Making The Tick-Strip Slide Rule

Dedicated, with Appreciation, to

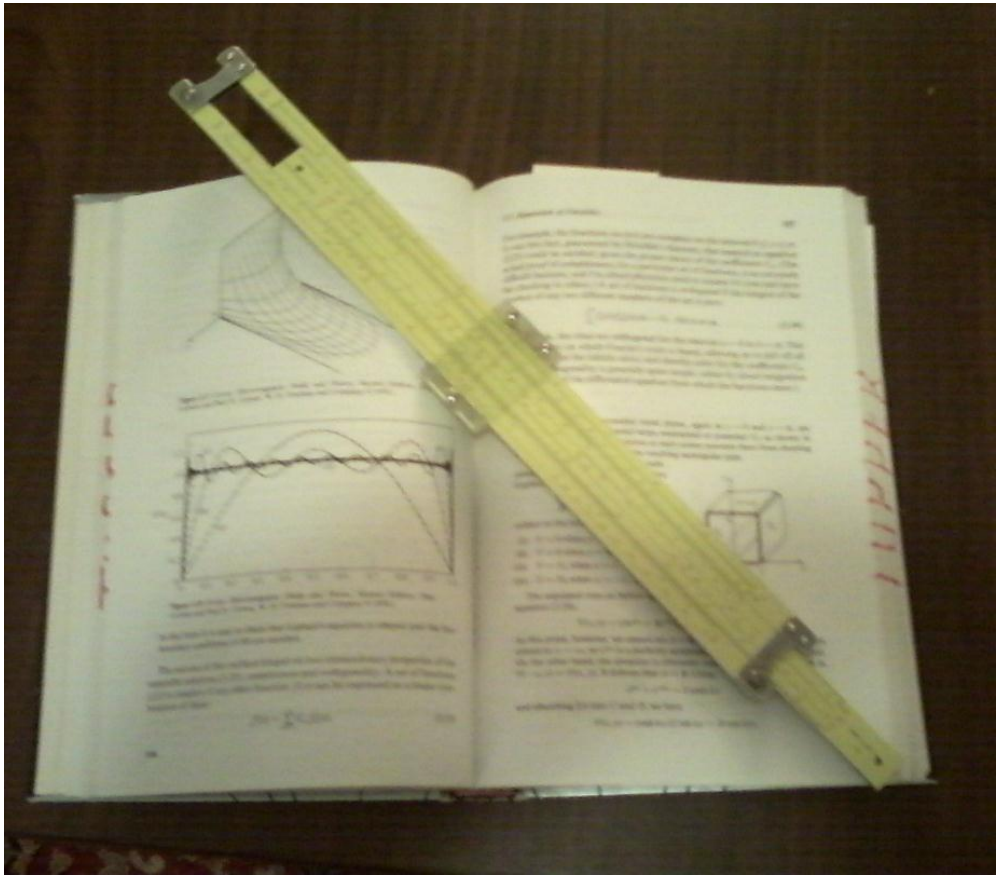
Don Otis,
for giving me my first slide rule along with an exciting first glimpse into science,

&

Cyrus Hamlin, N.A.,
for patiently inspiring me with his ability for visualization

Chris Tupper / Harpswell, Maine / October 2012

Before Computers....



.....The Slide Rule

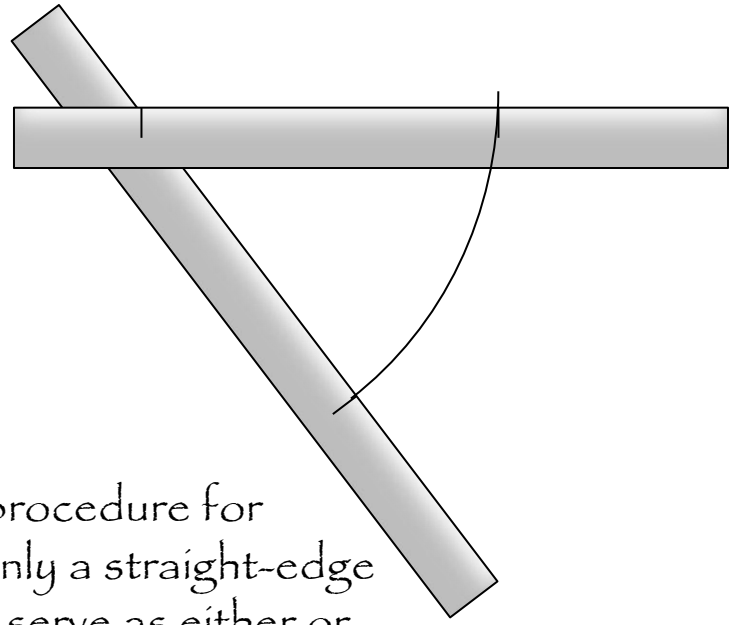
.....The Slide Rule.....

..... A clever mathematical tool allowing easy multiplication, the slide rule's simple operation is based on the fact that adding logarithms avoids the tedium of direct multiplication.

The slide rule was invented around 1620, shortly after John Napier laboriously developed and published the concept of the logarithm. This was about the time the Pilgrims were founding the Plymouth Colony.

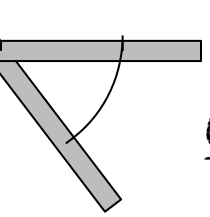
Extensively used in engineering until the advent of the computer in the late 20th century, the slide rule was an essential tool of the early rocket scientists and accompanied astronauts on journeys to the moon.....

Making The Tick-Strip Slide Rule

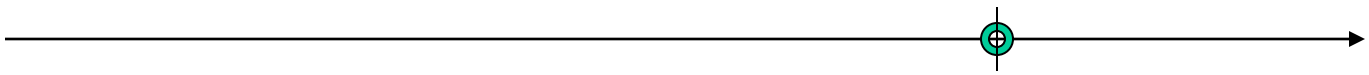


The following pages lay out a step- by- step procedure for graphically creating a "tick strip" slide-rule. Only a straight-edge and compass are required, and a tick-strip can serve as either or both.

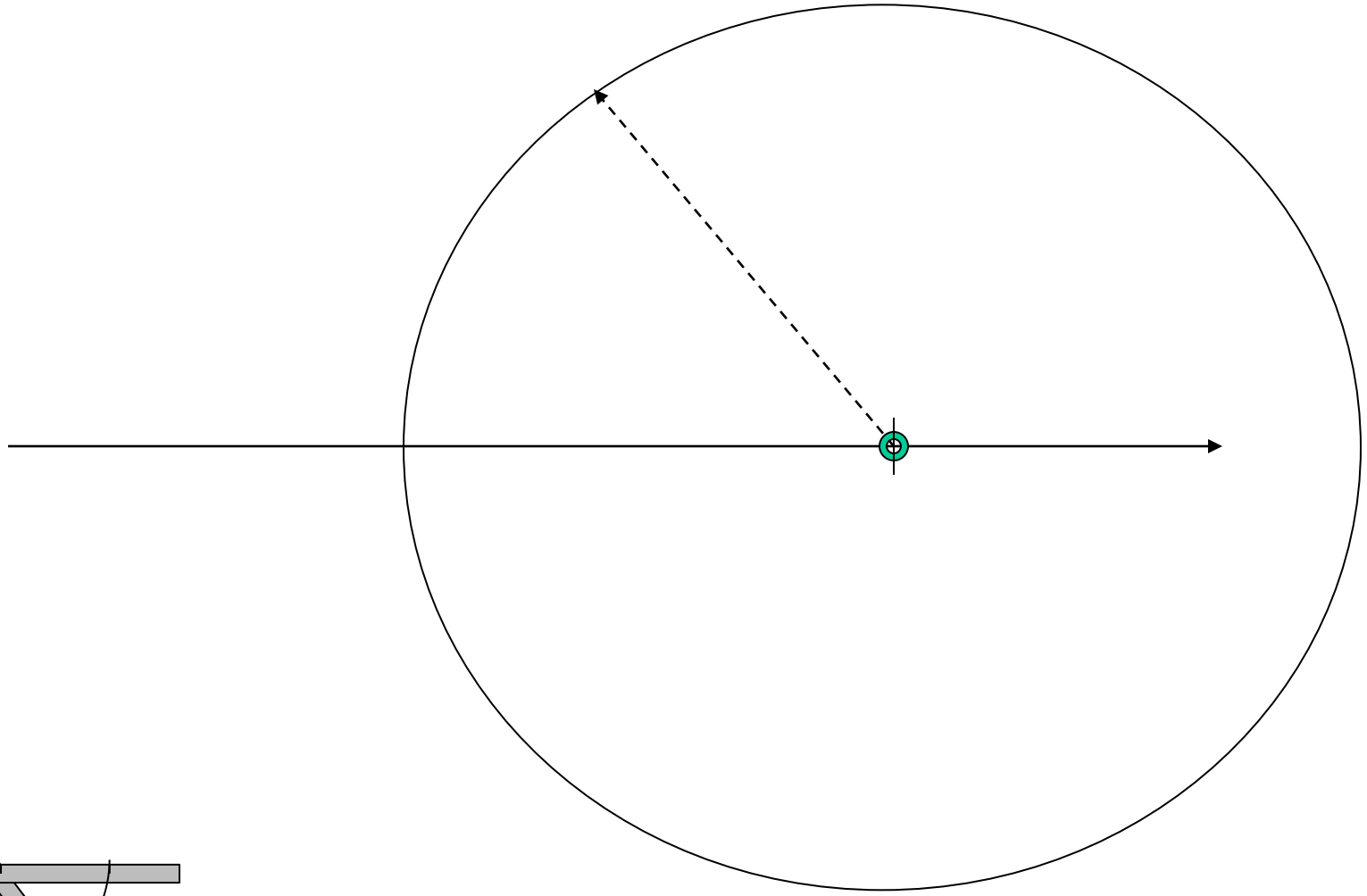
Beyond the tick-strip, only one carefully drafted free-hand (or spline assisted) curve is required, as will be evident....

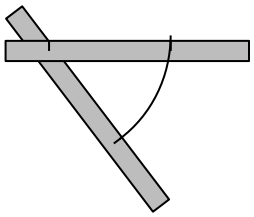


Use the tick strip as a straight-edge to create a horizontal line.
This will be our horizontal "X-axis"

