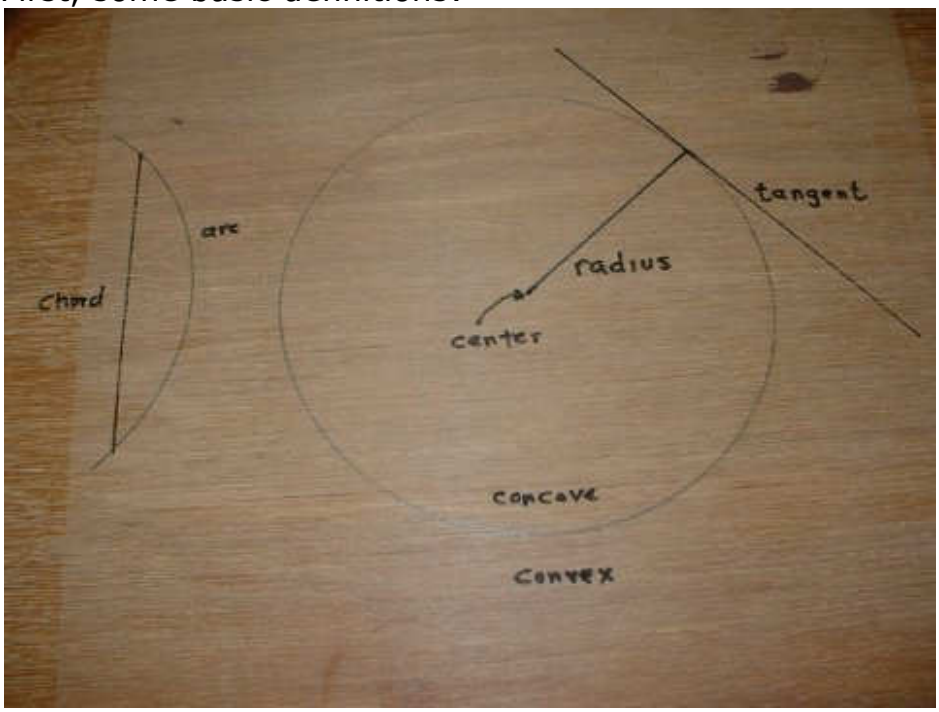
Drawing circles by Keith Mealy ©

At the January 8, 2011, Cincinnati Woodworking Club meeting, Keith Mealy shared his contest winning techniques for drawing circles of various sizes without complex calculations and measures.

Whether it's curves along a valance, the frame of an upholstered piece, or a corner of a seat, from time to time, we need to be able to draw circles. Been too long since that geometry class you slept through during second period or haven't had to work with your 10 grader on her homework? Here's a refresher.

First, some basic definitions:



Circle and its parts

1. Circle - all points the same distance from a single point, called its center
2. Arc - part of a circle's curve
3. Radius - n. the distance from the center to any point on the circle. Also a line between the center and any point on the circle. v. Round over a corner

4. Chord - a line touching a circle in two points, or a line through the end points of an arc
5. Tangent - a line touching a circle or arc at one point and perpendicular to the radius line
6. Convex - bulging outwards
7. Concave - bulging inwards

Tools to draw circles

Bottom: Circle Template, Top, L-to-R: Dividers, compass, combo compass-divider


Trammel Points

1. Anything shaped like a circle - tuna fish cans, coffee mug, socket wrenches, circle templates
2. Compass or divider - a hinged set of legs with the end of each leg a point or pencil point
3. Trammel points - points (or a point and a pencil) that clamp onto a beam (or any handy piece of wood or metal
4. Squares or shop-made V's

Useful factoid: For any three points that are not in a straight line, there is exactly one circle that you can draw with these three points on its perimeter.

Sample Project: I want to make a scalloped cornice board with the following specifications:

