



ANGLE TRANSPOSING

--With thanks to Warren Morrison of Watertown, Wisconsin

If you have a diagram that has "angles for quartz" ("Angles for quartz" is most commonly seen, but you will see others, and this formula works for all) and you want to cut that pattern from a material that has a different refractive index, how do you change all the angles of the crown and pavilion so that they will be appropriate for the material that you want to cut?

Also, if there are a range of main angle choices given (Long and Steele diagrams, for example, often include a range of main angle variations; termed "Design Angles") but the choices offered do not include a particular angle you want--how do you change the angles of the crown and pavilion so that they will be appropriate for the particular Design Angle that you do want to cut?

You can get "sort of" close by subtracting the main angle difference from the given angles, but that's not exact--and why not be exact--you can use an easy formula, shown below.

It's best to use a pocket calculator that has the trigonometric functions Sine, Cosine, and Tangent ("scientific" calculators are inexpensive now--does anyone use books of tables any more?).

The technique, borrowed from Long and Steele, is called the "tangent angle ratio"--it is this formula:

$$\frac{\text{Tan Old Facet Angle}}{\text{Tan Old Design Angle}} \times \text{Tan New Design Angle}$$

Now don't get nervous--the example that follows will make it clear.



ANGLE TRANSPOSING *cont'd*

EXAMPLE: You have a diagram in which the angles given are for quartz, i.e., the pavilion mains are 43, but you want to cut a garnet and use 41 degrees for the pavilion mains. Also assume one of the pavilion facets in the quartz diagram is 59.5 degrees. What does this angle become when you cut the garnet?

Here is what we have:

Old facet angle = 59.5 degrees

Old design angle = 43.0 " " (main angle)

New design angle - 41.0 " " (main angle)

Using your calculator enter 59.5 push the Tan button and the display will show the number 1.697663, [(a) below]. Now enter 43, push the tan button and the display will show 0.932515 [(b) below]. Finally, enter 41, push the Tan button and the display will show 0.869286 [(c) below].

$$\begin{array}{r} \text{(a) } 1.697663 \\ \hline \end{array} \times \text{(c) } 0.869286 = 1.582554$$

$$\text{(b) } 0.932515$$

Divide a by b and then multiply that result by c. Shown in the display will be 1.582554. With the calculator, convert this number (it's the tangent of the angle you are looking for) to an angle (easily done--on most calculators, you will push a button labeled "inv" or "2nd" and then push the button "TAN", and up pops the angle). In this case, the answer will be 57.7 degrees, the new angle needed.

(Once you become friendly with your calculator, you would do the above operation as follows (without bothering to look at the display until the end of the calculation): enter 59.5, push TAN, push \div , enter 43, push TAN, push =, push X, enter 41, push TAN, push =, push "INV" (or "2nd"), push TAN \rightarrow [display shows angle]

The method works on crown or pavilion and you can transpose either between a larger main angle or smaller one or the reverse.