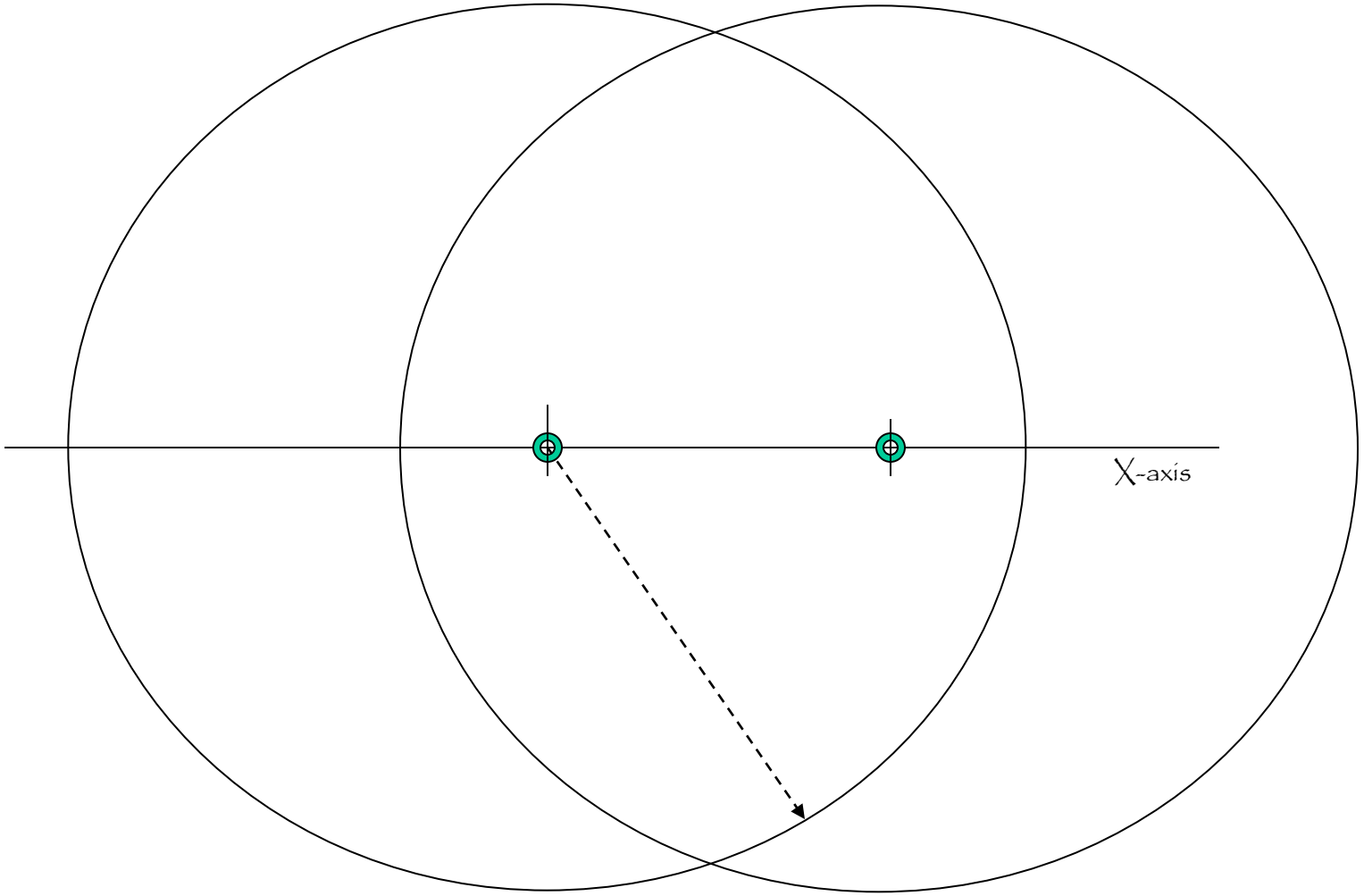


Pick a point on the line

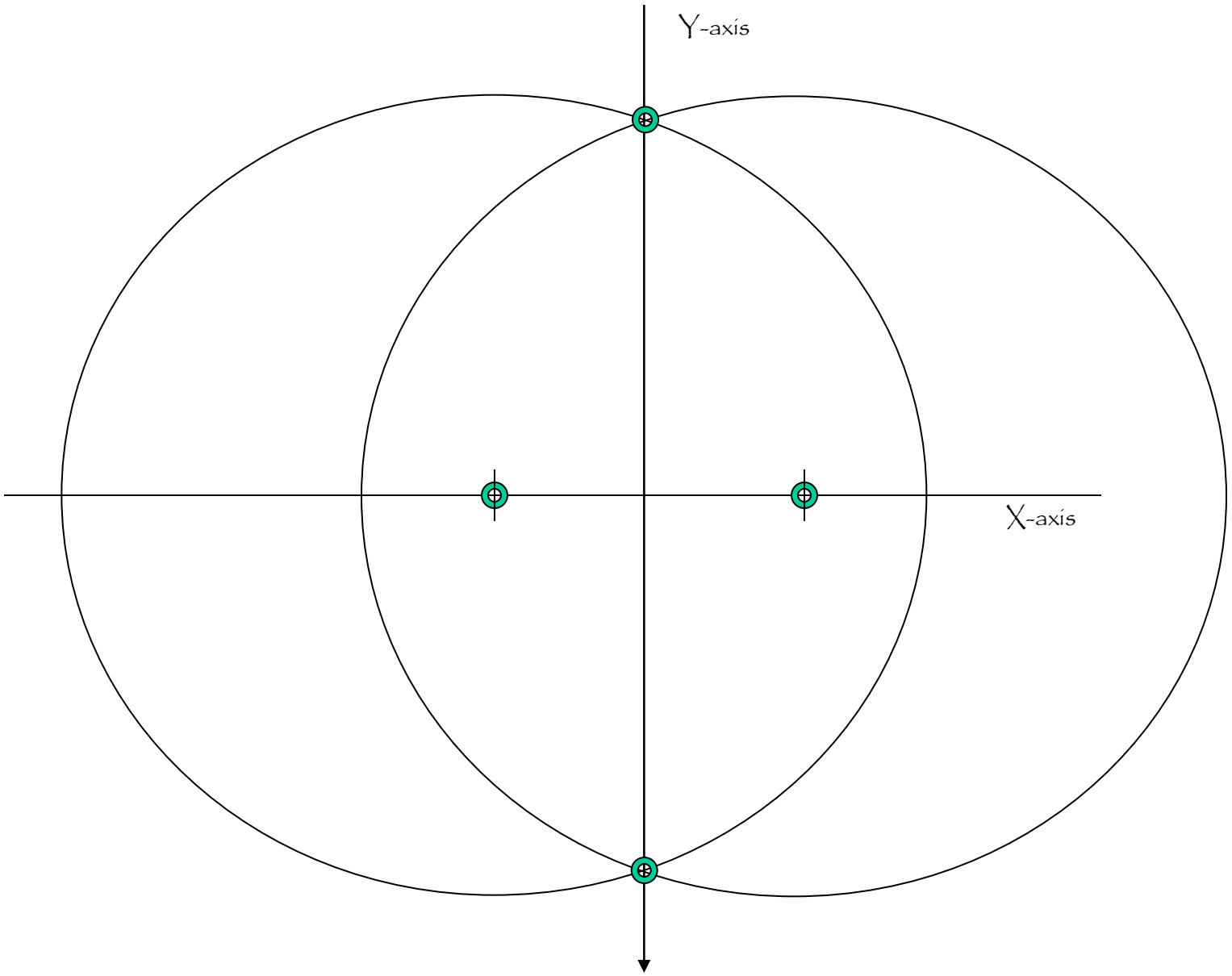




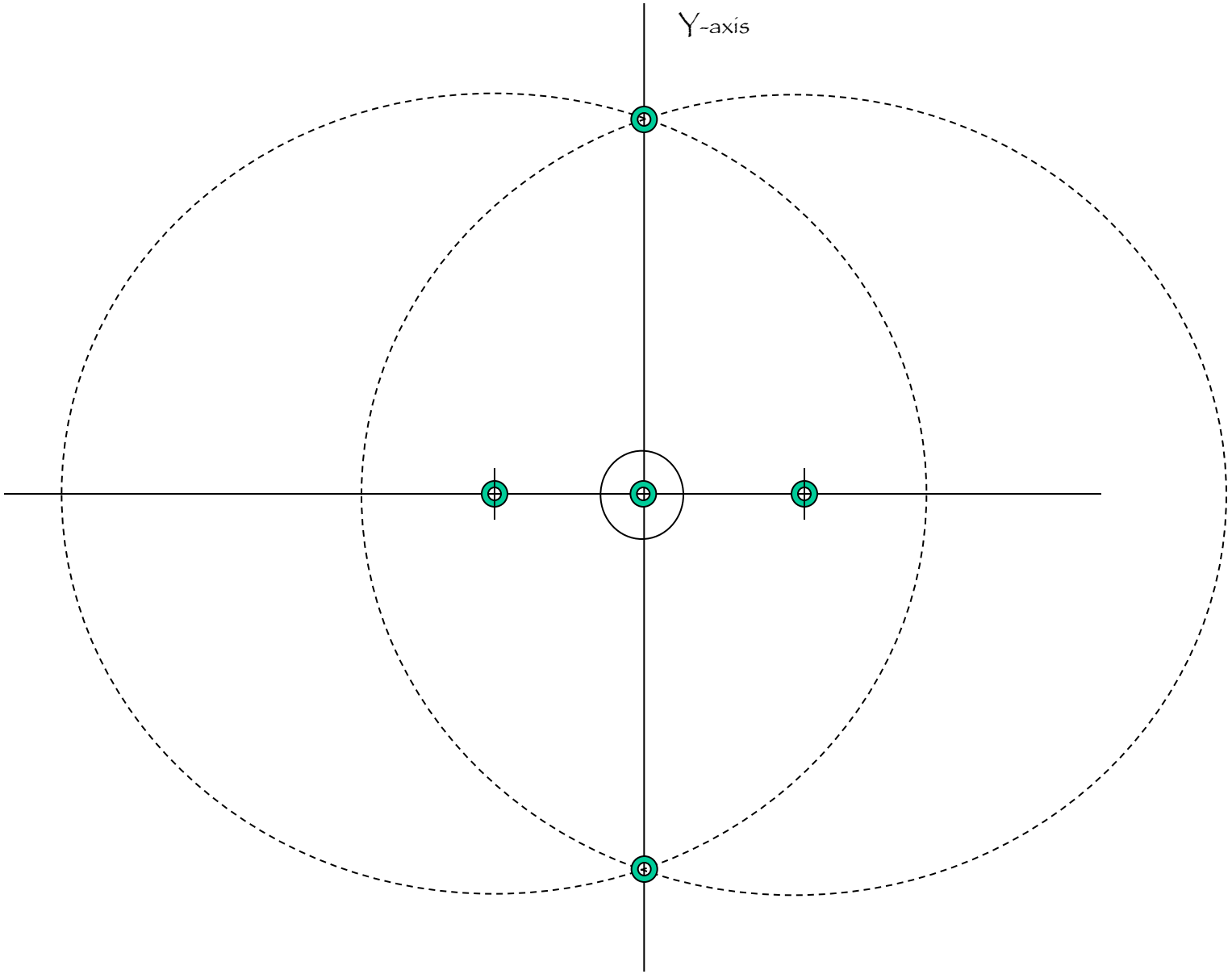
Use the tick strip as a compass



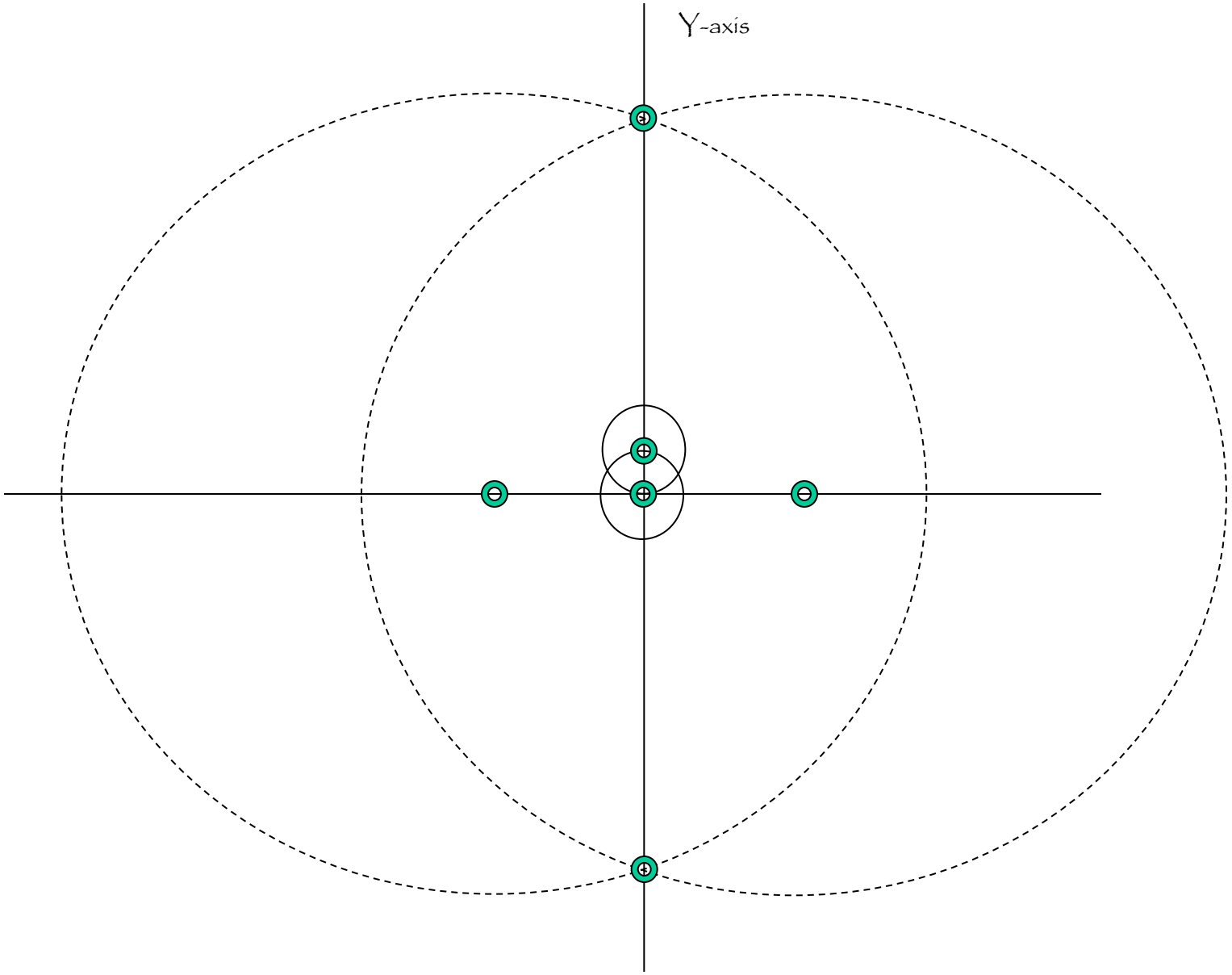
Pick a second point on the x-axis, and make a second compass circle of the same size



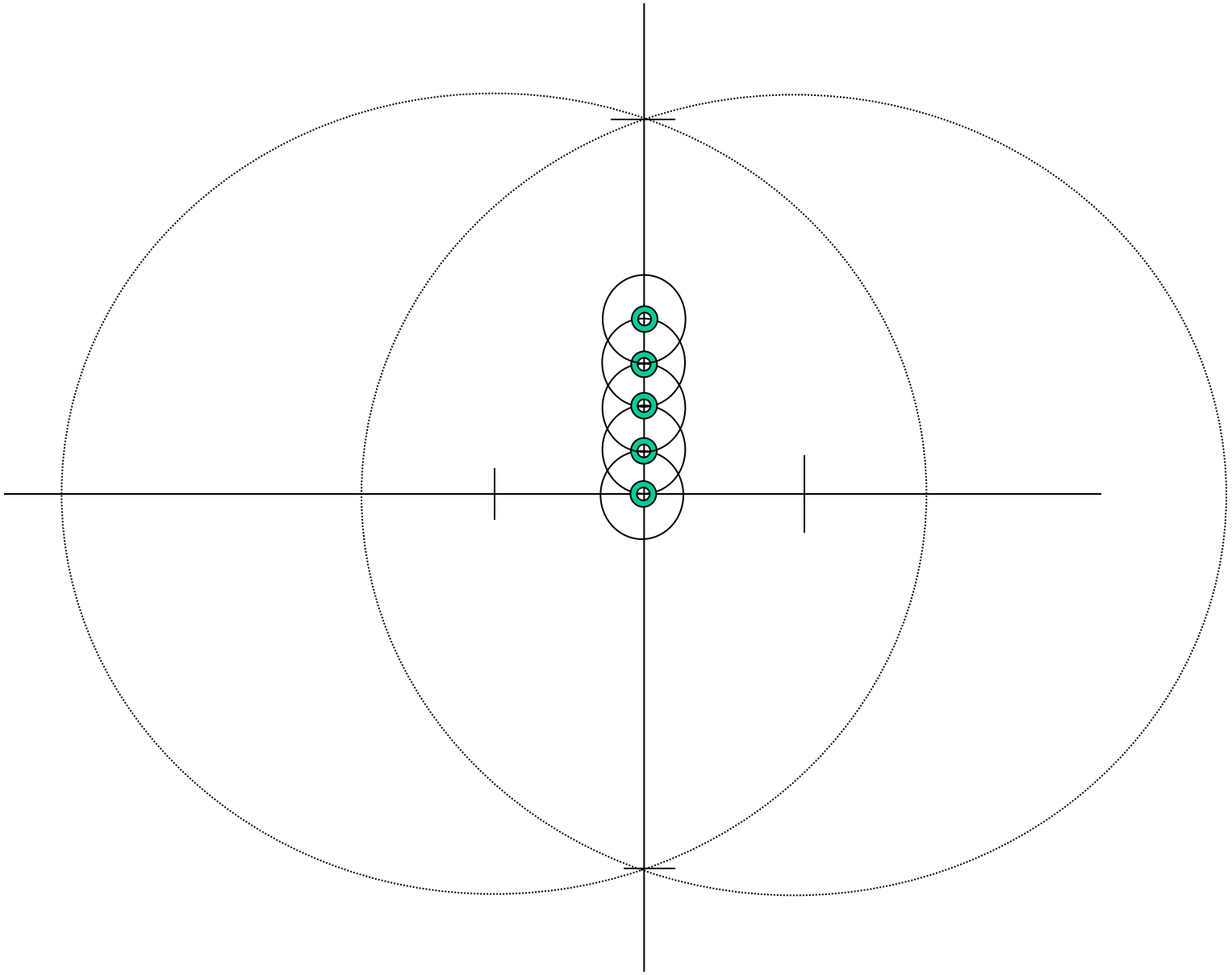
A straight edge line between the intersections of the circles bisects the line segment with a perpendicular – our Y-axis



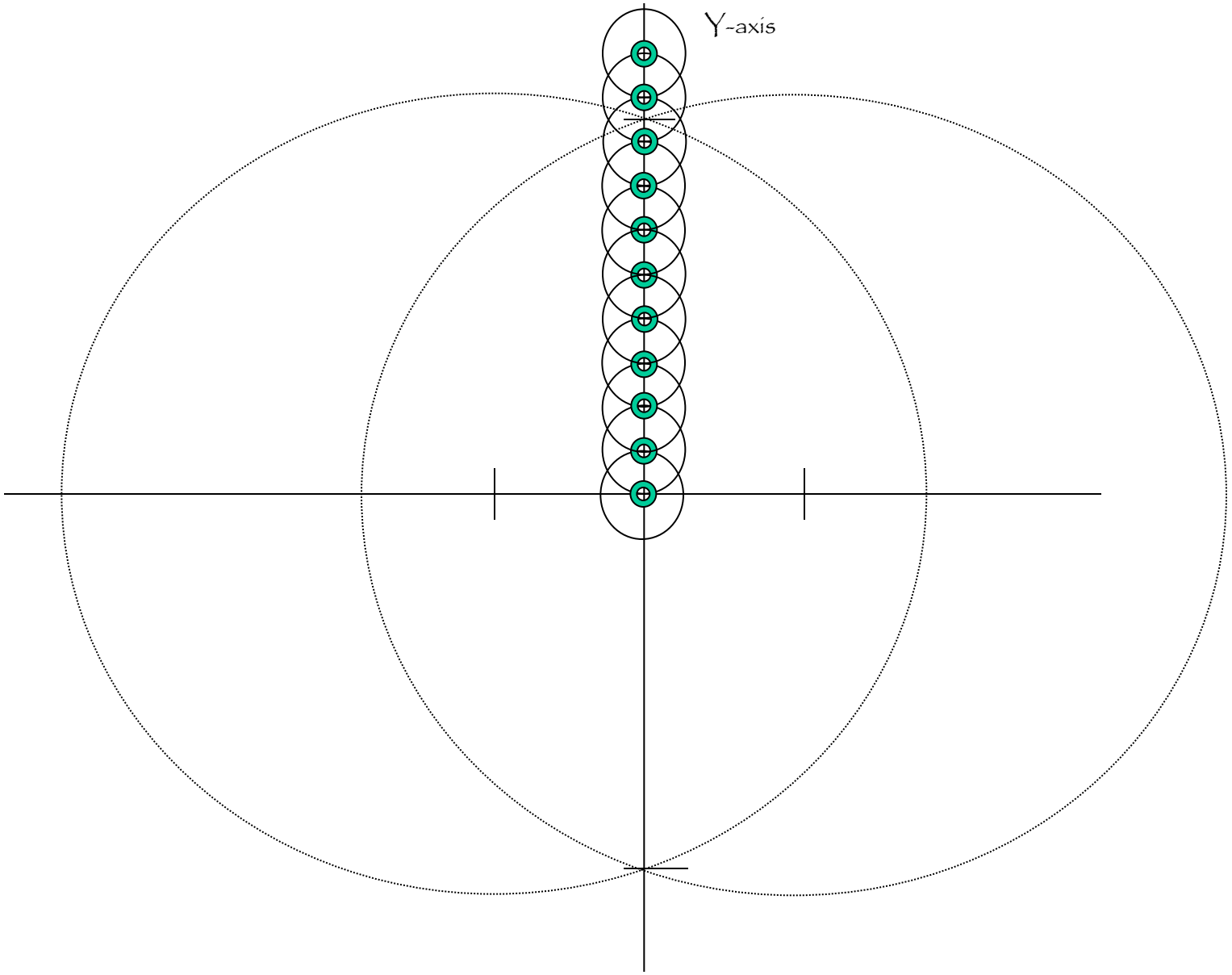
A new "unit" circle is made with the compass around the intersection of the X-axis and Y-axis - "unit" can be any size!



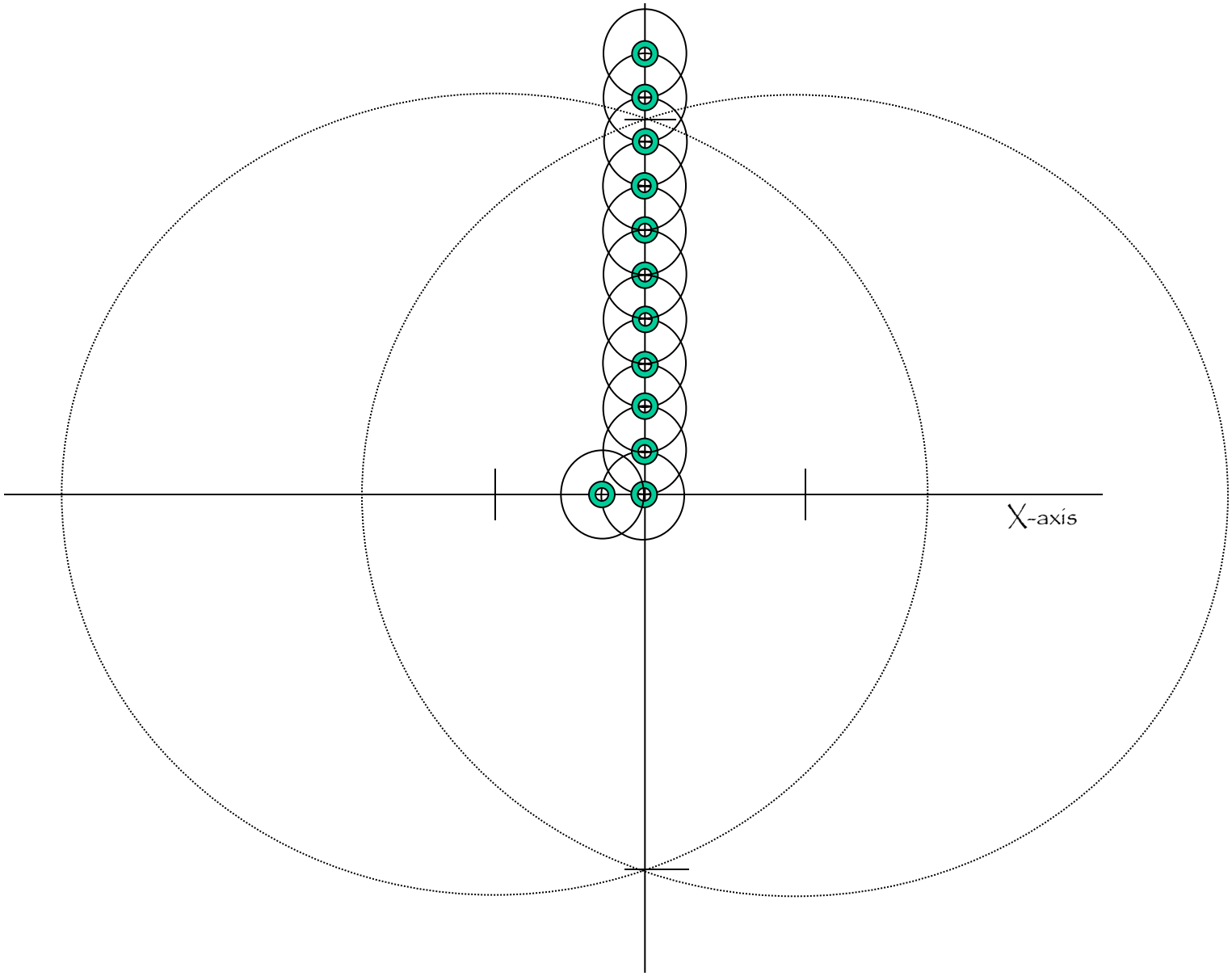
A new point is made where the first unit circle intersects the Y-axis.
Another unit circle is made with the compass around the new point.



