

## Construction- RA and Dec Umbrella

### Supplies & Tools:

- Bubble umbrella
- Perle cotton size 5- large spool
- 4 feet of ribbon or rick-rack to use for the ecliptic
- Embroidery needle
- Sharp scissors
- Eight 1-1/4" round hangtags (it is recommended to try metal ring type if the metal ring will fit through the hole in the umbrella rib; the string version may not be robust enough.)
- Braille labels- 0, 3, 6, 9, 12, 15, 18, 21
- Sharpie Markers- extra fine and fine
- Brown or tracing paper- large enough to cover one section of the umbrella
- Ruler
- Painter's tape
- Tape measure
- Optional but recommended- glue to secure knots
- Helpful- alcohol wipes (to correct marking mistakes on plastic)



### Making the Templates for RA Hourly Lines (assumes 8-ribbed umbrella)

- Use the painter's tape to secure the tracing paper over one of the umbrella sections.
- Crease or mark the side and bottom edges and the top point as accurately as possible.
- Cut out the template.
- Divide into thirds widthwise.
  - At about every 4 inches in height, measure the width and divide into three equal parts.
  - Connect these dots with two vertical lines so you will have three sections.
  - Write a big "L" on the left one, and a big "R" on the right one and cut apart.
- On the right edge of template "L" and the left edge of template "R", make tick marks every 1/4 inch from the bottom to the top.

### Sewing RA Lines

- Using painter's tape, line up template "L" to the right of one of the ribs. Using the extra fine Sharpie marker, make a little dot at each one of the tick marks. These will be your stitching marks. If your template slips, or you want to change something, use the alcohol wipe to erase and let dry before remarking.
  - Measure Perle cotton to double the length from the tip to the bottom of the umbrella. Add about 15 inches to that length. Cut and thread the embroidery needle.
  - Start about 1 inch from the top on the outside and leave about a 6 inch tail. Use a running stitch and go from dot to dot. When you reach the bottom, go through the fabric edge and make a knot on each side.
  - Then sew from the bottom to the top, being careful to stitch so the thread goes on the outside where it was on the inside on the way down and vice versa. Try your best to use the same holes that you made on the way down.
  - When you reach the top, come to the outside 1/4 inch past the original hole.
  - Tie the two ends together using a square knot, but do not trim.

- Repeat these steps using the "R" template for this section.
- When both the "L" and "R" sections are complete, knot the four tails together using a square knot. Secure with a drop of glue and trim to 1/2 inch when dry.
- Repeat for the other seven sections of the umbrella.

### Sewing Declination Lines

- Measure the umbrella from the bottom edge to the top and divide into 4.
- Make a tick mark along each rib at these lengths so that each rib is divided into four equal lengths. You will make 1/4 inch tick marks around the circumference at each of these marks.
- Take the tape measure and stretch it between two ribs. Secure it with painter's tape and make a dot every 1/4 inch using the extra fine Sharpie. Repeat for each section at this height, then repeat around at the other two heights.
- For the top line, measure a length of thread about 15 inches more than double the circumference, then sew much like you did the RA lines. Start at a rib where there is thicker plastic. Make sure the thread goes between the rib and the plastic, not around the rib, whenever you come to a rib. After you go around once, go around a second time, making sure to fill in the blanks. Reuse the same holes as much as possible. Tie the two ends together on the outside through the extra thick plastic at the rib joint.
- The bottom and middle lines are too long to do with one length of thread. Measure the circumference and add about 15 inches. Sew as you did the top line but go around only once with the first thread. Cut a second thread and then fill in the blanks. Tie the ends together on the outside.
- Secure all knots with a drop of glue and trim to 1/2 inch when dry.

### Ecliptic

- The ecliptic starts at the edge on one side (0 hrs) and ends on the edge directly across from it (12 hrs). It curves up to 23.5 degrees at the 6 hour mark. This height is slightly above the bottom Declination line which is at 22.5 degrees.
- Use painter's tape to secure the ribbon or rick rack in place. Make sure the ribbon goes between any ribs and the plastic.
- Take several stitches at the ends to secure the ribbon to the cloth edging of the umbrella. If you are using ribbon, use a running stitch along both outside edges. I do not think it is necessary to sew more than that.
- Secure all knots with a drop of glue and trim to 1/2 inch when dry.

### Hang Tags for Right Ascension Markings

- Label each tag using the Sharpie: 0, 3, 6, 9, 12, 15, 18, 21.
- Place the corresponding Braille label on the back.
- Attach to the appropriate rib of the umbrella.

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