# Tina's Complex Number Slide Rule

A natural development of my series of simple to make slide rules is to find out if it is possible to make a Complex Number Slide Rule similar to that created by J. Whythe and marketed by Stanley using the Fuller style cylindrical slide rule as the basis. Most of the hard work has already been done for me by Robert Dawson with the beautiful results shown on his website http://cs.smu.ca/~dawson/images2.html . Robert also provides a scale that can be downloaded with which others can experiment.
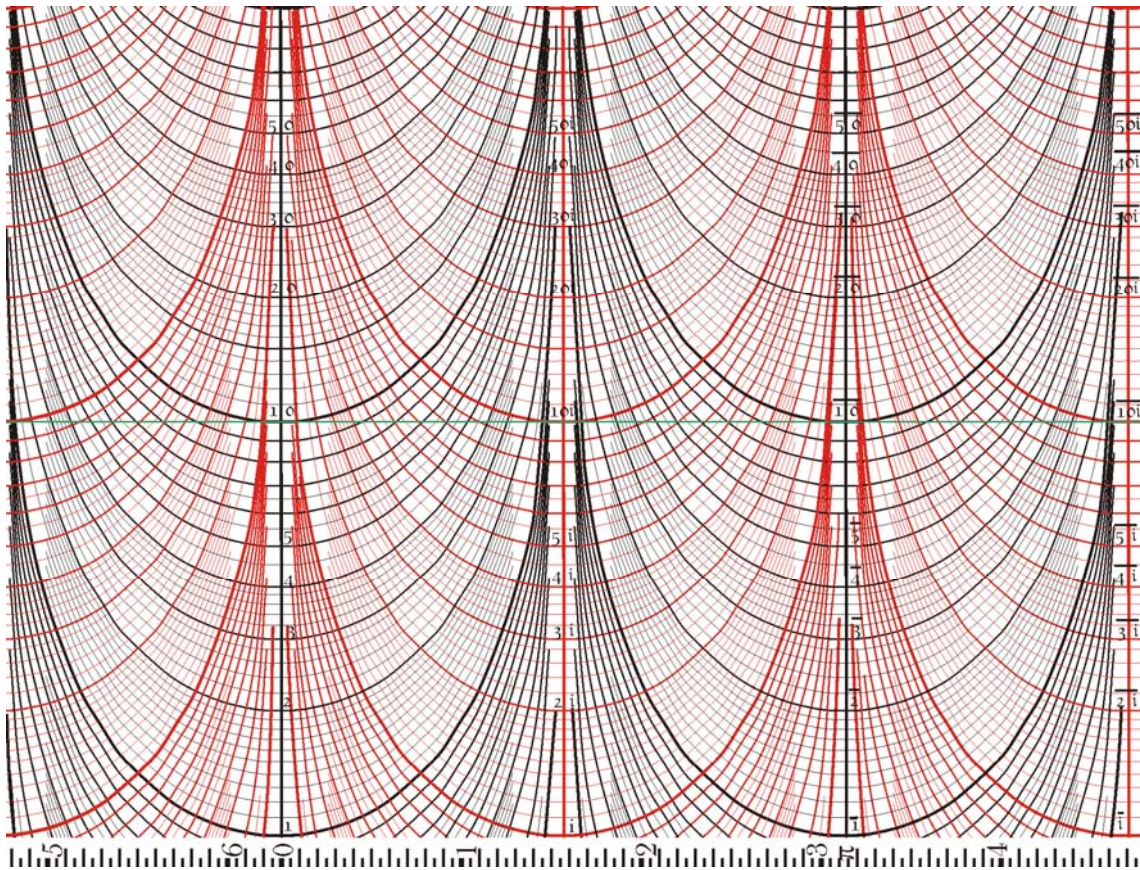
This scale is as you can see a thing of beauty in itself. I printed it out to see if it would work with my cursor design.
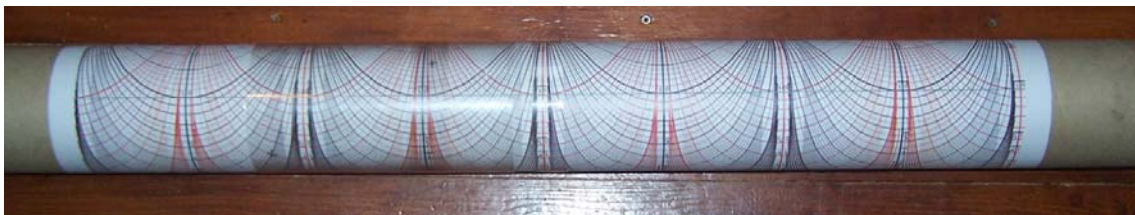
The above picture shows my prototype. The scales don't move once attached, all the work is done using the cursors. A large celluloid sheet wide enough to encompass one complete scale and long