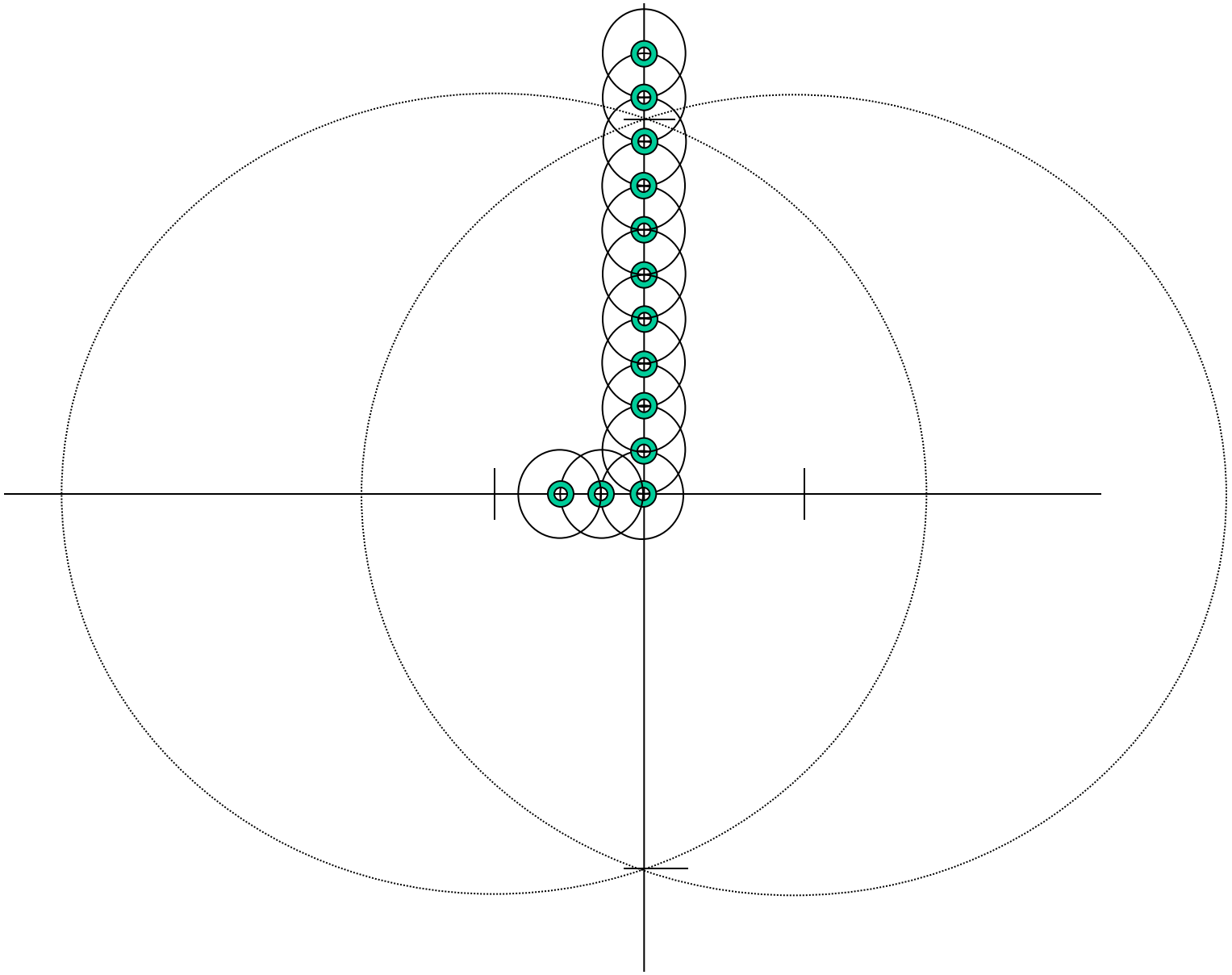
New points, evenly spaced, are made by repeating the procedure.....



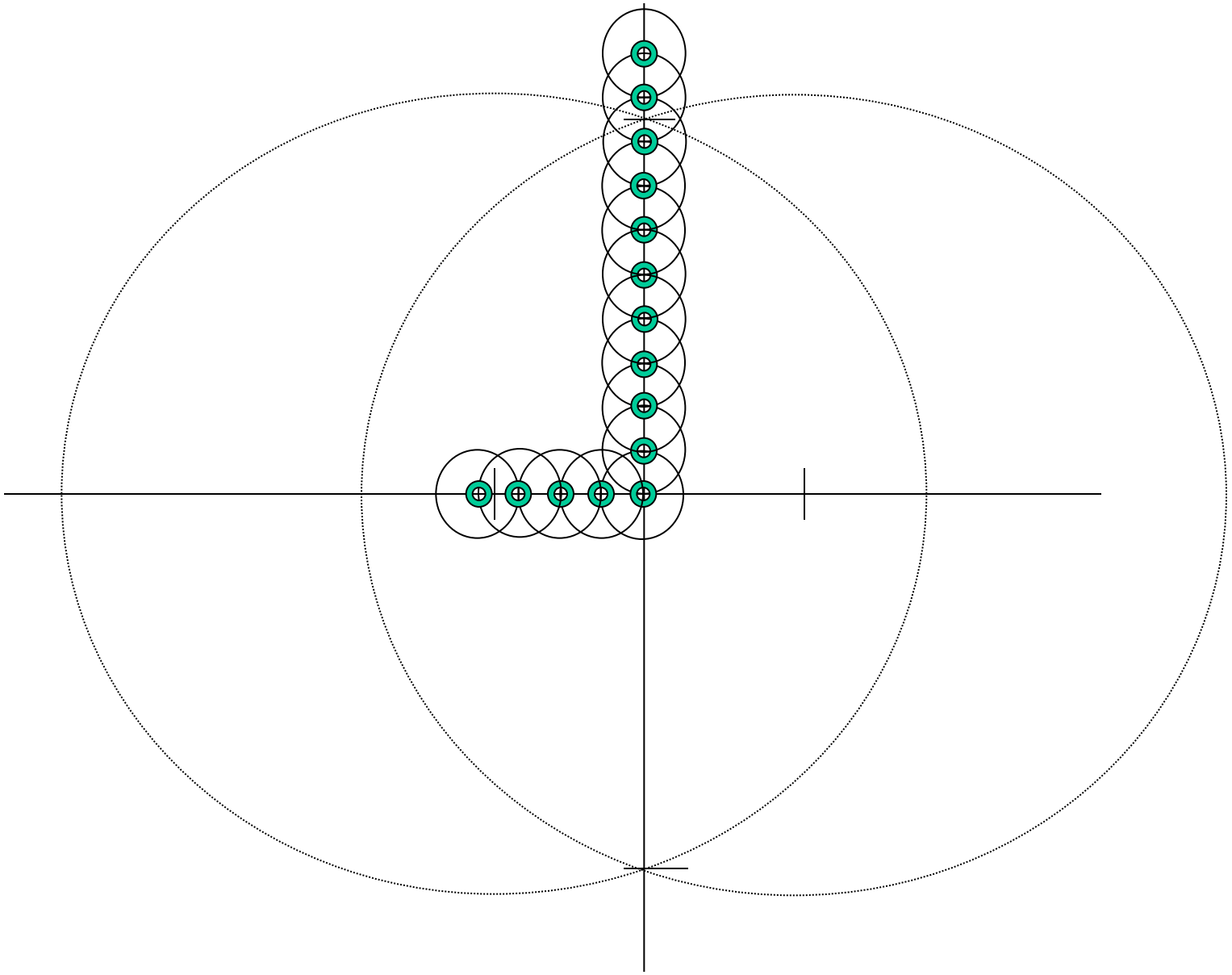
... Until there are 11 evenly-spaced points (0-10) on the Y-axis



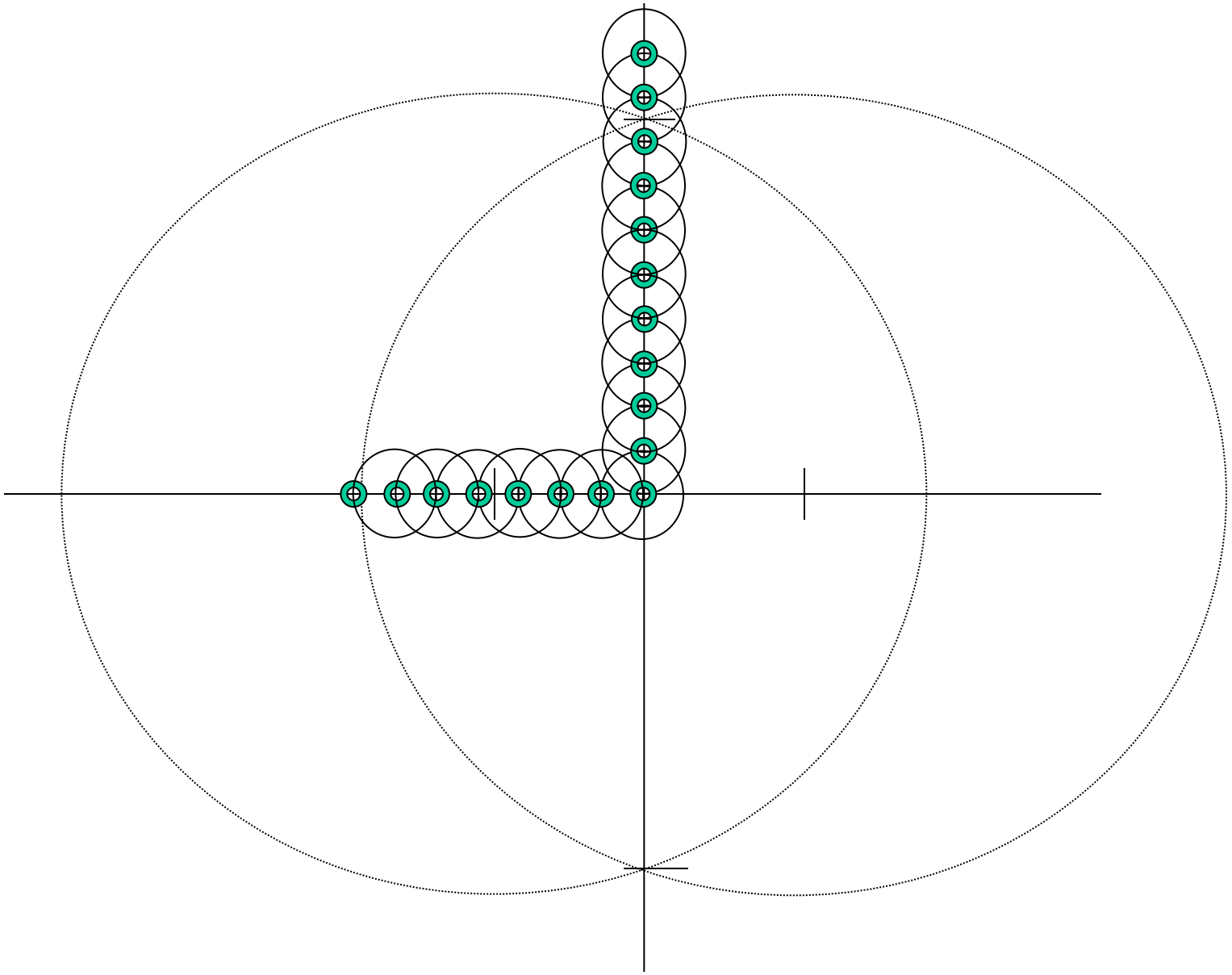
The process is repeated down the X-axis using the same unit spacing....



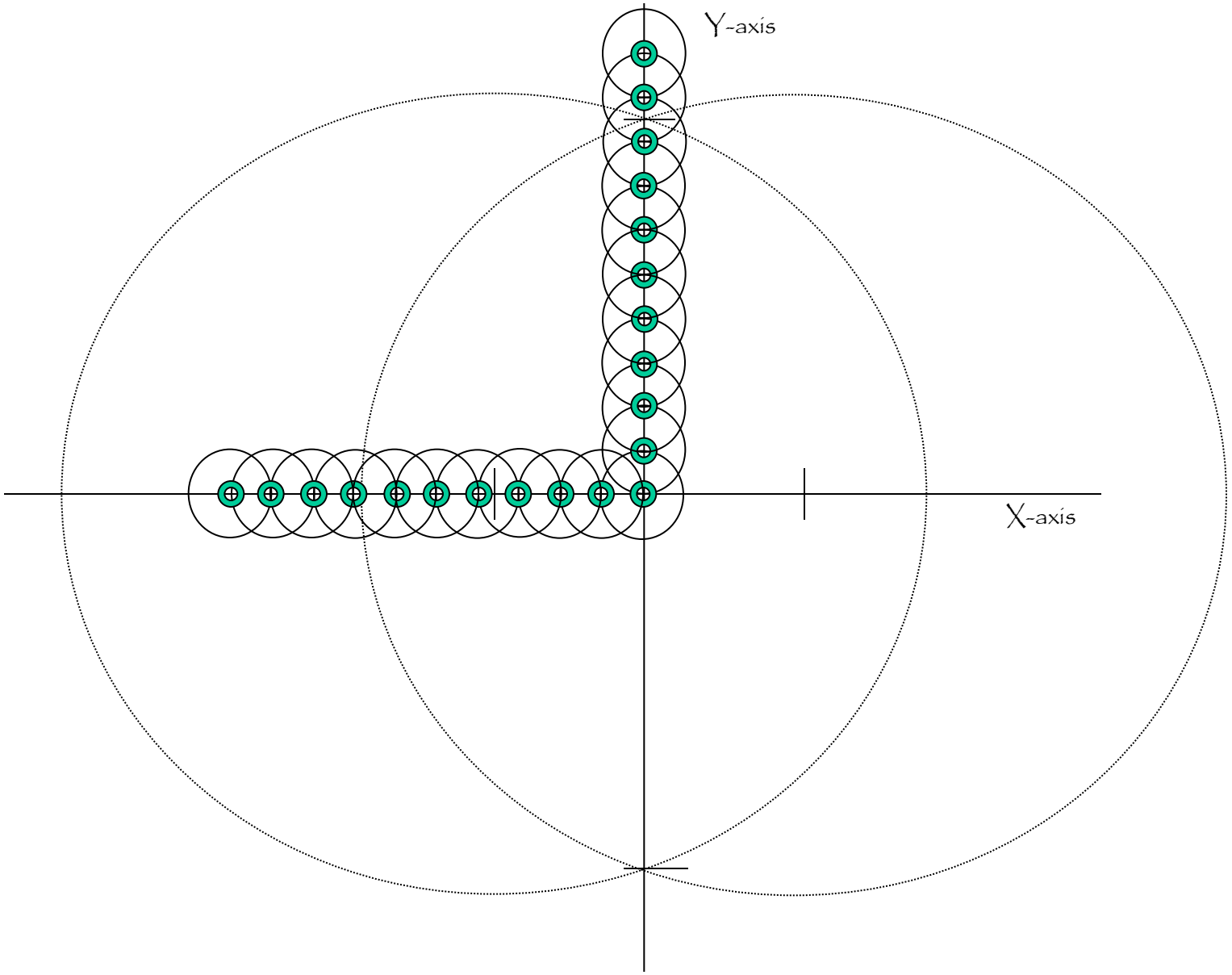
...(A real tick-strip master knows a faster method) ....



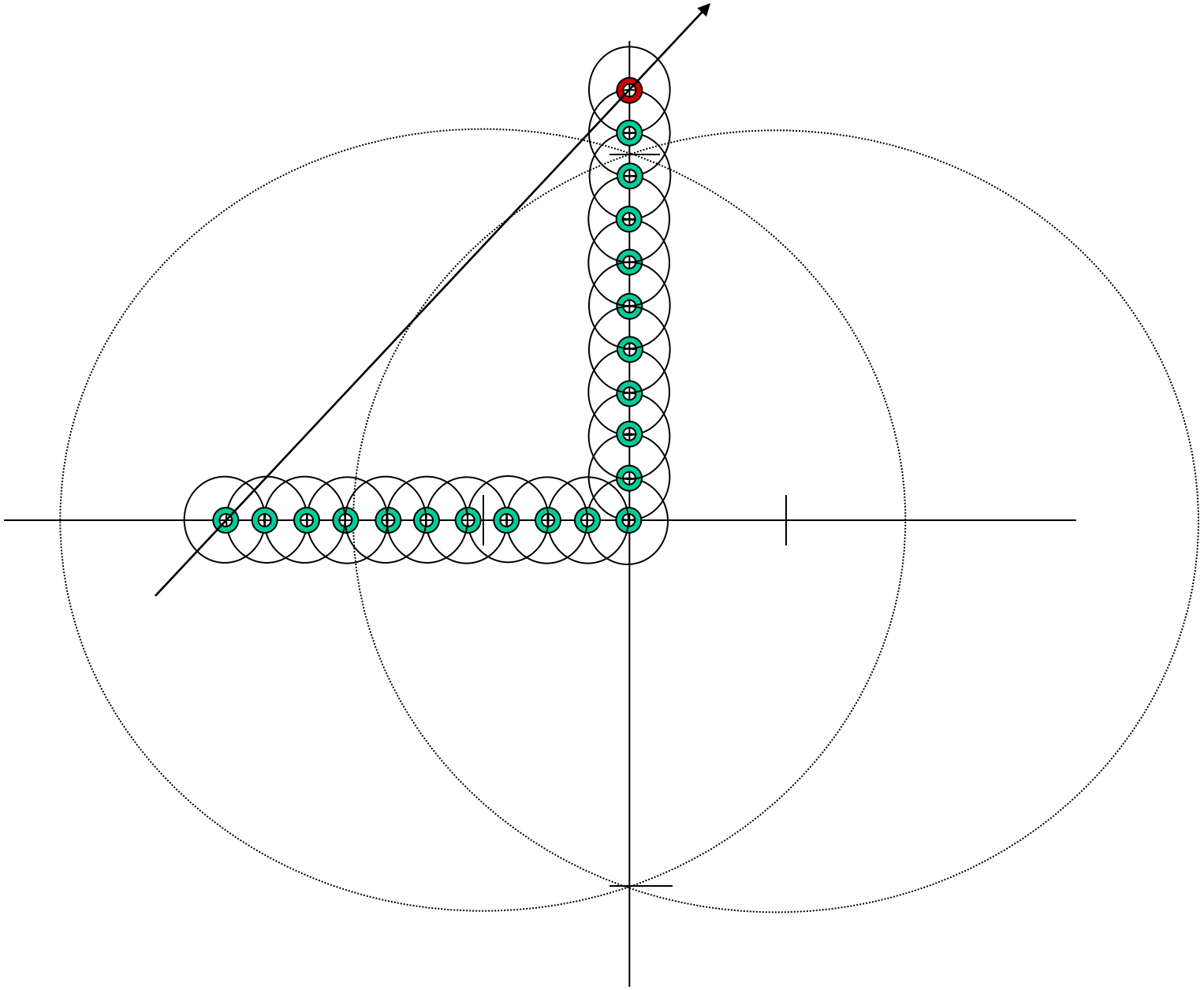
...(And skips this step)....