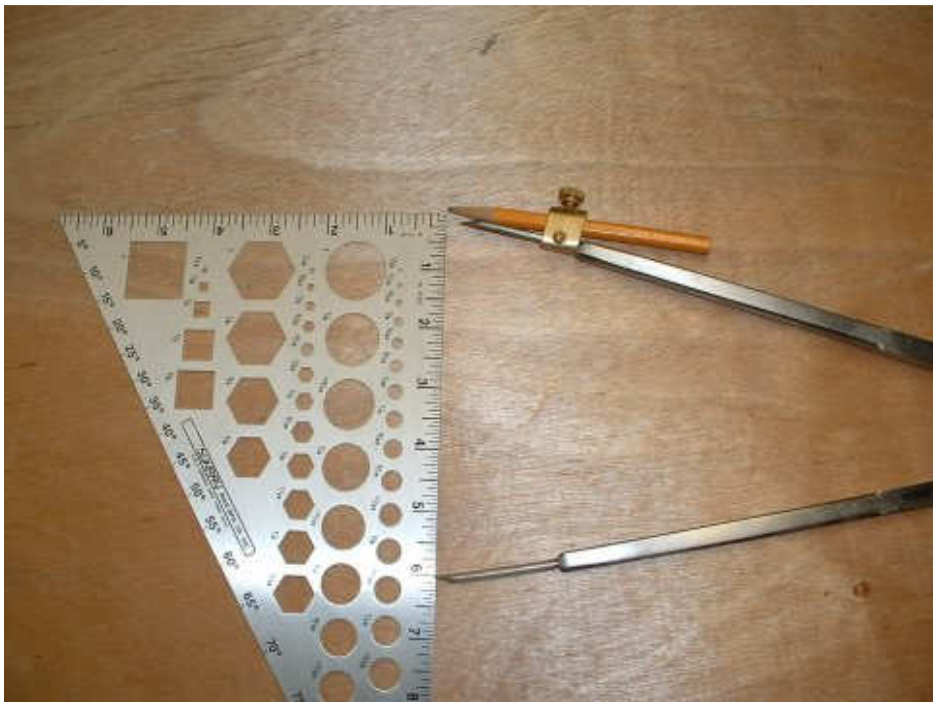
1. Overall length : 82 ½" (the only thing I need this for is to determine the center line)
2. On each end is a quarter circle with radius of 6"
3. Next in from the end is an arc with chord length 12" and height 4" (so it is 2" up from the end scallop)
4. In the middle, for whatever length is left, an arc with height 4"

Small circles (measuring a few inches or few cm)

If you need a small circle for rounding off a corner, look around for something that's about the right size. You can use bobbins, coffee mugs, cans, socket wrenches or circle templates to simply trace around a circle or arc, providing you have one the right size.

Using a coffee can to round off corner of chair seat

If you don't have something round the right size, grab a compass or divider, set the radius distance and pencil away.



For the sample cornice, set a 6" radius

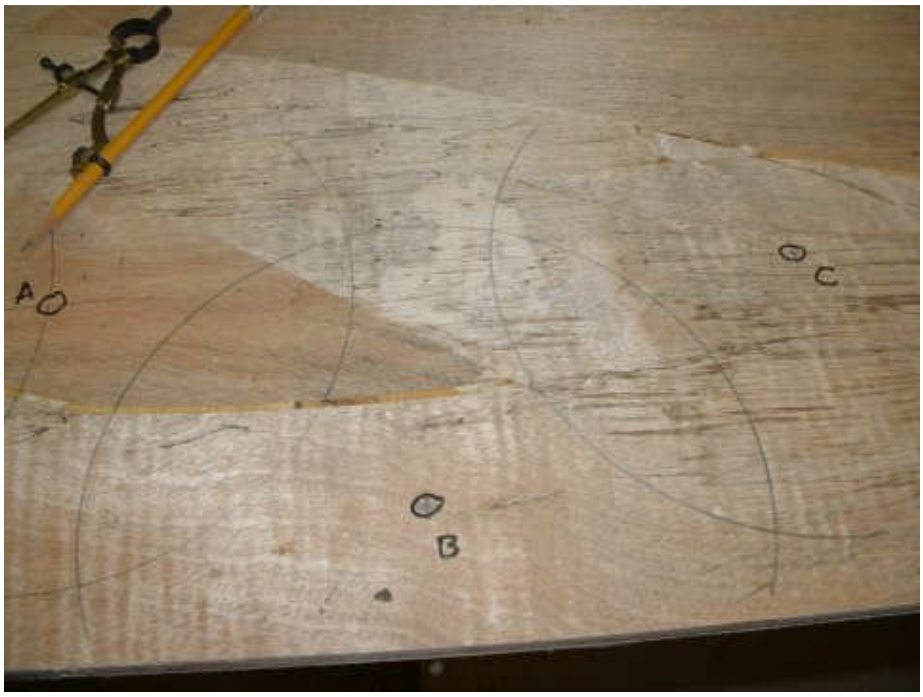
Mark off a 6" radius quarter circle, using a compass

Medium-sized circles (from a few inches to a few feet)
Use compass, dividers or trammel points for circles from a few inches to a few feet . If you don't have trammel points, make your own from a scrap

