# BENDING A (REASONABLY) PRECISE ARC

When you bend a piece of wood by laminating it – or any other method – there is always some *springback*. When you loosen the clamps and take the wood out of the mold, the bend "relaxes." That is, the fibers partially spring back toward their old shape. You are left with a curve that is somewhat less than curve of your mold. To bend a piece of wood to a *precise* curve, you must plan for this springback and make the curve of the mold more pronounced than the final curve you want to achieve.

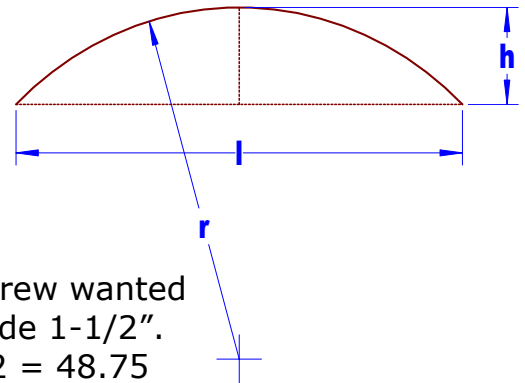How do you do this? With a little math. The specific formula that you need is:
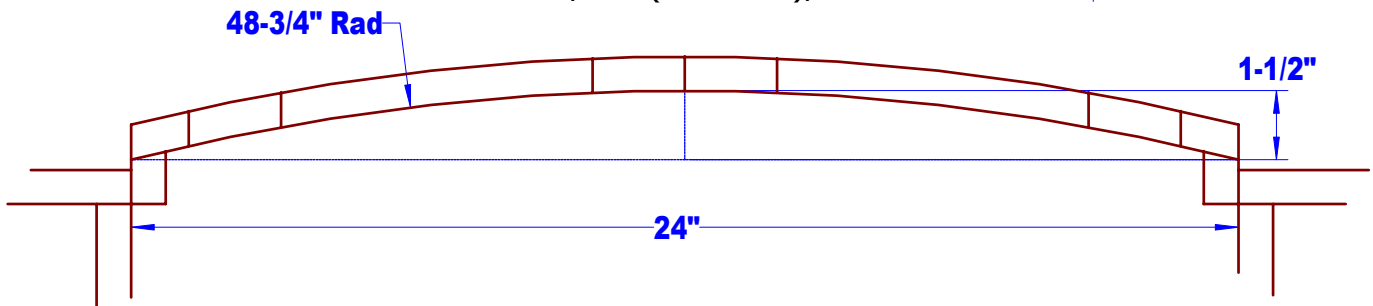
**r = (l$^2$ + 4h$^2$)/ 8h**

Where:
**r** is the radius of the arc
**l** is the length (or chord) of the arc
**h** is the height of the arc.

First determine the arc you want. On his cabinet, Drew wanted the arc on the breakfront to be 24" long and protrude 1-1/2". This works out to a radius of 48-3/4": (576 + 9)/12 = 48.75

Make a simple mold with the radius you want (In Drew's case, 48-3/4") and make a bend in the mold. *Use the same species of wood you will use when you make the final parts.* When the wood comes out of the mold, measure the length and height of the arc, then figure the radius. Drew laid the piece on a yard stick and measured the chord at 23-3/4"" chord, then measured the height of the arc from the yardstick. It was 1-3/8", meaning the wood had relaxed to a 52" radius arc. That's really pretty good, but we wanted to be a good deal closer.

Find the percentage of springback (**%$_s$**) by subtracting the radius of the mold (**r$_m$**) from the radius of the molded wood (**r$_w$**), then dividing the result by the radius of the wood:

**(r$_w$-r$_m$)/r$_w$ = %$_s$**

In this case, the springback was 6.3% of the bend.

The next step is to make a mold that compensates for the springback. Multiply the radius you want to achieve (which is also the radius of the original mold, $r_m$) by the percentage of springback ($\%_s$), then subtract this number from the radius you want to achieve. This is the radius for the compensating mold ($r_{cm}$):

$$r_m - (r_m \text{ x } \%_s) = r_{cm}$$

For Drew, this worked out to about 45-45/64".

The new mold did not produce a precise 48-3/4"-radius bend in the wood. There are enough differences between boards – even boards of the same species – that you will never be able to hit the nail squarely on the head except by a happy accident. But it was *reasonably* precise – it worked out to a hair shy of 49". And that, as the saying goes, is close enough for government work.

Nick Engler, Director
Shopsmith National Woodworking Academy