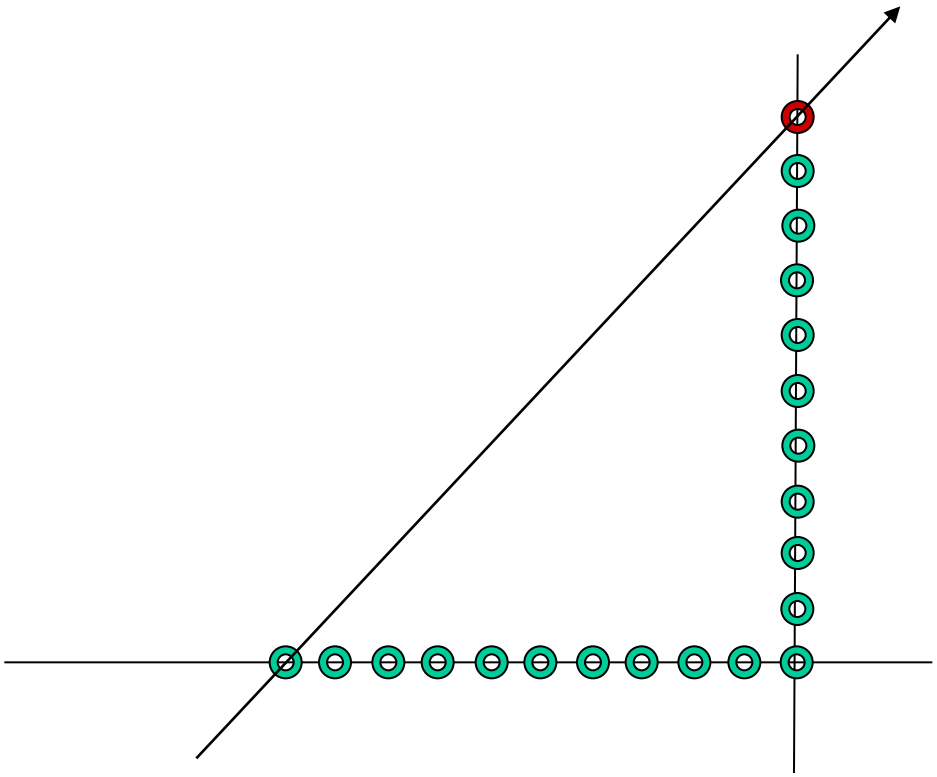
...(And THIS step)....



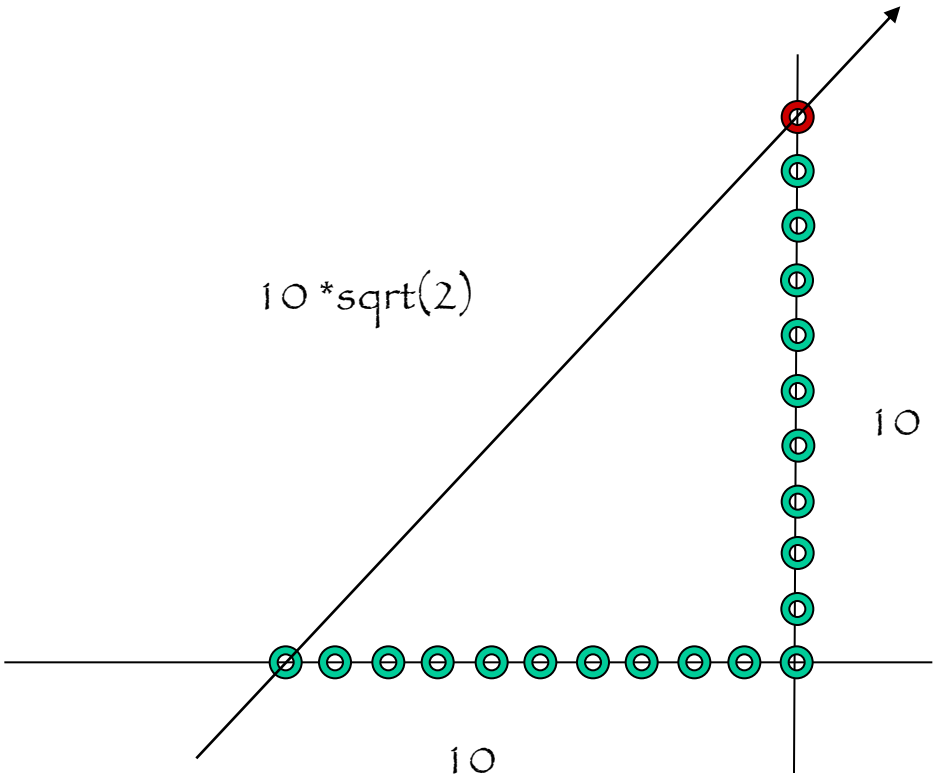
...(to get here, with the Y-axis copied to the X-axis)....



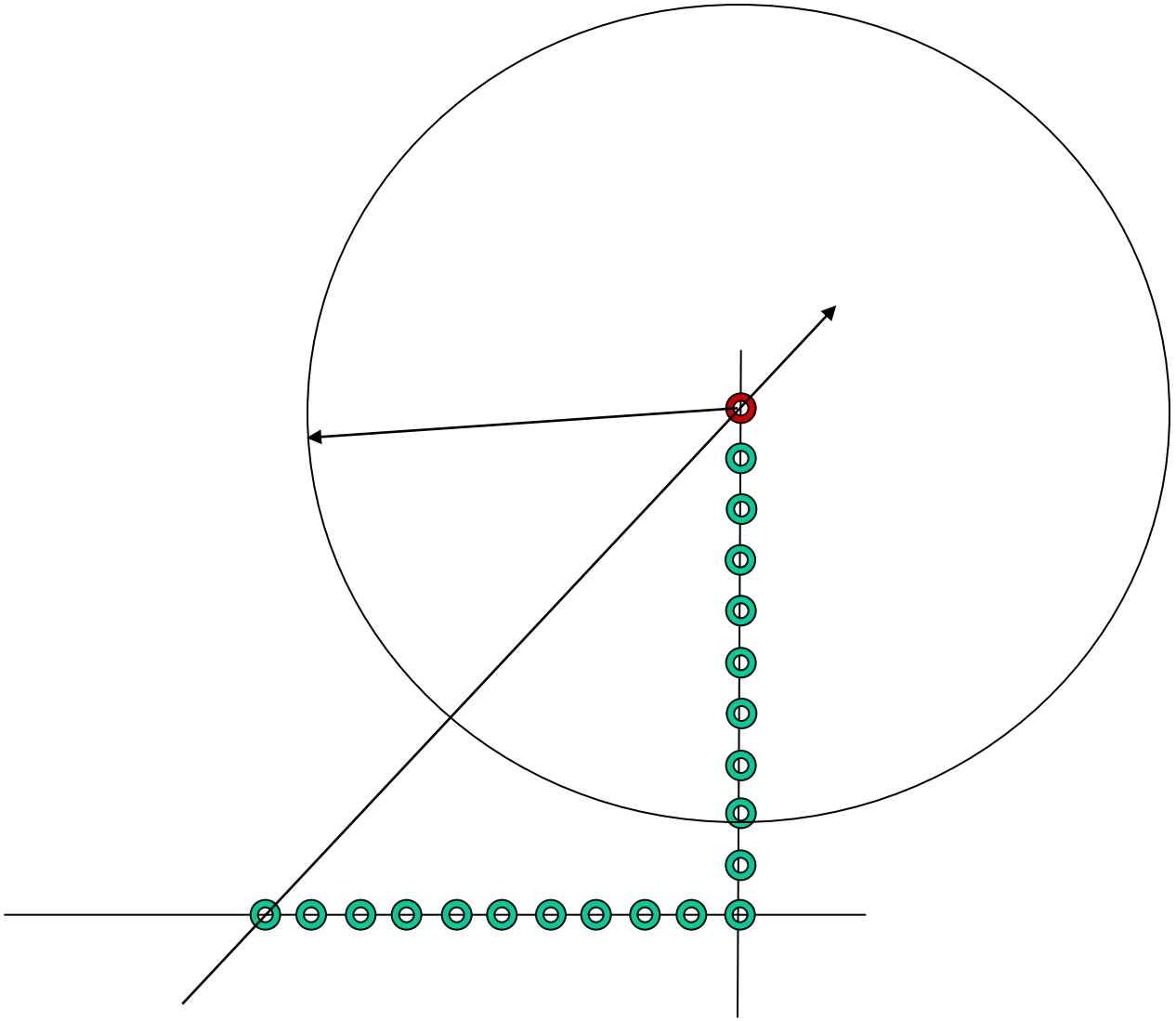
Now a straight edge connects the end points into a right triangle....



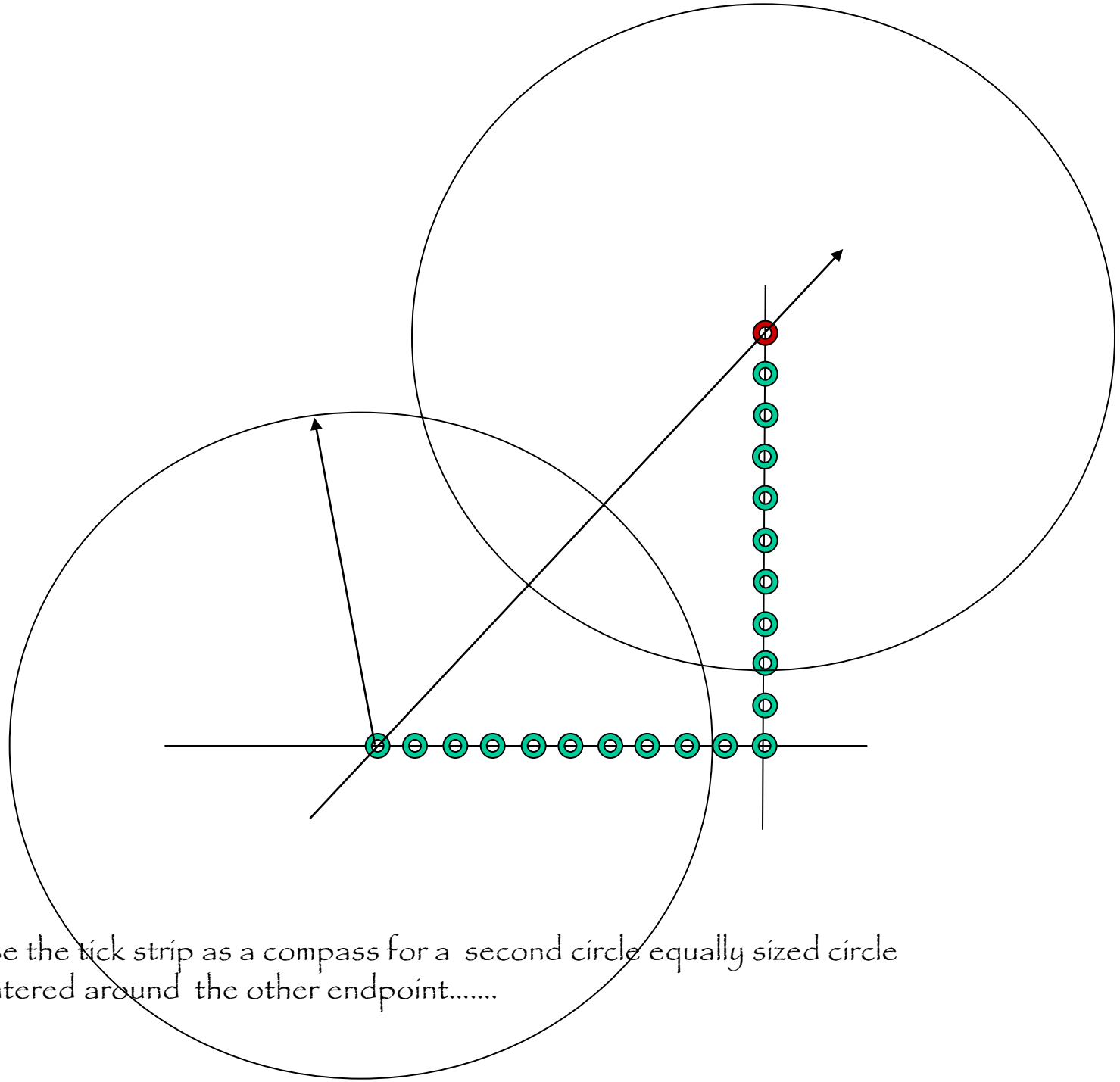
... A 45 degree right triangle with sides 10 units long ....



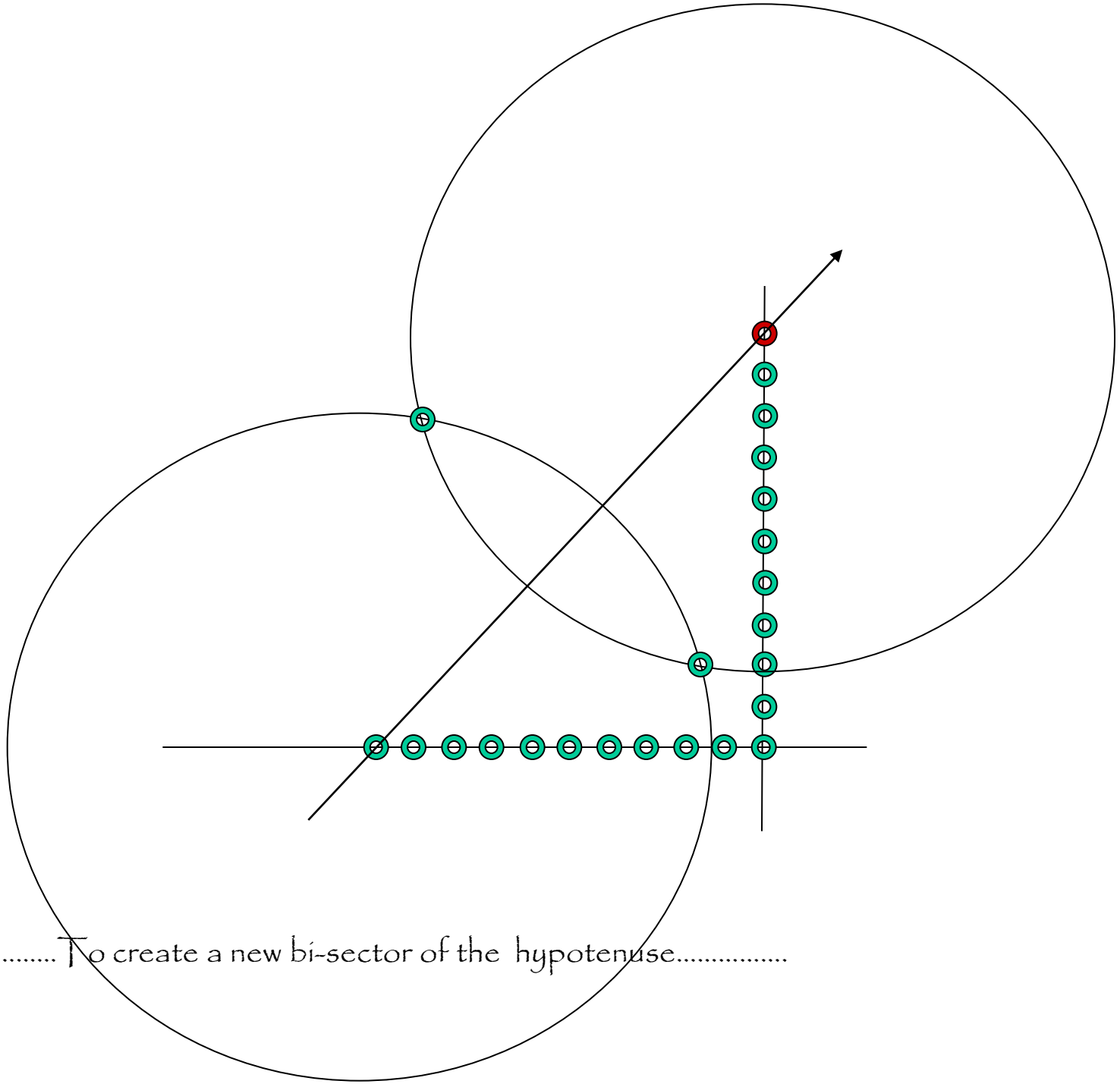
...With a hypotenuse length of 10*(SquareRoot(2))....



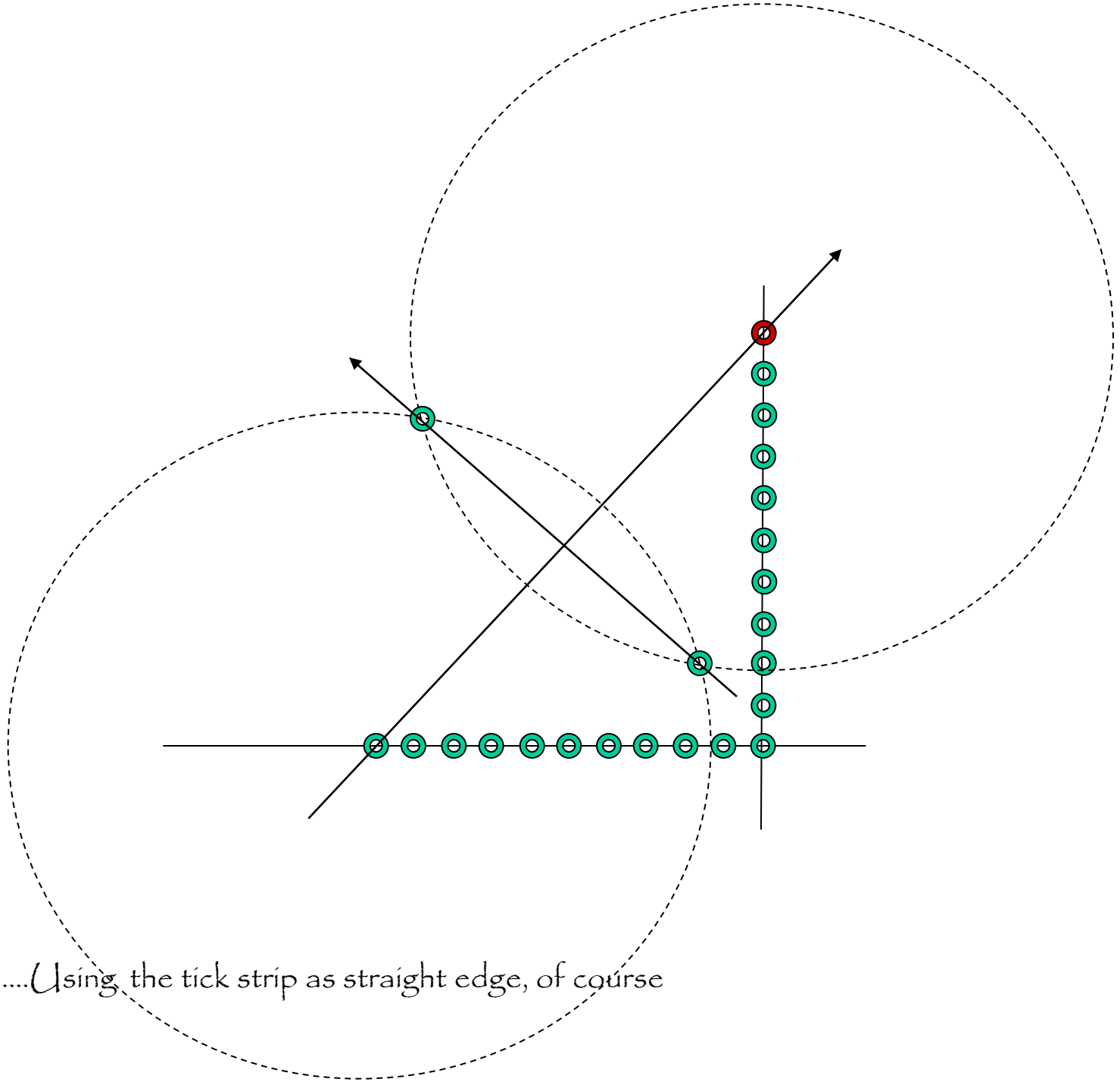
Now use the tick strip as a compass for a circle greater than half the hypotenuse centered around one endpoint.....



