# Tools 2: The Carpenter Square or Framing Square

**by Dave Osborne**
(www.daveosborne.com)

Most trades people and home handypersons have a steel square (also called a framing square or carpenter square) in their tool kits.

However, not many people really know how to use the many scales and tables this tool has to offer. This article won't try to explain these tables, which are covered easily and fully in a very good book I highly recommend called Modern Carpentry by Willis H. Wagner.

The steel square is made up of two legs joined at the heel to form a right angle. The longer leg, called the body is 2" x 24" and the shorter one, called the tongue is 1½" x 16". If you hold the body of the square in your left hand with the tongue pointing to the right you are looking at the face of the square, which usually has the brand name on the heel. The back of the square is the reverse side. Along the edges of the body and tongue on both sides are the graduations of the square. These consist of the following fractions of an inch: eighths, tenths, twelfths, sixteenths and thirty-seconds.

For the purpose of this discussion we will only be interested in the rafter table and how we determine the length and cut of a common rafter.

The pitch of a roof can be expressed in three ways (each example is the same pitch):

1. As a ratio of the rise to a unit run of 12" (e.g. 5 and 12 pitch)

2. As a ratio of the total rise to the span (e.g. 5/24 pitch)
3. In degrees (e.g. 22.5°)

A carpenter uses the first method, a building code uses the second and a mathematician uses the third.

A carpenter with his square in hand will refer to the roof pitch as 4.5 and12, 5 and 12, 6 and 12, etc. I prefer a pitch of 5 and 12 for an average roof because it is the easiest pitch to calculate.

If you measure the hypotenuse on your square between 5" on the inside of the tongue and 12" on the inside of the body you will get a measurement of exactly 13". This tells you that for every 12" of run on your rafter you get 13" of length along the board. That is the same as gaining 1" of rafter length to each foot of run. See how easy that is? For a 26 foot span or 13 foot run of the rafter its length increases by 13". So the length of the rafter from the centre of the ridge board to the face of the outside wall will be 14'-1".

Look on the face of the body of your square. On some squares this is the rafter table. Look under the 5" mark on the top and on the first line of the table. The length of the common rafter per foot of run is 13.0". For a pitch of 7 and 12, look under the 7. See, it's 13.89. So for a 13 foot run the rafter length, from the centre of the ridge board to the outside face of the wall would be 13 times 1.89 or 24.57 inches longer than 13 feet, which comes to 15'-0 9/16" or 15.05 feet.

You can also step the square down the rafter the number of feet in the total run (half the span). It's just like moving the square for each tread and rise on a stair stringer, except going down the rafter. With a 7-12 pitch

you would hold the square with the 7" mark on the tongue and 12" on the body on the top of the rafter edge with the heel of the square below the rafter. Scribe along the side of the tongue where the 7 intersects the rafter and mark the 12, then put the 7 on this new mark and mark a new 12 position on down the rafter. Do this the number of runs or in this case 13 times. Both lengths of rafters should be the same—15.05 feet or 15'-0 9/16", in our example.

Remember, this measurement is from the centre of the ridge board to the outside of the wall. You would have to subtract from the rafter half the thickness of the ridge board, which is ¾" for a 2" ridge board (really 1½" wide) or 3/8" for a 1" ridge board (really ¾" wide). Determine this length by making a parallel line ¾" or 3/8" inside the first line, not by measuring along the top of the rafter by ¾" or 3/8".

The mark on the rafter corresponding to the outside wall point should be scribed along the tongue of the square as was the top cut on the rafter. This cut is called the plumb cut since it is plumb or verticle when the rafter is installed.

Now we come to the outside wall of the building and we have to add to the length of the rafter to account for the overhang of the roof, which can be 12", 24" or whatever. From the outside wall line on the rafter, figure your overhang, say 24". So for our example, step down two more steps with the square, then subtract 1½" for the rafter trim board parallel to this line. A handy tip is to use the width of the tongue of the square, which is 1½", to reduce the length of the overhang by the thickness of the trim board.

Back to the outside wall line, place the outside of the tongue of the square alongside this outside wall line, with the body of the square pointing away from the wall and the heel below the top of the rafter, then move the tongue of the square up and down this line until you read 3½" at the intersection of the bottom of the rafter. Scribe along the square at this point. Below this line forms the seat cut or bird's mouth. It drops the rafter down an inch or inch and a half to prevent the wall from spreading out from the roof load. That is also why the ceiling joists are nailed to the rafters at the top of the plate line.

Mark this rafter PAT (not for the neighbour's husband or wife), it's for "pattern" and make a copy of this rafter. Then take both rafters up on the roof and put a short ridge board between them. With the rafters pulled tight against the outside wall they should fit perfectly. Once you're sure the pattern is exactly right you can use it to cut the rest of the rafters.