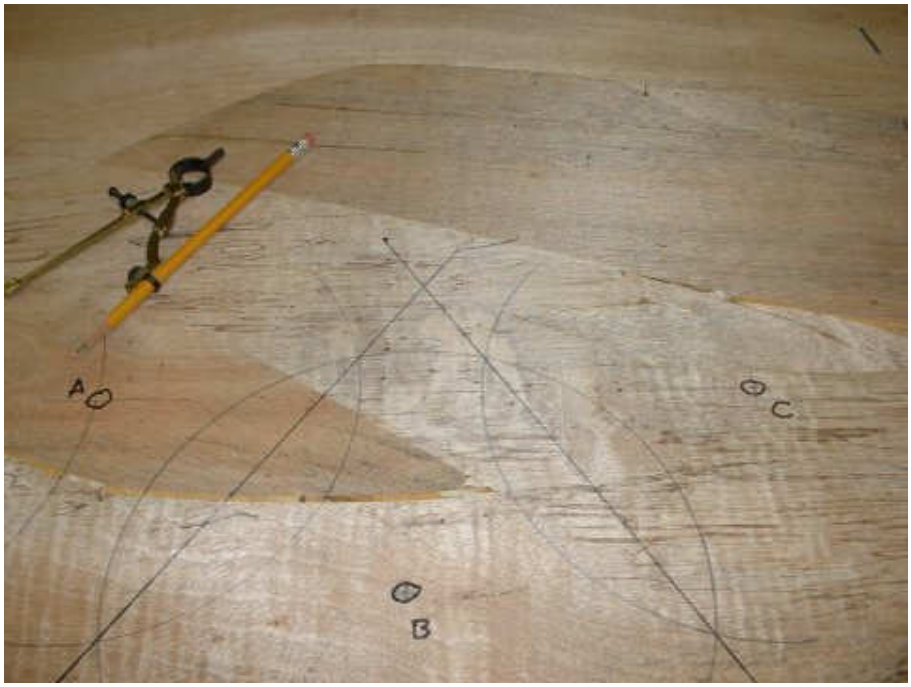
of wood with a nail in one point and a pencil at another. You can also use a piece of wood to make a circle cutting jig for a router along the same principle. Mount the router to the wood as a base place, add a straight cutting bit, then measure your desired radius and insert a screw to hold the center. Either make multiple passes, increasing the depth on each pass, or trim the circumference first with a saw and use the router to trim off the excess and smooth the cut.

Determining the center of an arc (or the center of a circle from any three points) using pencil and compass:

On the left side of the cornice, lay out three points (A,B,C) on the short arc



Set the compass at any distance more than halfway between A and B. Draw intersecting arcs from points A, B, and C.



Draw straight lines from the points of intersection (each will be a radius line). Where they intersect is the center of the circle containing the arc ABC

Set a compass from the just found center of the circle to any of the points and scribe out the arc.

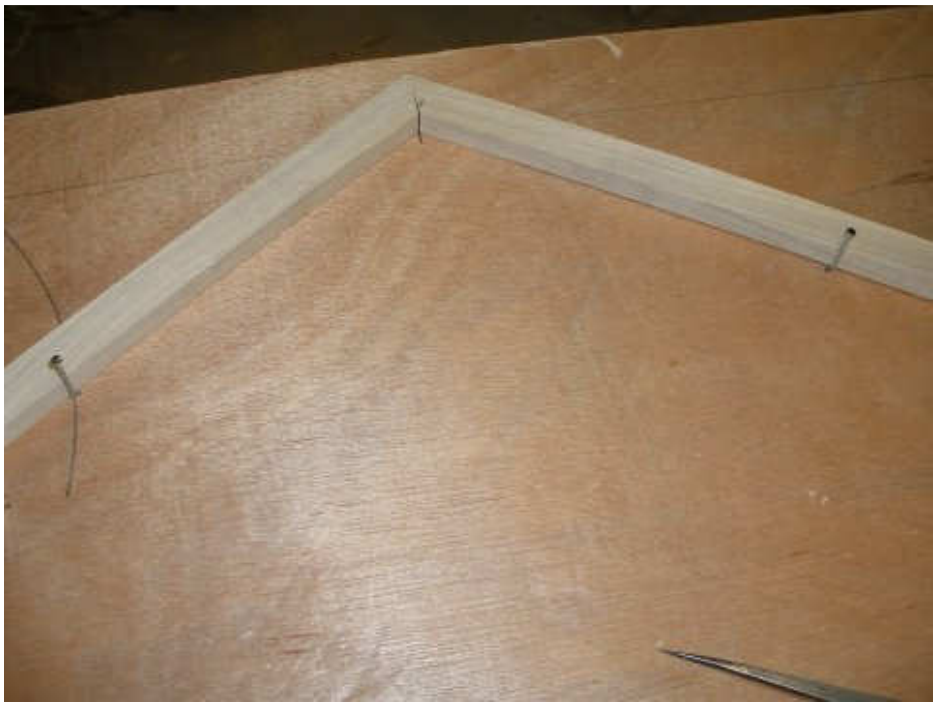
Large and very large arcs (radius more than a few feet)