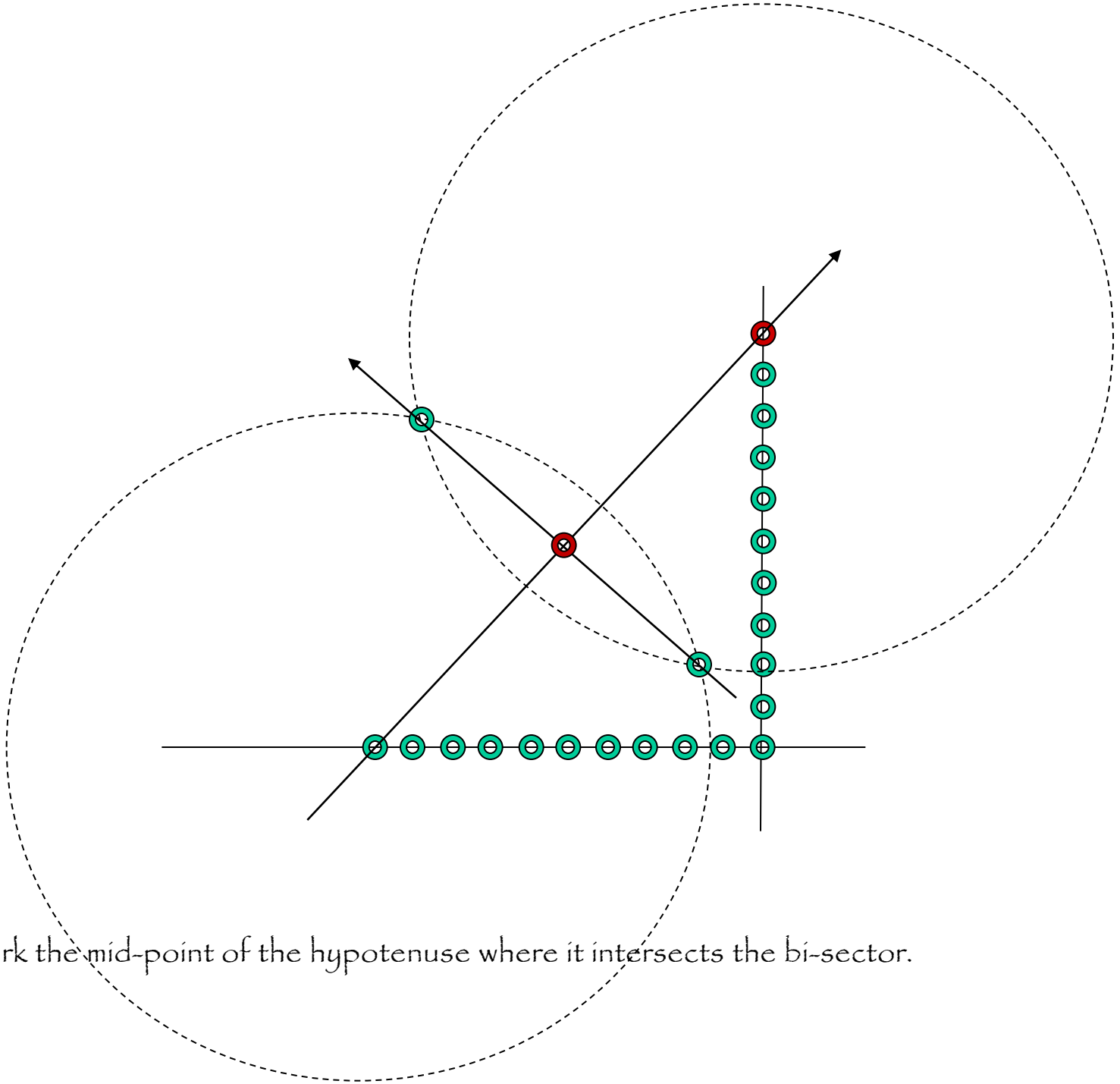
Use the tick strip as a compass for a second circle equally sized circle centered around the other endpoint.....



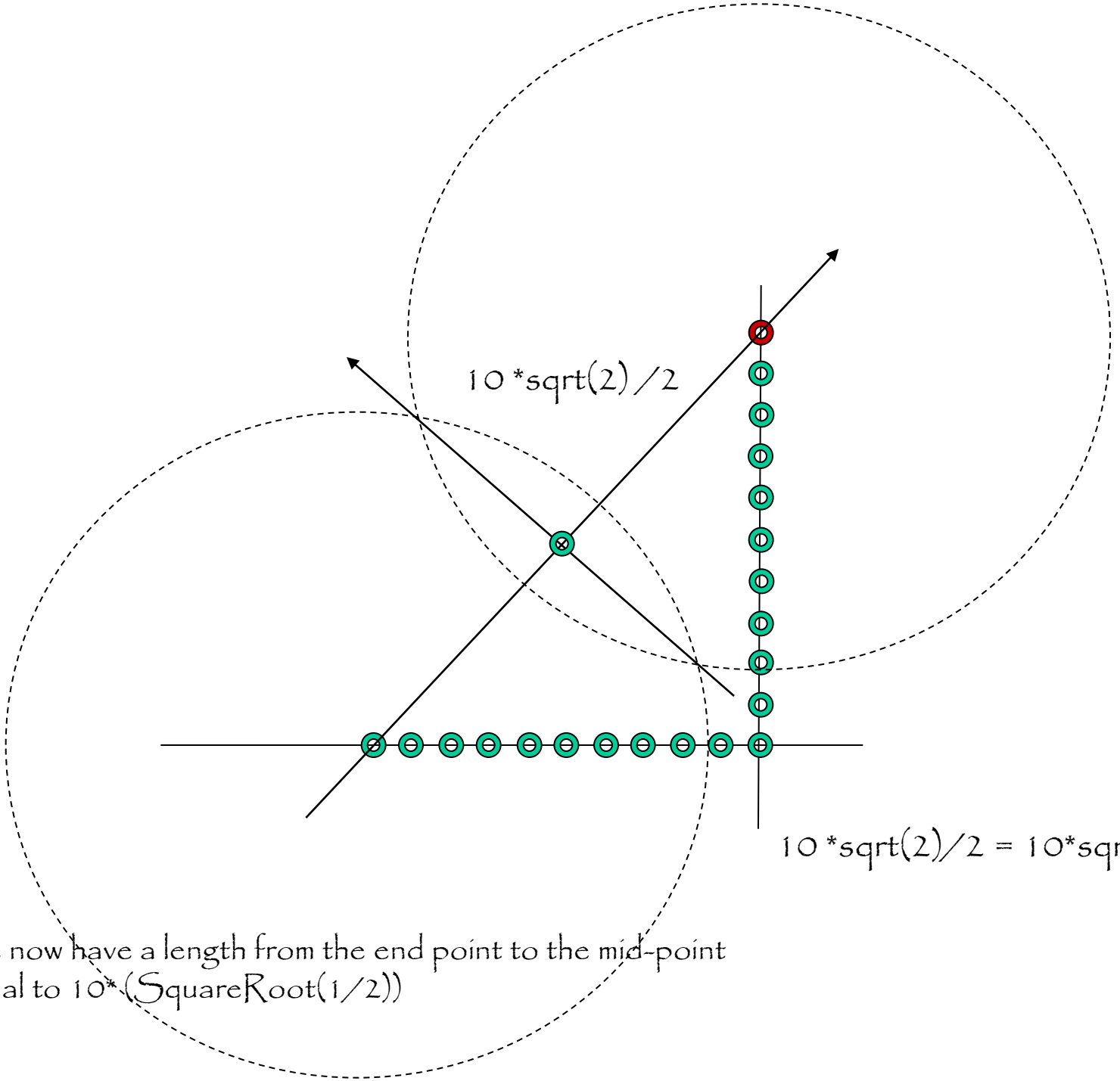
..... To create a new bi-sector of the hypotenuse.....



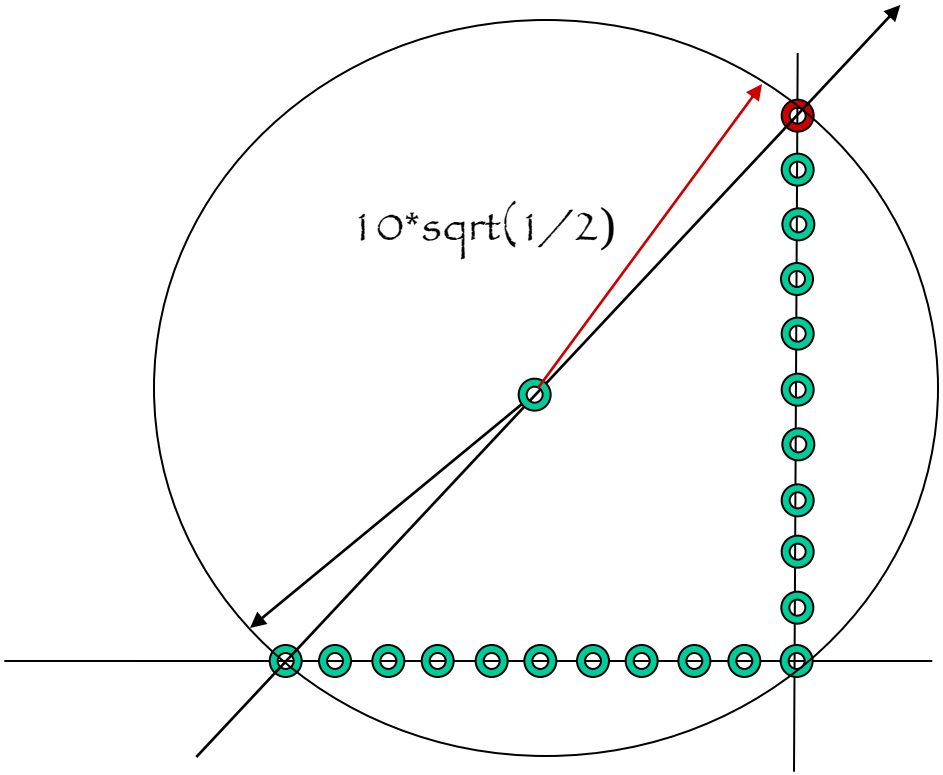
.....Using the tick strip as straight edge, of course



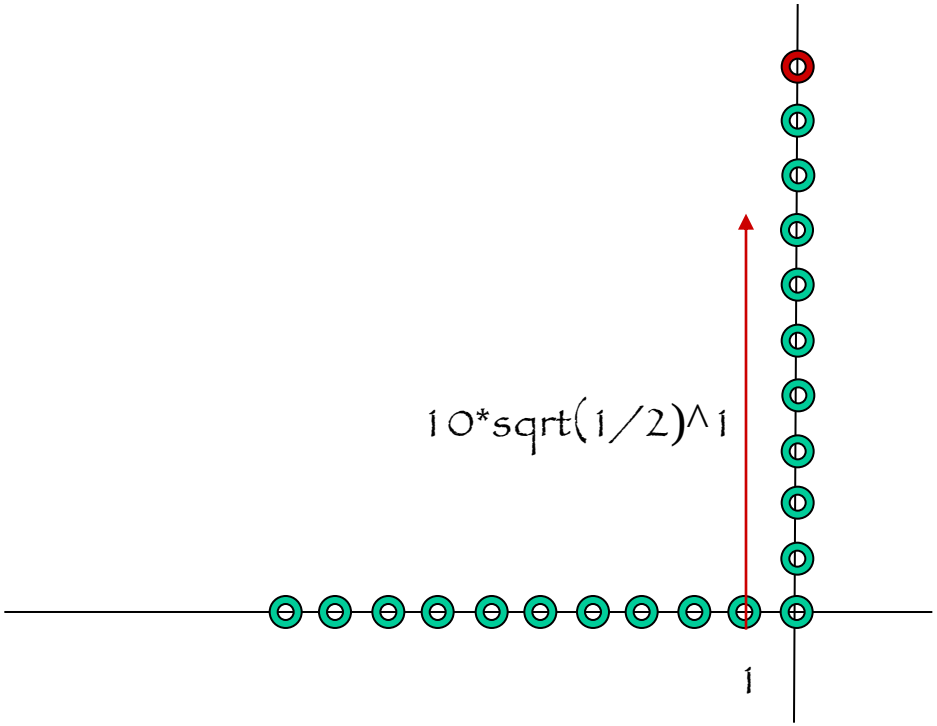
Mark the mid-point of the hypotenuse where it intersects the bi-sector.



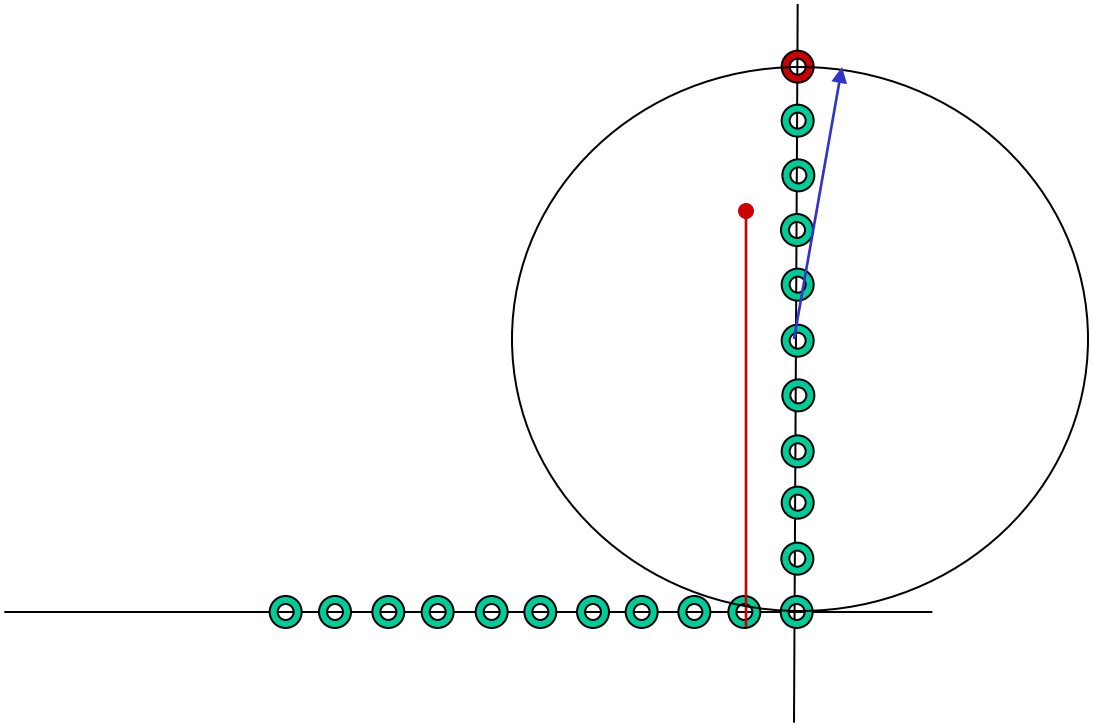
We now have a length from the end point to the mid-point equal to 10*(SquareRoot(1/2))



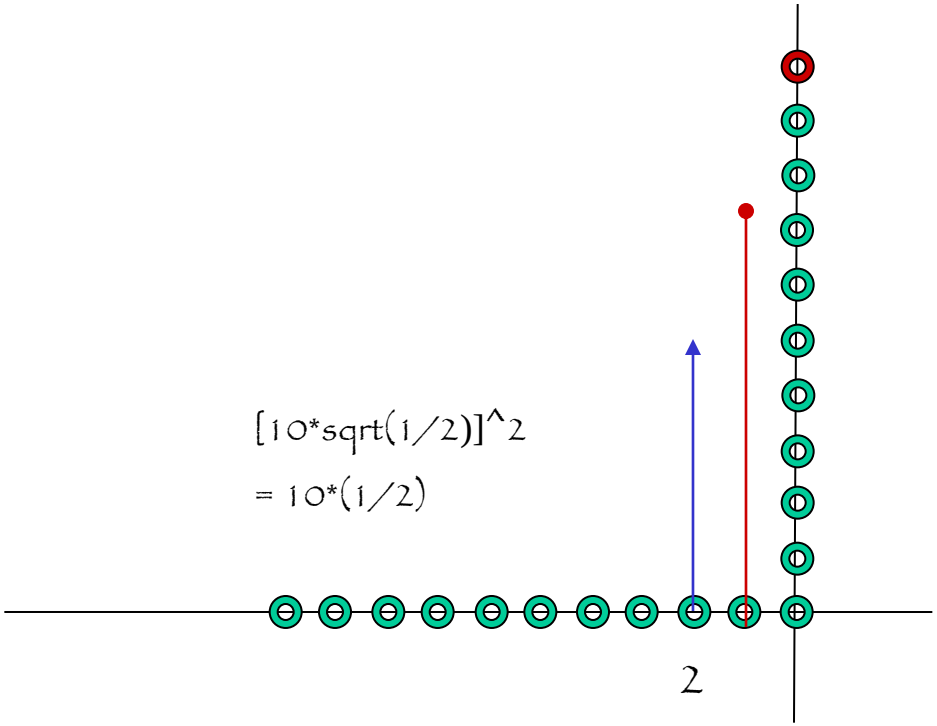
Copy this length with the tick strip .....



