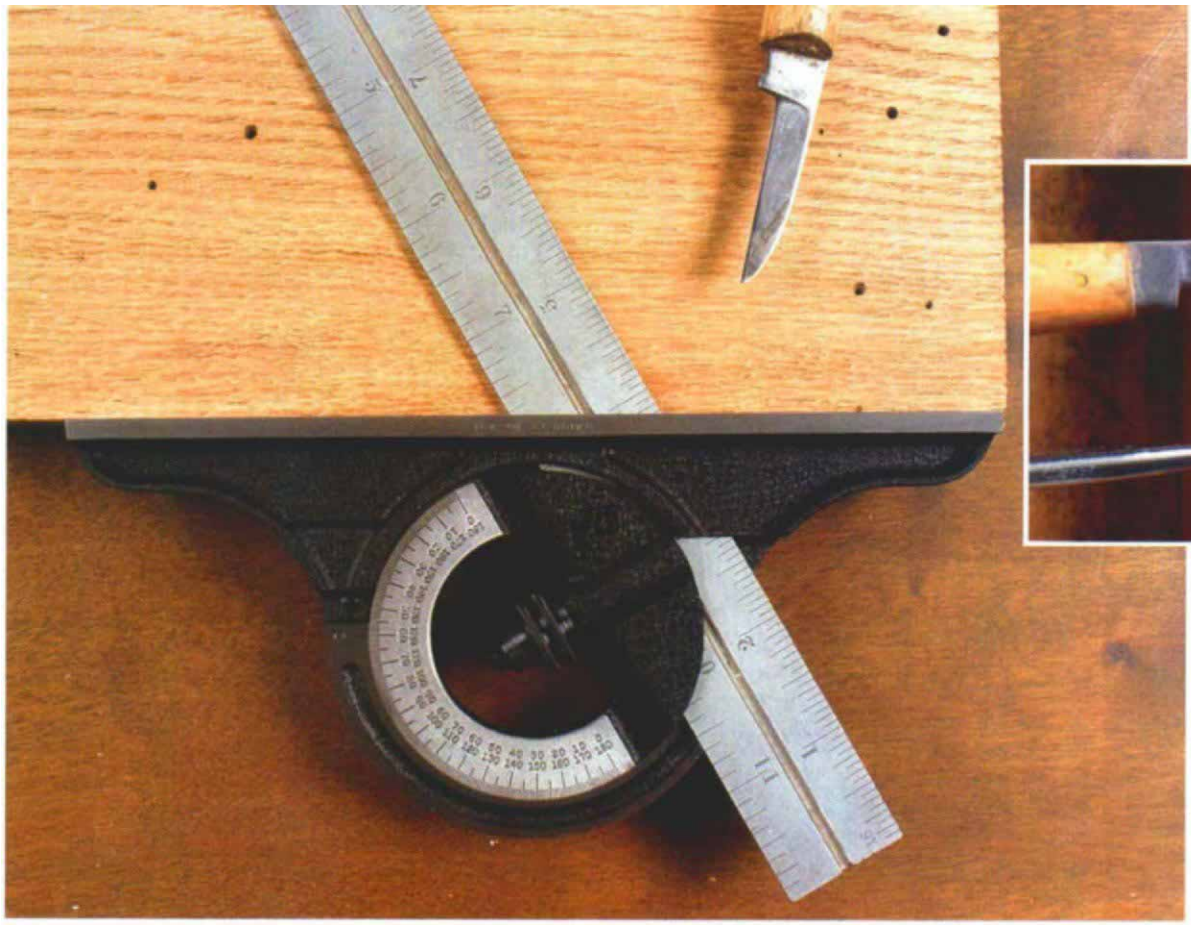
For marking, use a knife not a pencil

Pencil lines are too wide for accurate layout work, and the graphite tends to smear. Scoring the wood with a knife makes a precise mark that won't smudge or wear out. There are a number of different marking-knife designs on the market I don't see much reason to choose one design over another as long as the knife leaves a clean, accurate cut, and it's comfortable to use. The blade should be thin and very sharp at its tip so it can be held tightly against the blade of a square. Then the line can be knifed right along the edge.

Strive to make your layout marks in exactly the same manner each time. Hold the marking knife at the same angle relative to the ruler and the wood each time you mark the work. A knifed line should be deep enough to see easily. Yet it should be as light as possible to keep the knife blade from following the grain rather than the ruler.

Many furnituremakers leave dovetail layout lines on drawer sides or cabinet faces as a sign the piece was made by hand. But ordinarily, you wouldn't use a marking knife on surfaces that will be exposed after assembly. Your best bet is the traditional carpenter's pencil with the lead sharpened to a knife-edged chisel point. The pencil's chisel point draws a cleaner line than the conical point on a standard pencil. And the pencil's rectangular body won't roll off your bench.