enough to wrap around the cardboard tube is used for the major cursor. A crosshair is drawn or attached to this one quarter of the distance from the left hand side as shown above. A second thin strip of celluloid with a crosshair is wrapped around the major cursor to produce the minor cursor. The major cursor is free to move horizontally and around the tube. The minor cursor can move similarly and independently of the major.

By placing two complete complex number scales side by side as shown above those results which would normally fall off the side of the scale are capture by the second. Those results which fall off the top of the scale are captured by the cylindrical shape of the device at the bottom of the scale.

To Multiply

A complex number is found at the point on the scale where the curve through its real part intersects the curve through its imaginary part.

Place the major cursor over number 1 (not -1, i or –i) place the minor cursor over the first multiplier without moving the major cursor. Move the major cursor to the second multiplier and read the answer under the minor cursor.

To Divide

Place the major cursor on the divisor and the minor cursor on the dividend. Move the major cursor to the number 1 and find the answer under the minor cursor.

Gauge Points

Gauge points can be added to the surface of the main cursor whilst the crosshair is over the number 1. I am not sure whether gauge points are of use on a complex number slide rule or not.

Roots

Finding square roots of complex numbers is more difficult than finding the square roots of real numbers, a task which is not straightforward. With the complex number scale laid flat on a drawing board (as shown below with a Thacher and a Position Line Scale) or other flat surface, the square root is half the distance between the position of the complex number on the scale and number 1. By placing two scales side by side with their scales contiguous, both square roots can be found by finding the points half the distance between the complex number on the scale and both instances of the number 1. Cube roots can be found one third of the distance from the number 1 to the complex number.
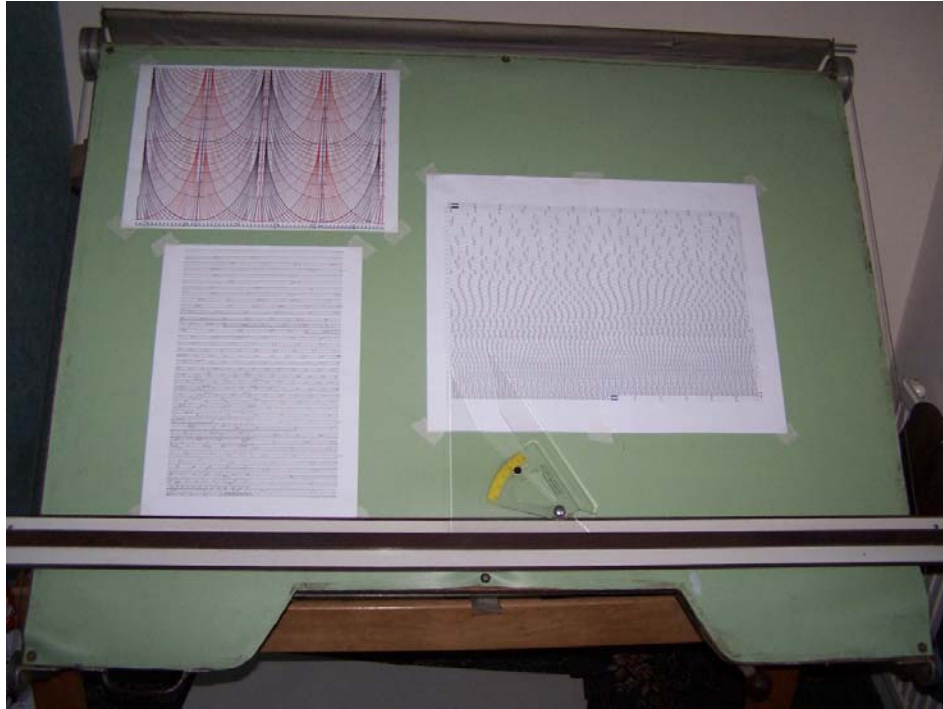
If you have a Gerber Graphanalogue or Variable Scale it can be used to find roots quickly and accurately as shown below.
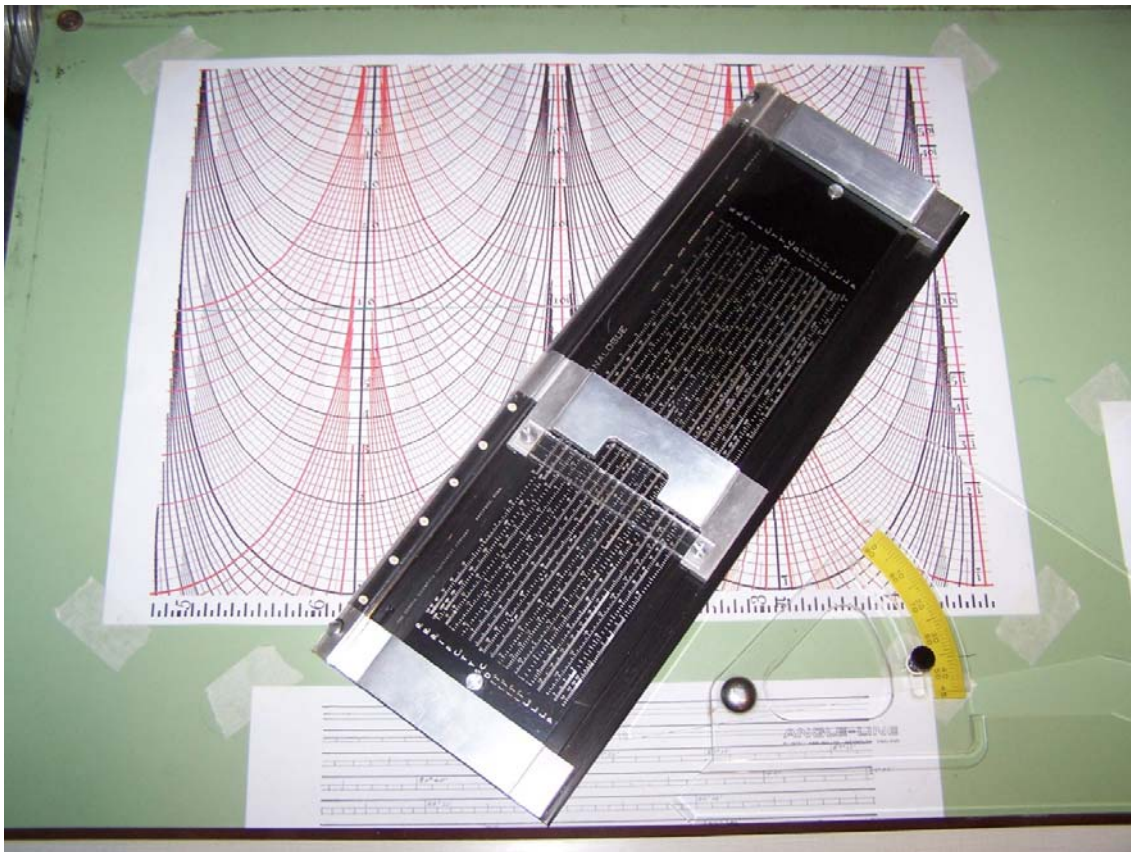
You can find all you need to know about Gerber's instruments from Nathan Zeldes website at http://www.nzeldes.com/HOC/Gerber.htm .

Reciprocals

Reciprocals can be found on the slide rule by setting the major cursor at 1 and the minor cursor at the complex number concerned. The major cursor is then moved so that the minor cursor is at 1. The reciprocal is found at the major cursor.

Does it work?

The answer to the question in the title is that I think so. I tried some simple sums.

(2+3i) x (2+3i) = (-5+12i) but on the slide rule I get (-4.5+12i)

(2+3i) x (3+4i) = (-6+17i) but on the slide rule I get (-5.5+16.7i)

(-2+3i) x (2+3i) = 13 and on the slide rule I get 13

(-2+3i) x (2+4i) = (-16-2i) and on the slide rule I get (-16-2i)

As you can see the answers are sufficiently close to make one believe that the design is feasible but not accurate enough. Having checked the scale I have found that the scale is inaccurate and needs to be re-drawn. Unfortunately computer aided design software is something I don't have.