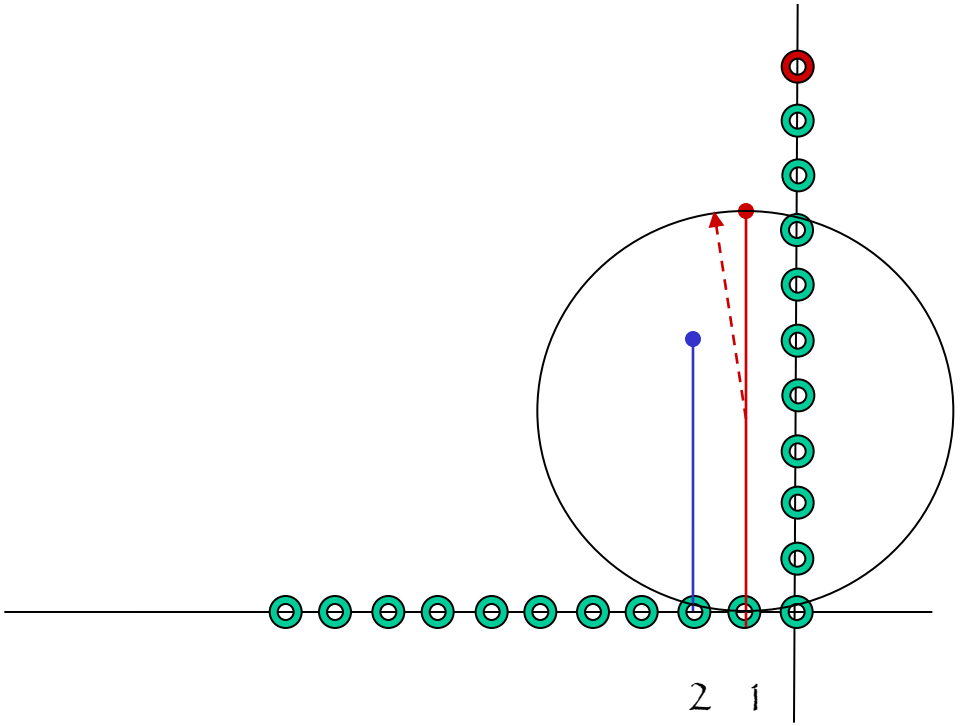
Place this length vertically on the #1 point to the left of the intersection of X-axis and Y- axis.....



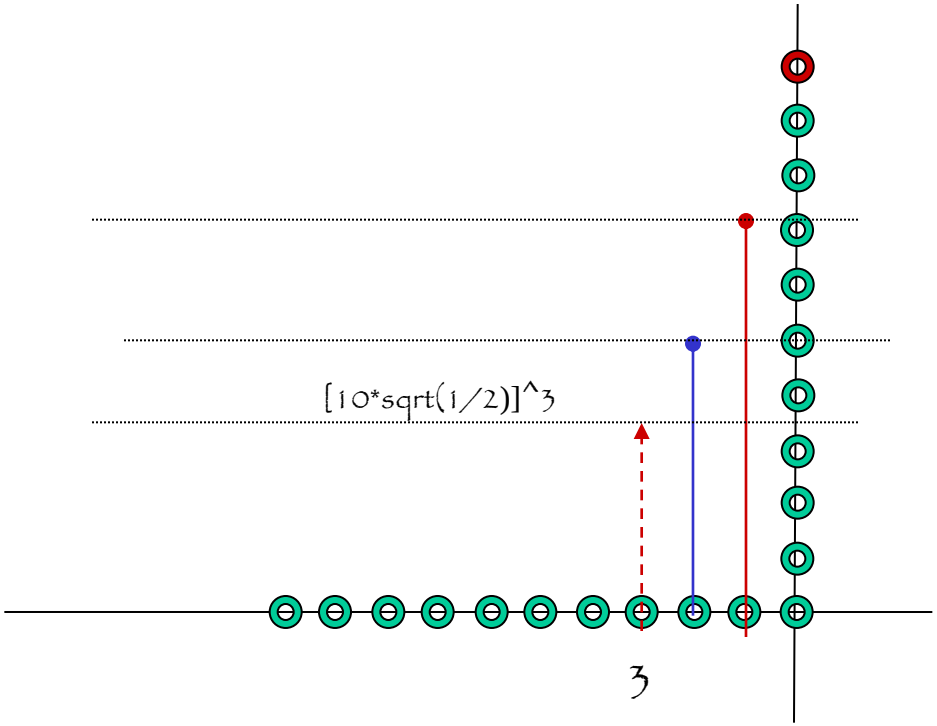
Now use the tick strip to copy half the length of the 10 units on the Y-axis .....



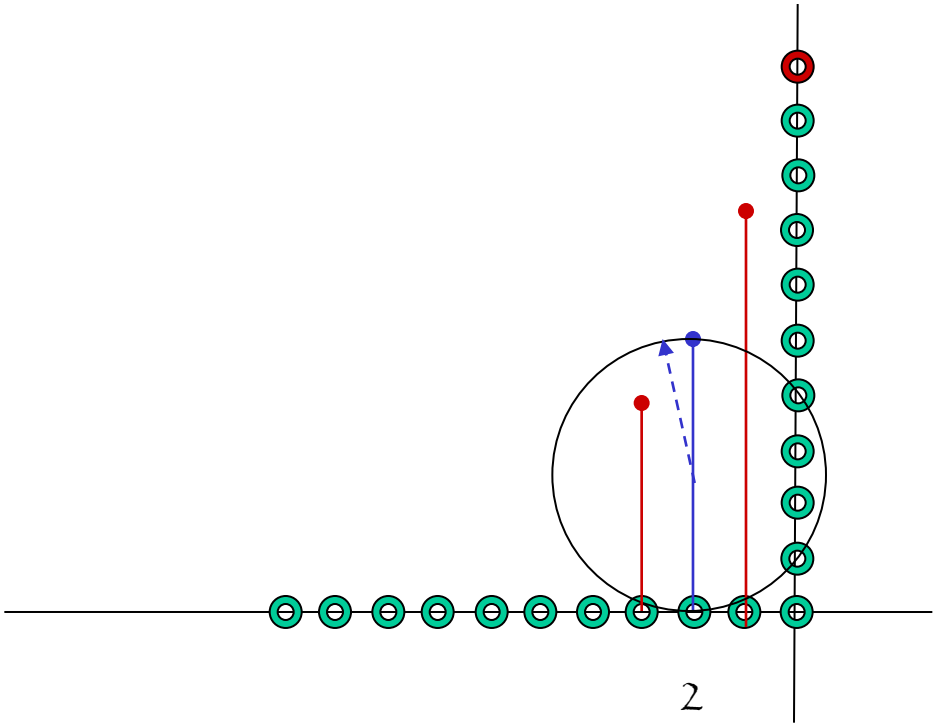
Place this length vertically on the #2 point to the left of the intersection of X-axis and Y- axis.....



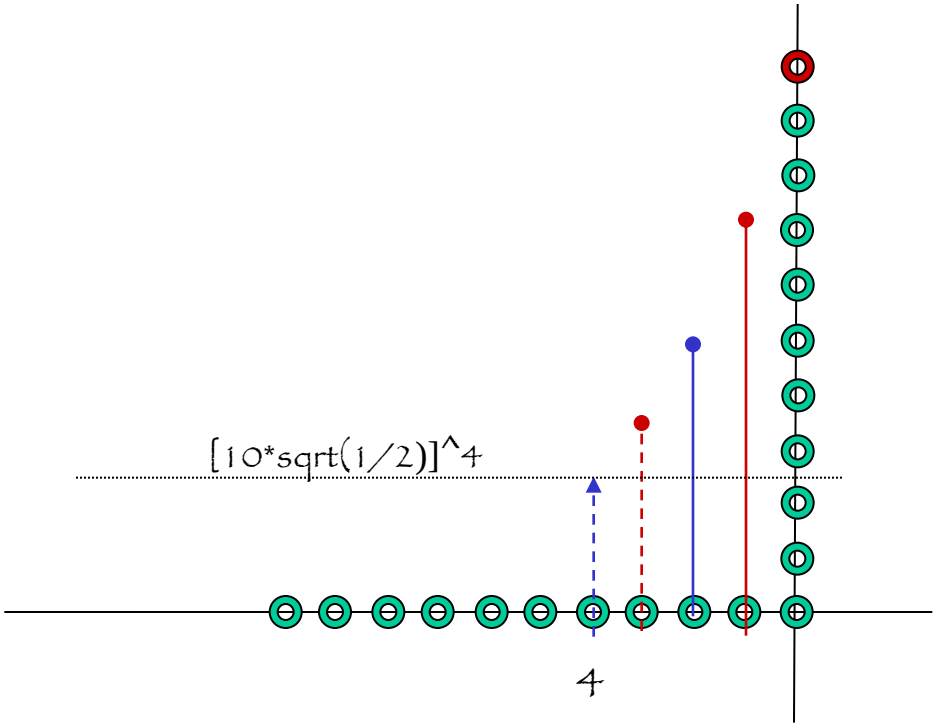
Now use the tick strip to copy half the length of the line on point 1 left of the axis..... you can either bi-sect the line, or mark the full length on the tick strip and then fold the tick strip in half.....



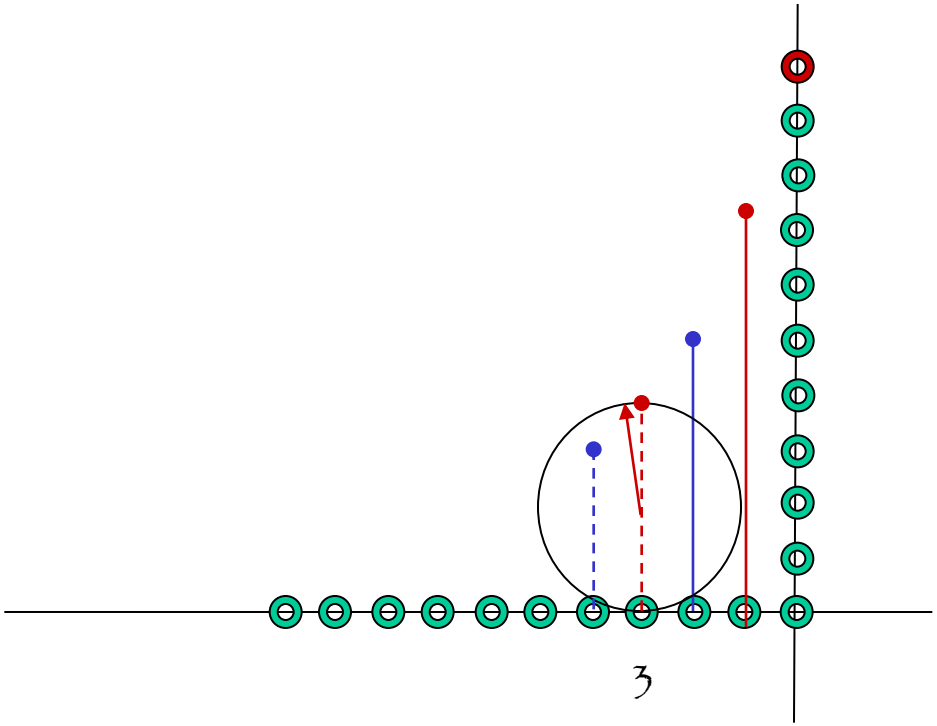
Place this (half) length vertically on the #3 point to the left of the intersection of X-axis and Y- axis.....



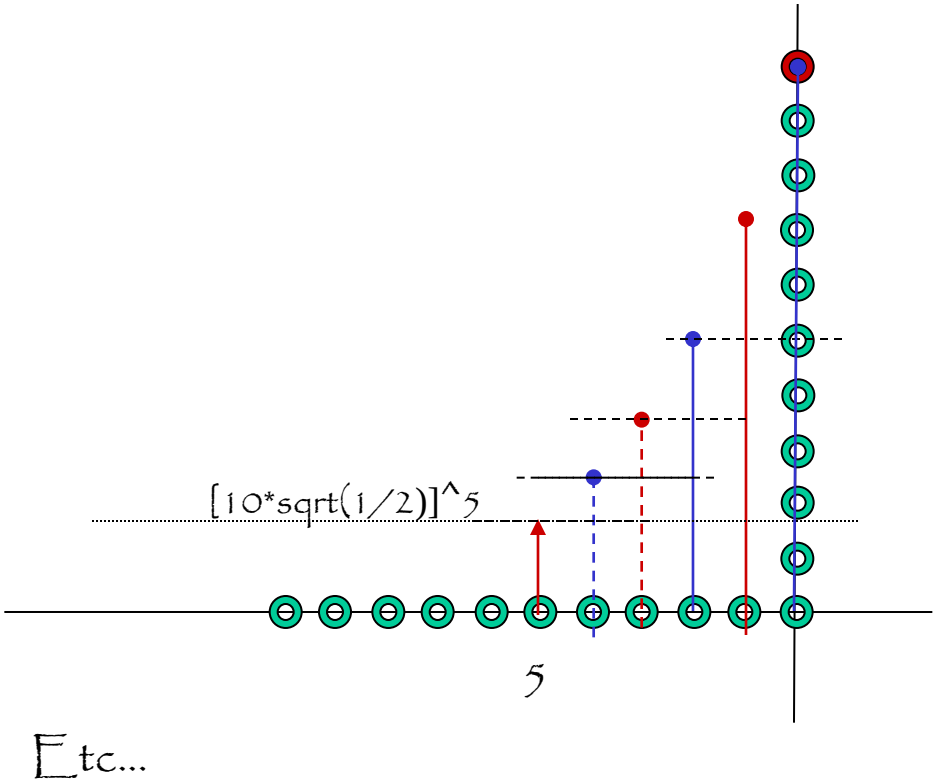
Now use the tick strip to copy half the length of the line on point 2 left of the axis.....



Place this length vertically on the #4 point to the left of the intersection of X-axis and Y- axis.....



Etc...



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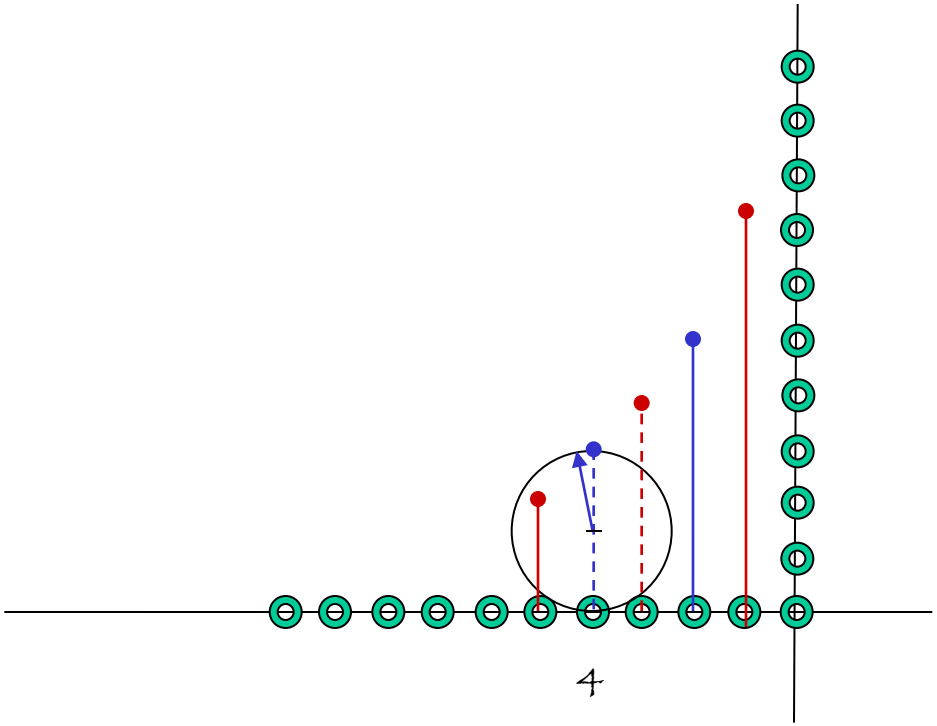
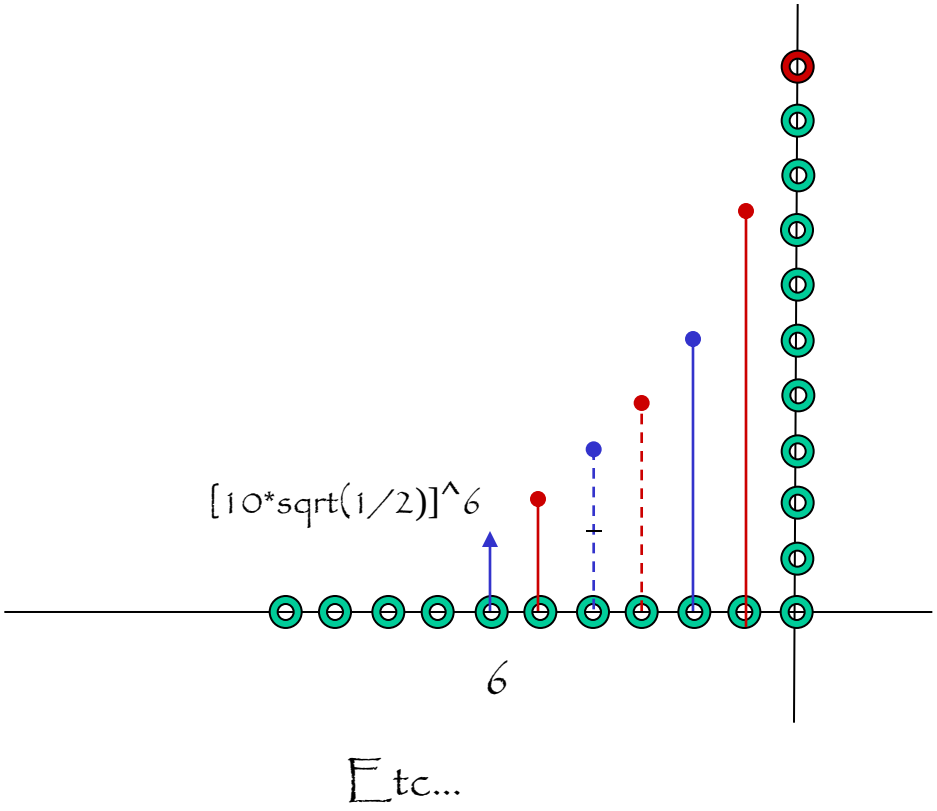
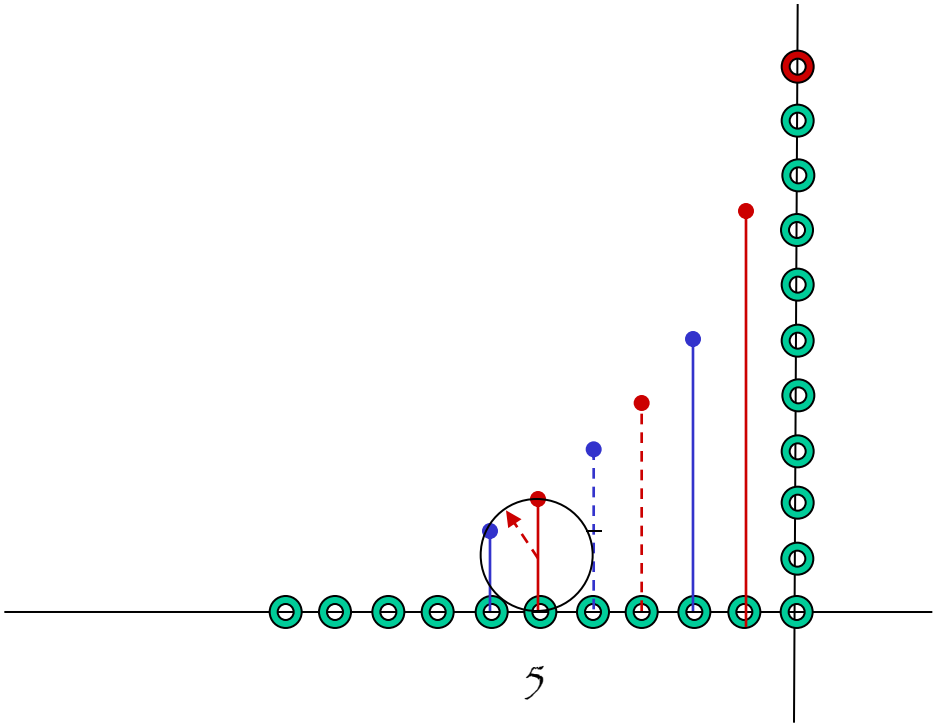


Etc...