Normally you know the distance between the endpoints and the height of the arc. For very large radii, using a trammel is either difficult or impossible due to space considerations.

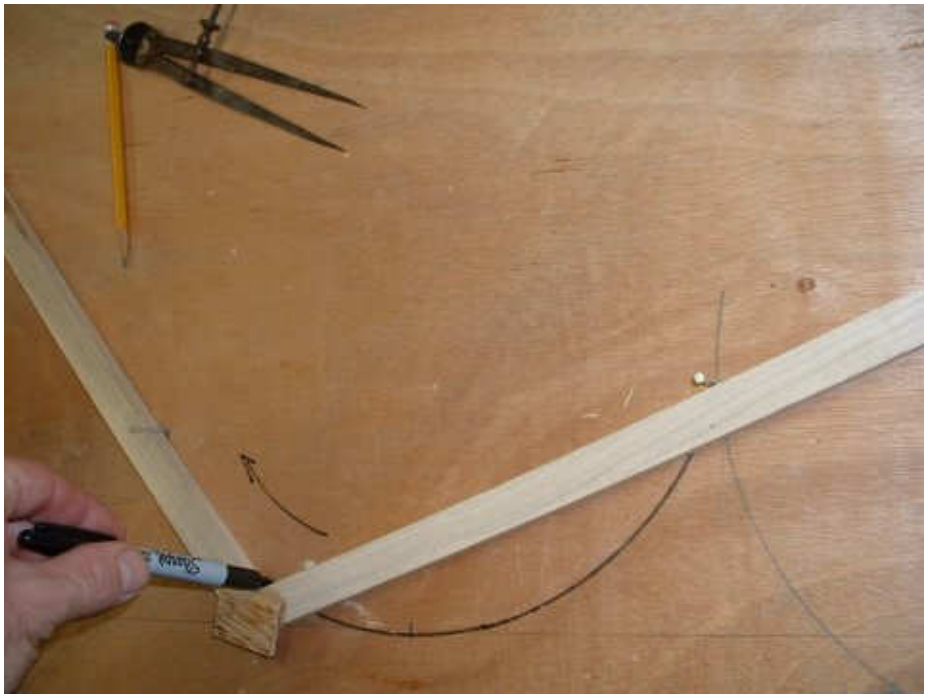
Method A (Pivoting on two end-points only)

1. Mark the center point and end points. Put a nail at each end of an arc.
2. Make a "V" from two stiff pieces of wood. For large legs, you may want a center brace (making an "A" shape).
3. Put one edge of each board at the nail at the end of the arc and join them at the center point. Fasten the boards together securely.
4. Put a pencil at the apex of the V and while keeping contact with both end nails, move the V and trace the shape of the arc.

Note: if the V is 90 degrees, the result will be a semi-circle (half circle).



On the right side of the cornice, I'm showing this method. I have cut some scrap wood into the approximate miter angle, and glued in place with a few drops of super glue and more scrap wood. Note that I have nails only in the end points of the arc.



In a few minutes the glue has set up. Keeping the arms of the V on the nails, I sketch out the arc.

Method B (pivoting on each end and center)

1. Put a nail at each end of the arc and the center point
2. Make a "V" from two stiff pieces of wood. For large legs, you may want a center brace (making an "A" shape).
3. Put one edge of board one at the nail at the end of the arc and at the center nail
4. Put the other board parallel to the chord (measure up from center line and end point . Fasten the boards together securely.
5. Put a pencil at the apex of the V and while keeping contact with one end nail and the center nail, move the V and trace the arc. Repeat for the other side.

To mark out the long center arc, I've cut some scrap wood and cut away half the thickness so I can make a half lap joint. Once set to the right position, using the nails, I glue the V together with 5-minute epoxy.

Keeping the pencil in the apex of the V, and both arms on the nails trace the left side of the arc, then the right side

Completed cornice layout.

Article submitted by:
Keith Mealy
10125 Montgomery Rd
Cincinnati, Ohio 45242