Some woodworkers prefer using an awl



***An awl point breaks wood fibers** across the grain; a sharp knife cuts them.*

Use a protractor to scribe any angle but a right angle. Without superfine etched graduations on the head, finding an angle will be hit or miss. Cheap protractors can misguide you by several degrees.

rather than a marking knife. Even when it's sharpened to a fine needle point, though, an awl suffers from a tendency to follow the wood's grain and crush fibers, not cut them (see the top right photo). Marks scratched with an awl tend to be fuzzy, especially in soft woods.

Marking and mortising gauges

There are different kinds of marking gauges, but they all work on the same principle. The basic marking gauge consists of a steel cutter mounted on a beam that fits in a fence. A setscrew or wedge fixes the beam to the fence at whatever distance is desired. Marking gauges can have pins, small blades, even discs for cutters. Gauges that have blades are called cutting gauges.

Marking gauges are used to scribe a line parallel to an edge. Set the pin or knife to the distance to be marked, and then tighten the fence to the beam with the setscrew or wedge. Hold the fence against the edge of the material with the pin touching the wood. Because the tool is guided by the edge of the work, any line that's cut with a marking gauge is certain to be parallel to that edge as long as the fence is held firmly against the work while the line is being cut.

The pin of a factory sharpened gauge makes a fuzzy, irregular mark. Filing the tip to an oval-shaped knife edge makes it cut better (see the center photo at right). A pin filed to a slight angle helps draw the fence against the workpiece. For cutting across the grain, a cutting gauge does an even better job than a marking gauge (see the photo at right). Even when the pin of a marking gauge is sharpened as described above, it can hop or tear out when marking across the grain. The alternating rings of soft summer and hard

***Good lighting, a magnifying glass and careful filing** will greatly improve the performance of a pin gauge. The pin may be filed to a small knife edge, which won't tear the wood as much.*

***The larger blade of a cutting gauge** will produce a cleaner cut across the grain.*

The author draws his shopmade disc gauge toward him. *The cutter (inset) does not spin freely, but when it dulls, it is easily turned to a fresh edge.*

Woodworking dividers, *when properly sharpened, will scribe a clean line across and with the grain (below).*

winter wood cause the gauge to do this. A cutting gauge's knife doesn't have this problem, but it needs a light touch to keep it from making a deeper cut than you need.

I prefer a marking gauge with a small disc for a cutter. Fastened to the end of the beam, the disc is about the size of a dime and has a bevel on the side facing the fence. A disc cutter combines the advantages of both pin and knife. It will mark equally well across and with the grain. The bevel pulls the fence against the stock as you draw the tool along the work, and the line it cuts is clean, straight and sharply defined without being too deep.

A mortise gauge is simply a marking gauge with two independently adjustable cutters. It's used to make two parallel layout lines. To use one, first set the distance between the pins to the width of the mortise, and then set the beam to the mortise location on the workpiece. The two cutters outline me width of the mortise with one stroke of the gauge.

A bevel gauge or protractor for angles

A protractor is used to measure and determine angles. It has a radial scale calibrated in degrees and an arm that pivots on the center point of the scale's radius. A protractor can be set to any specified angle in its range, and the protractor's arm is then used to draw the set angle onto the stock. A good machinist's combination square set comes with a very accurate protractor that has a vernier caliper that allows you to measure angles as small as ¼°

A protractor is useful for determining exact angles, but a bevel gauge is the preferred tool for checking, comparing and transferring angles (see the center photo on p. 85). Bevel gauges are similar to protractors in principle, having a handle and a sliding blade that can be adjusted to any angle, but they don't have a scale.

Dividers and trammels for circles and arcs

Woodworking dividers are used for scribing small circles and arcs (see the bottom left photo). The best dividers have a joint tensioned with a bow spring and a fine-pitch adjusting screw. For best results, sharpen one of the divider points to a sharp needle; this is the point you will use as the axis to pivot from. Sharpen the other point to an oval knife shape, as on the marking gauge, with the flat side of the knife shape at right angles to the main axis of the dividers. Sharpened in this fashion, dividers will cut an arc as cleanly as a marking knife (see the bottom right photo).

A trammel is nothing more than two sharp steel points (or a steel point and a pencil point) mounted in heads that slide on and clamp to a long beam. Trammel heads equipped with an eccentric point allow you to finely adjust the radius after they have been clamped to the beam. The trammel's great advantage over dividers is that the radius of the circles it can draw is limited only by the length of the beam. To draw an arc with a 10 ft. radius, simply mount the trammel heads on a beam that is as long.

Besides drawing arcs and circles, both dividers and trammels can be used to lay out complex geometric shapes with a high degree of accuracy. If you need to lay out a hexagon, for example, you can do it with dividers. Just draw a circle with the desired radius, and without changing the setting of the points, step the dividers around the circumference to divide it into six equal parts. Then connect the intersection marks with straight lines, You now have a pretty good hexagon. □

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Top photo: Dennis Preston