Etc...



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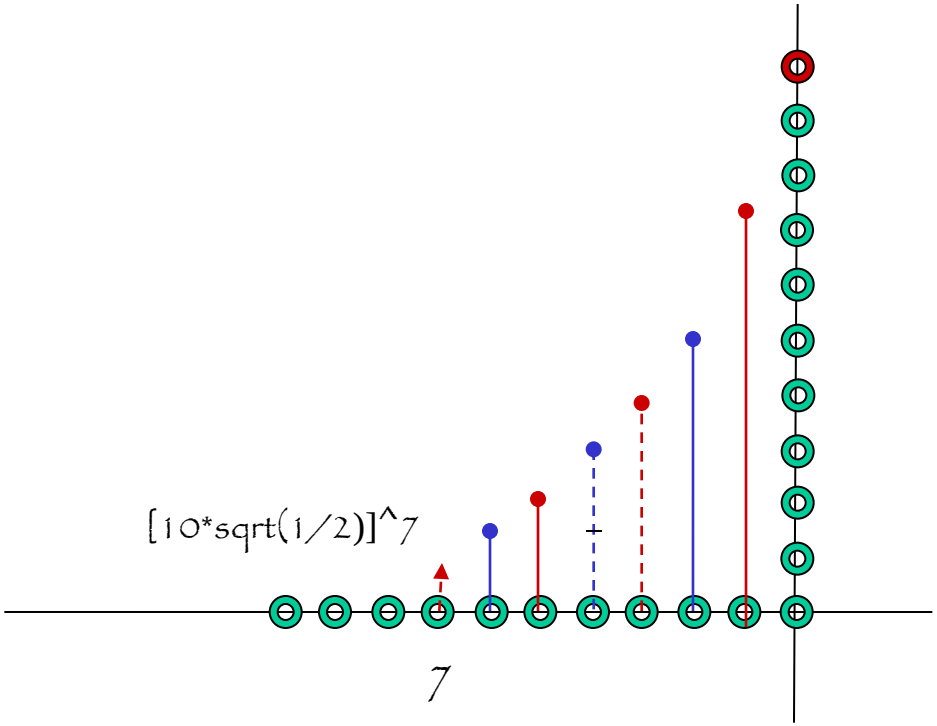
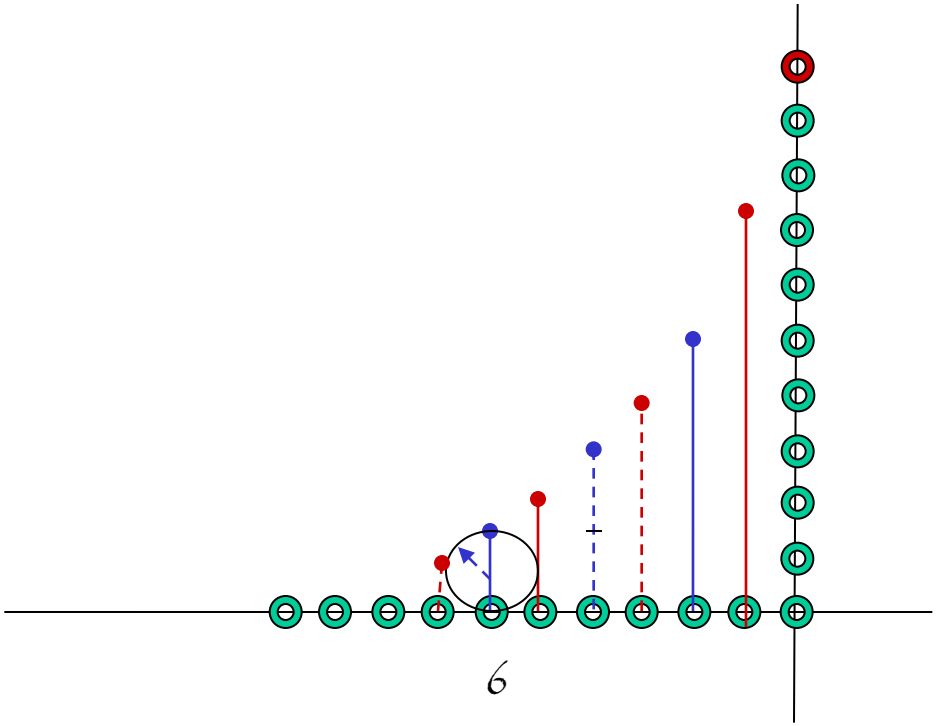
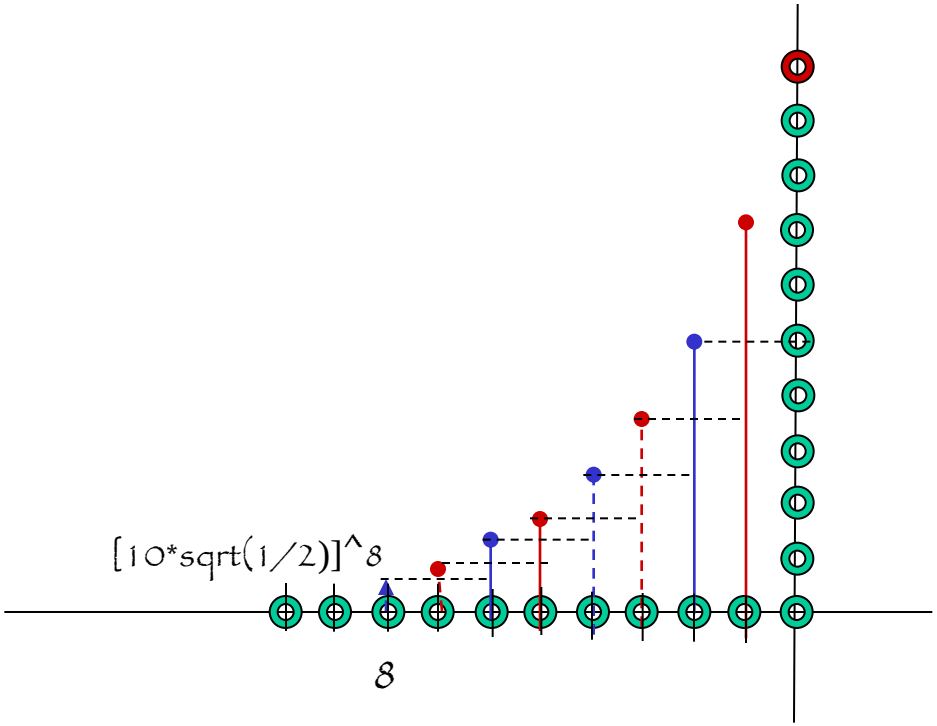
Etc...



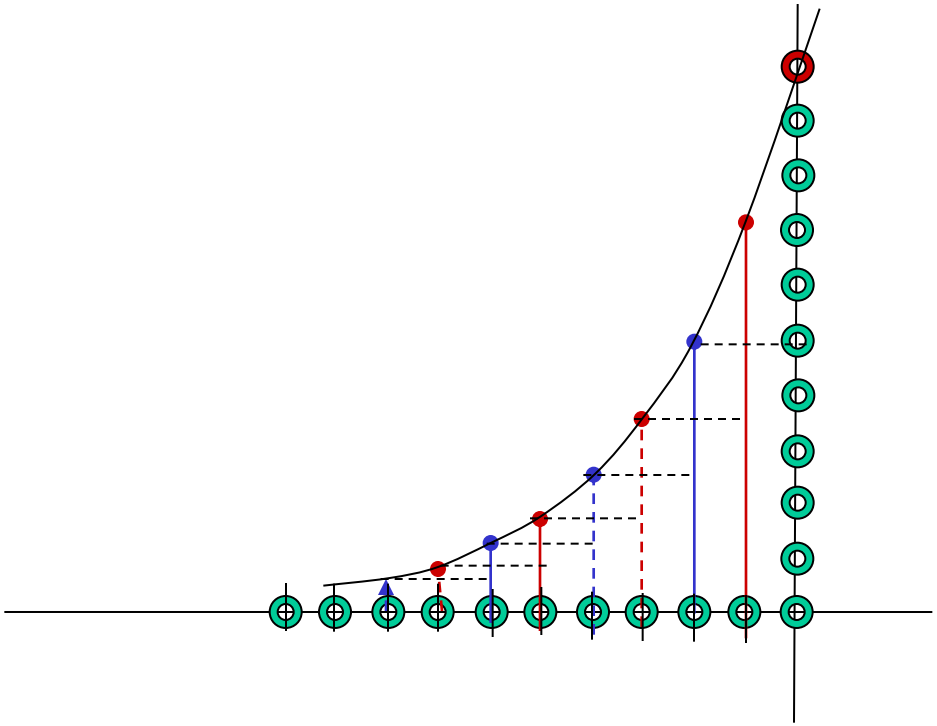
Etc...


6
Etc...

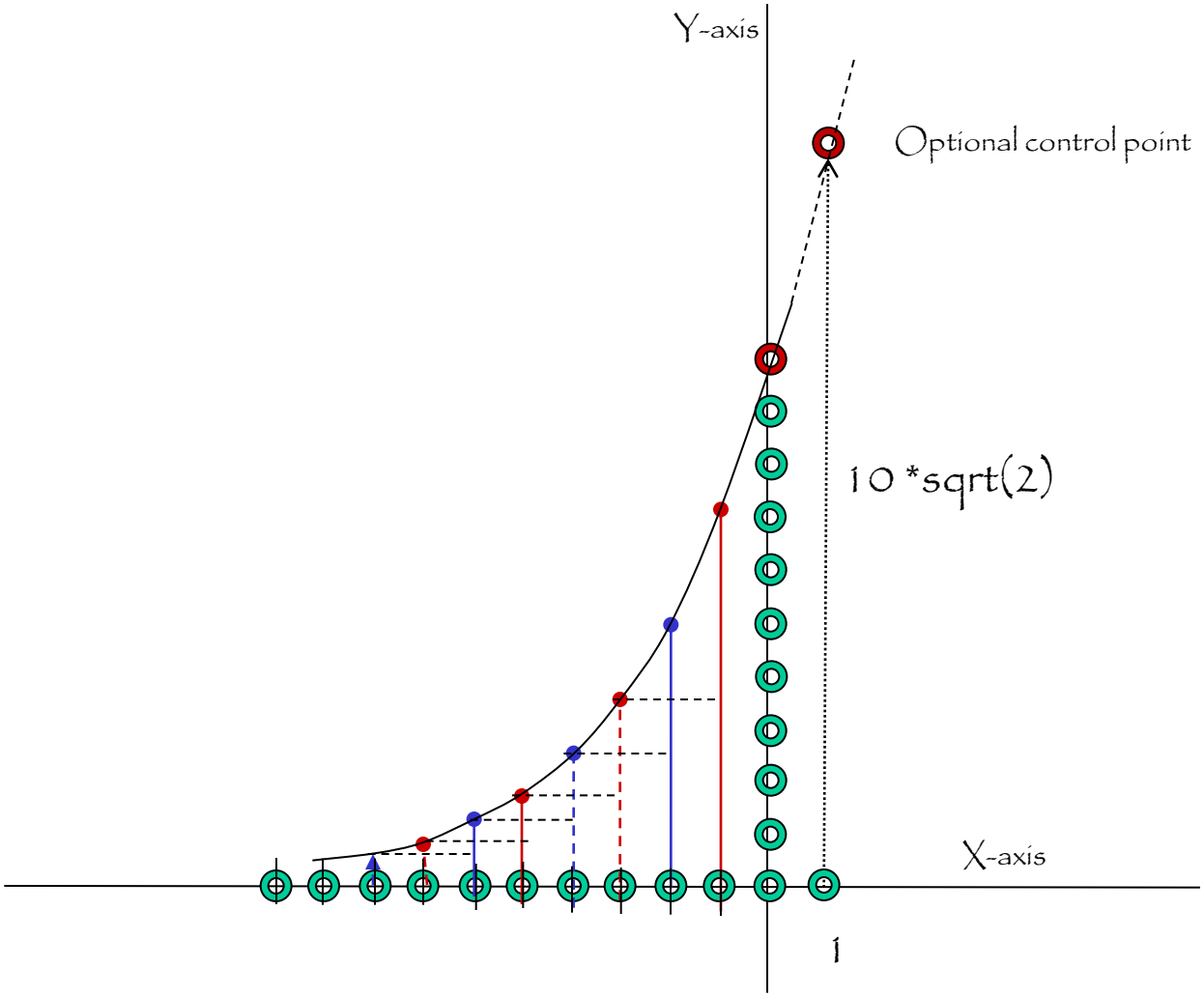


Eight is enough ...

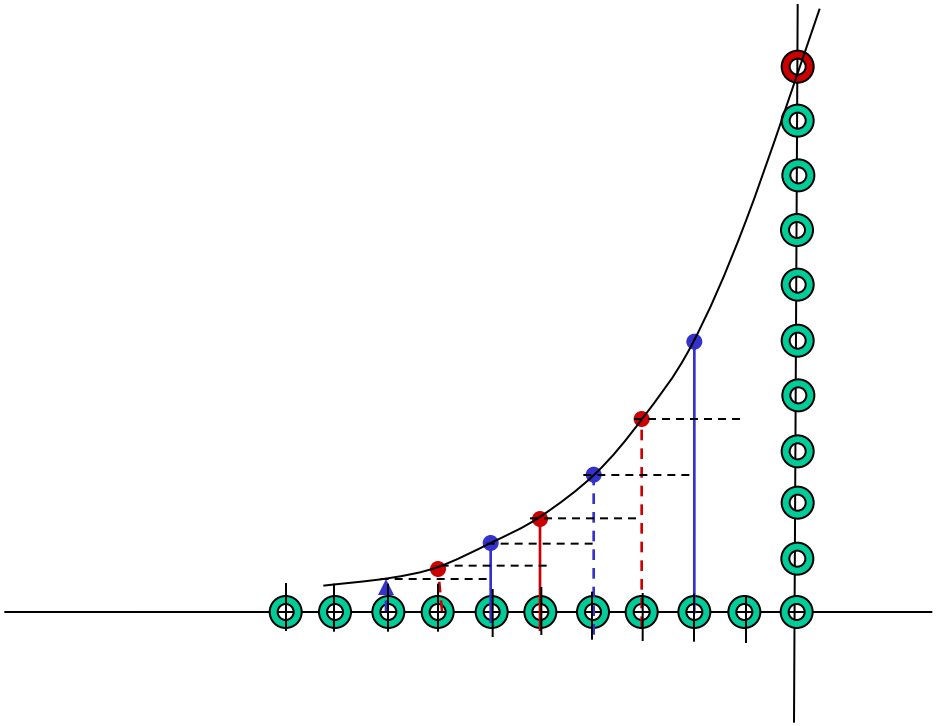
... Each line is ½ of the length of the line two points to the right



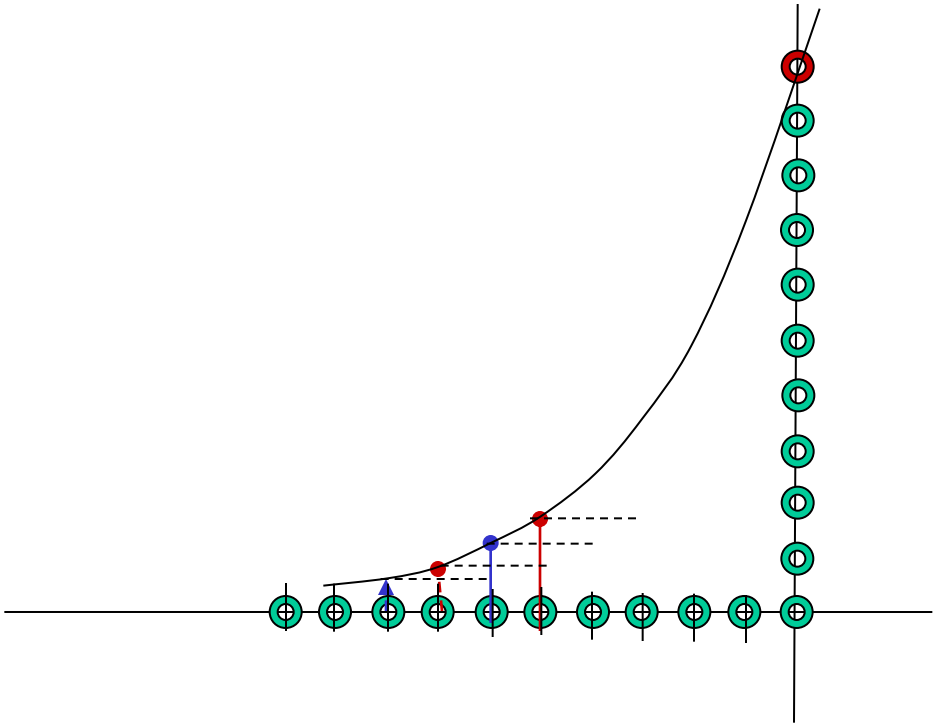
Now draft a free-hand or spline guided curve through the points....



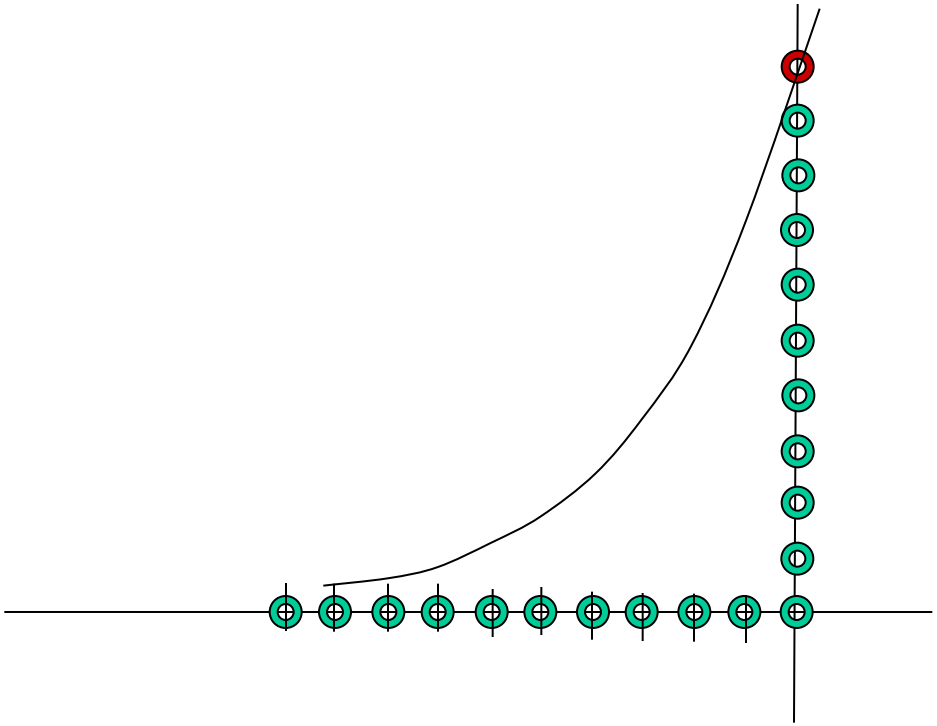
Optionally, that first hypotenuse could be used to make a curve control point vertically over the point 1 unit to the right of the intersection of the X -axis and the Y-axis ....



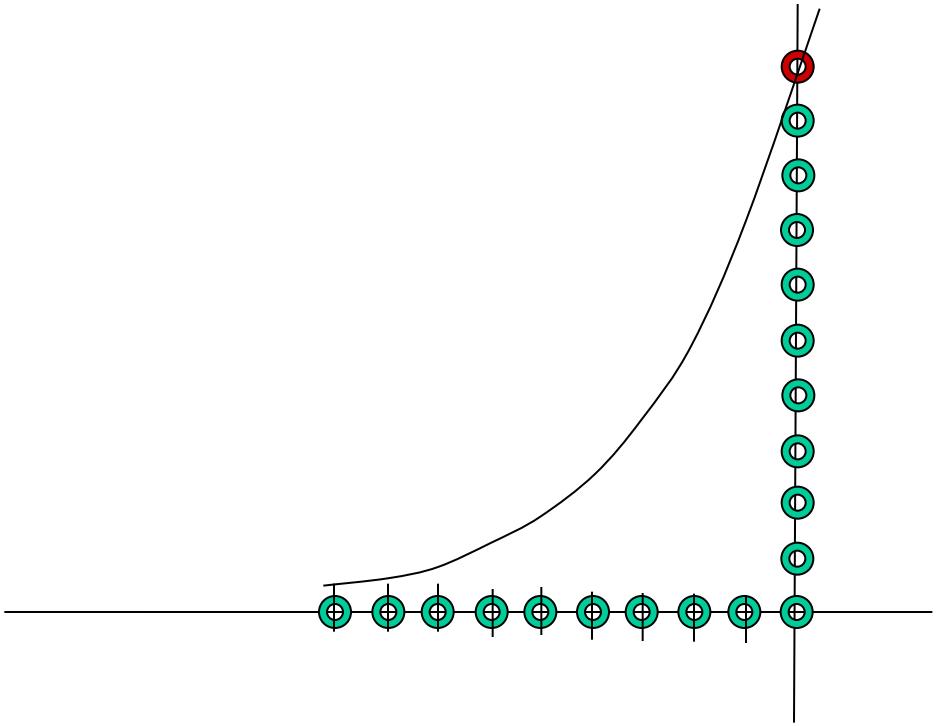
For Clarity's sake we now remove the construction lines.....



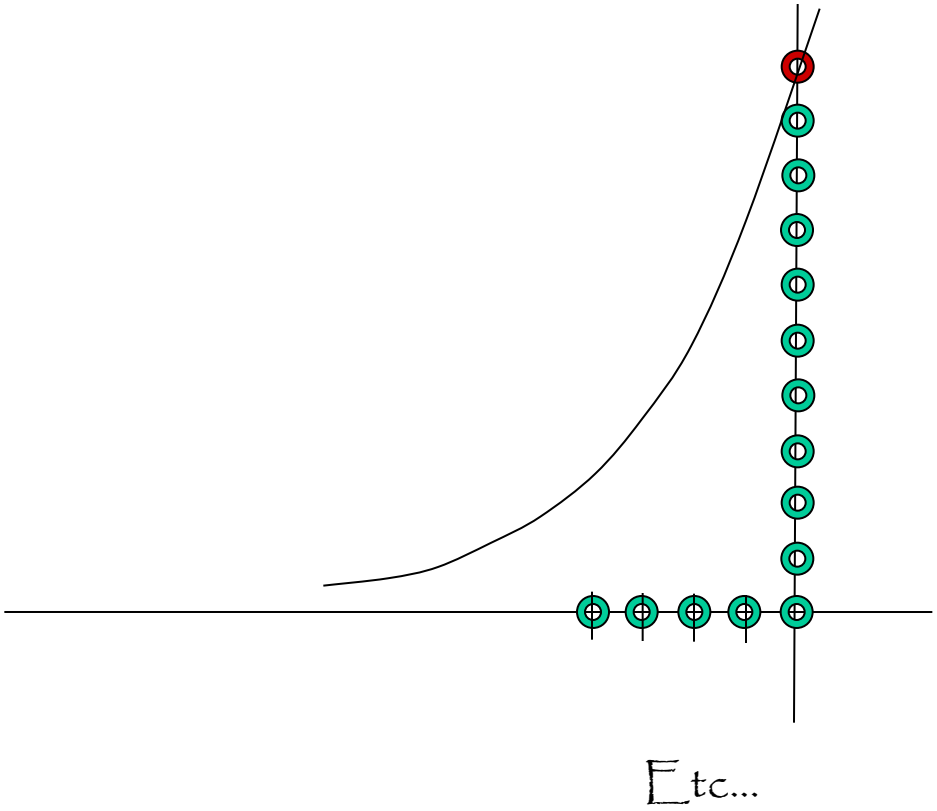
Etc...

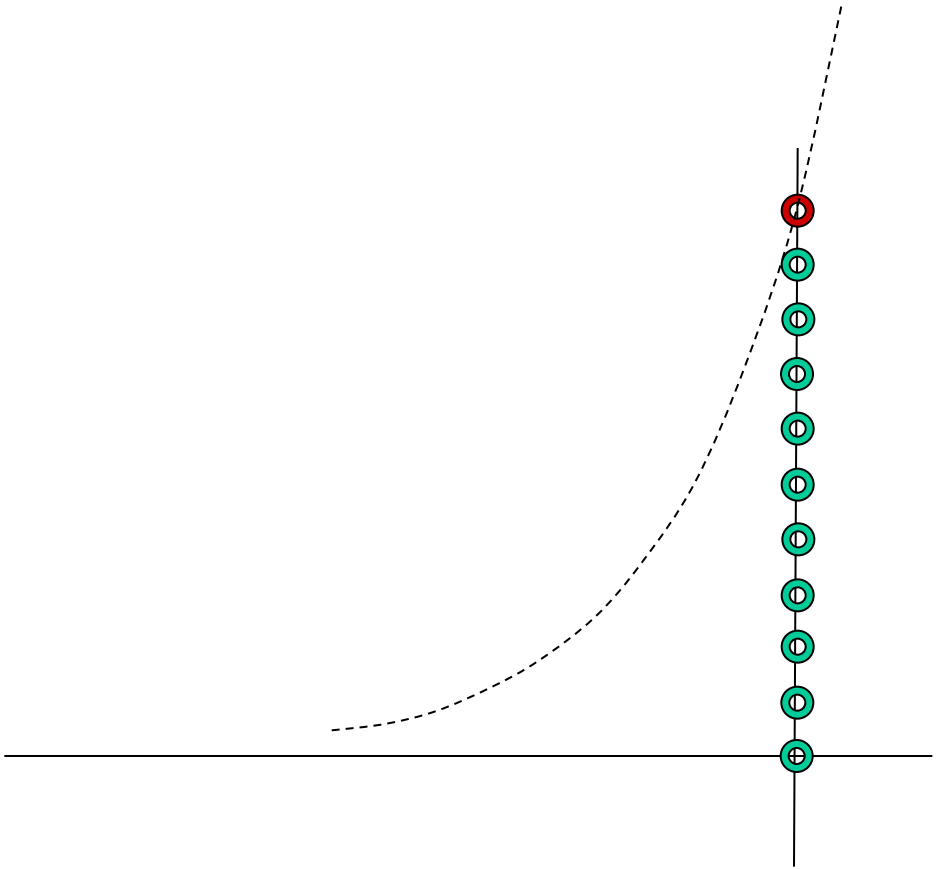


Etc...



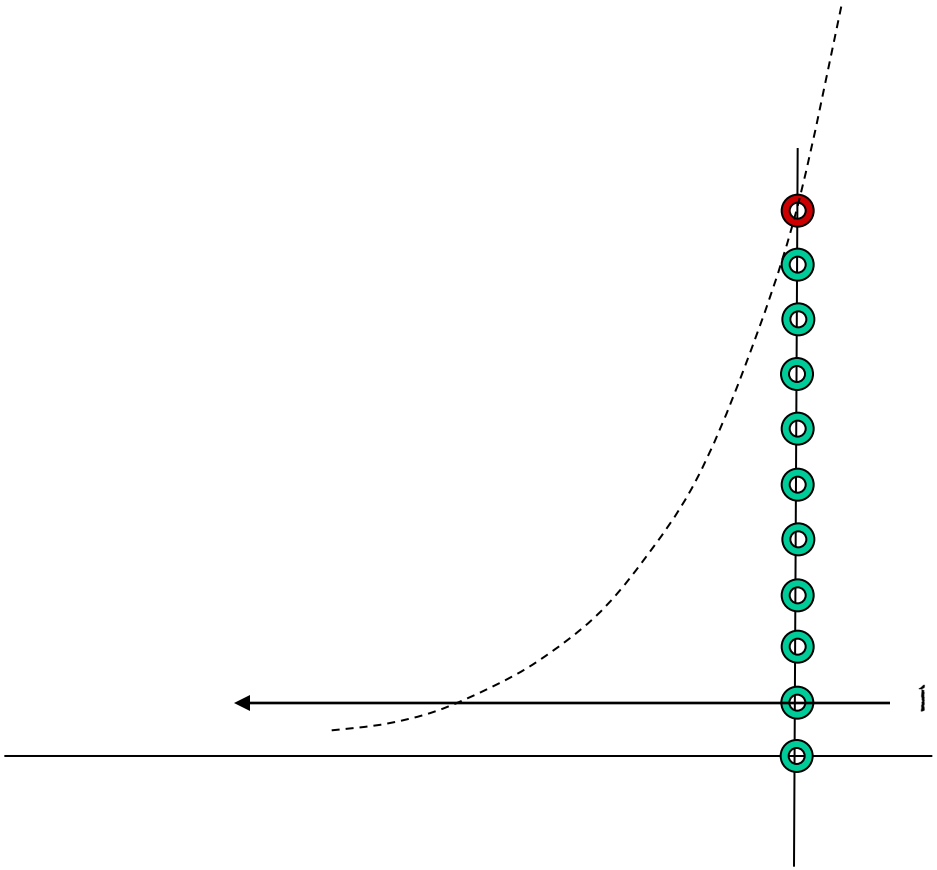
For Clarity's sake we also remove points on the X-axis


Etc...

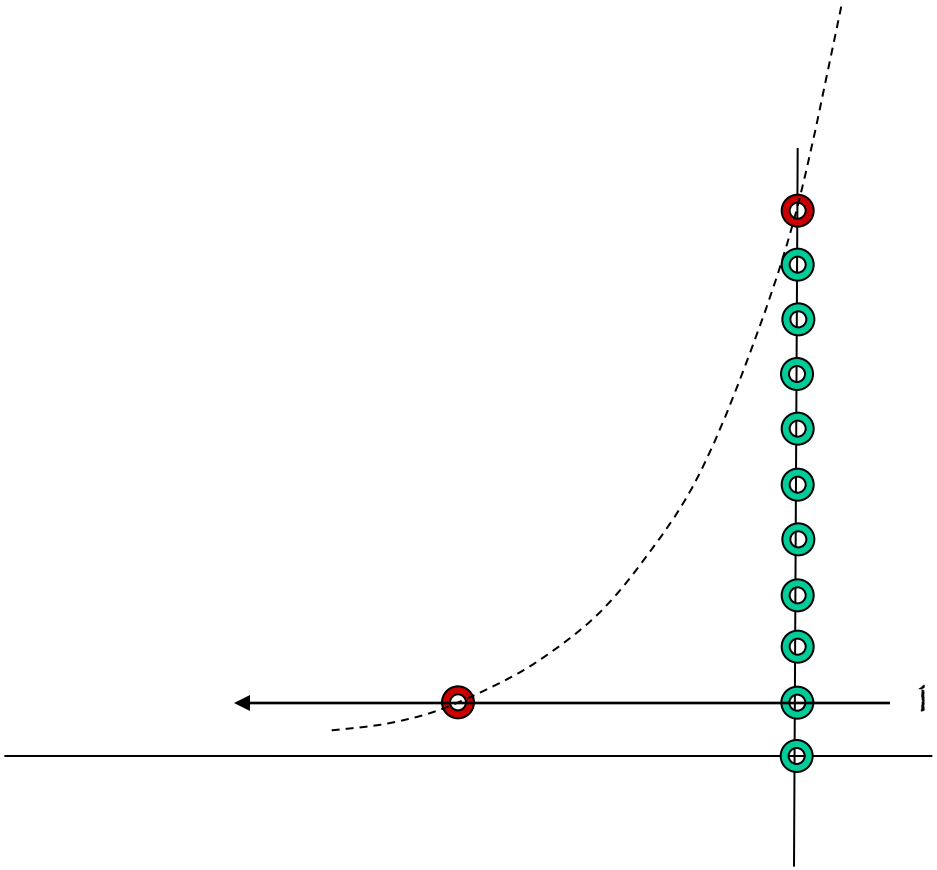


Etc...

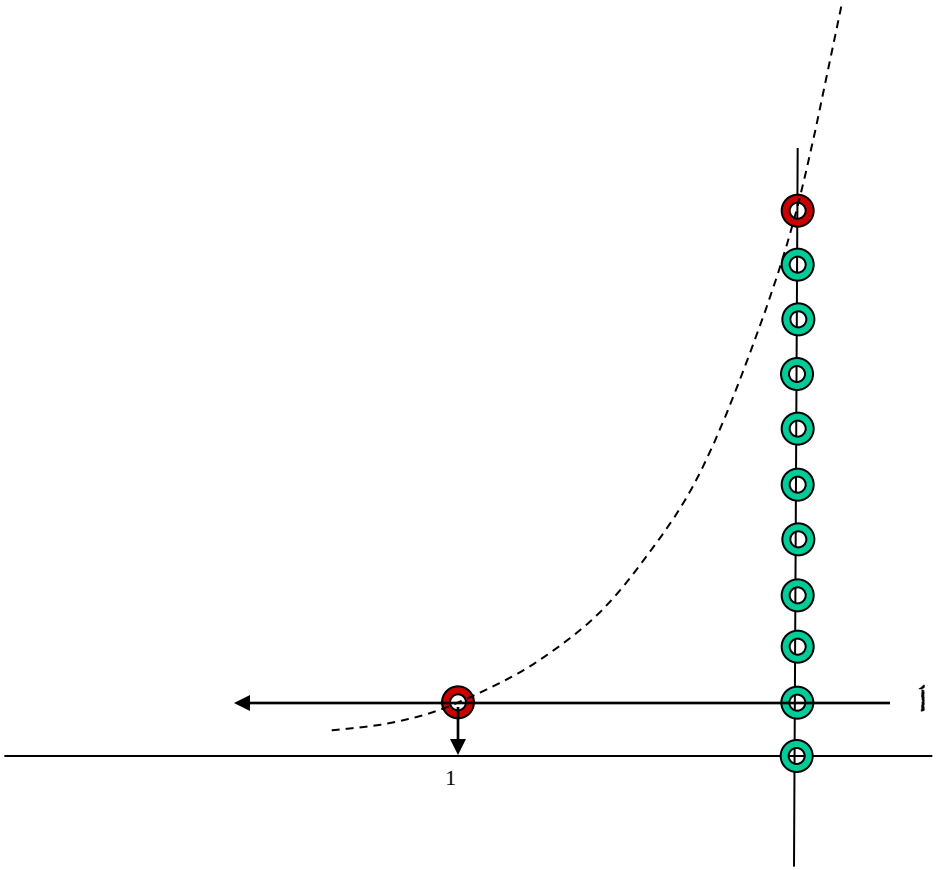
Leaving the Curve, the Y-axis points and the clear X-axis



Now place a horizontal line through point #1 above the Y-axis

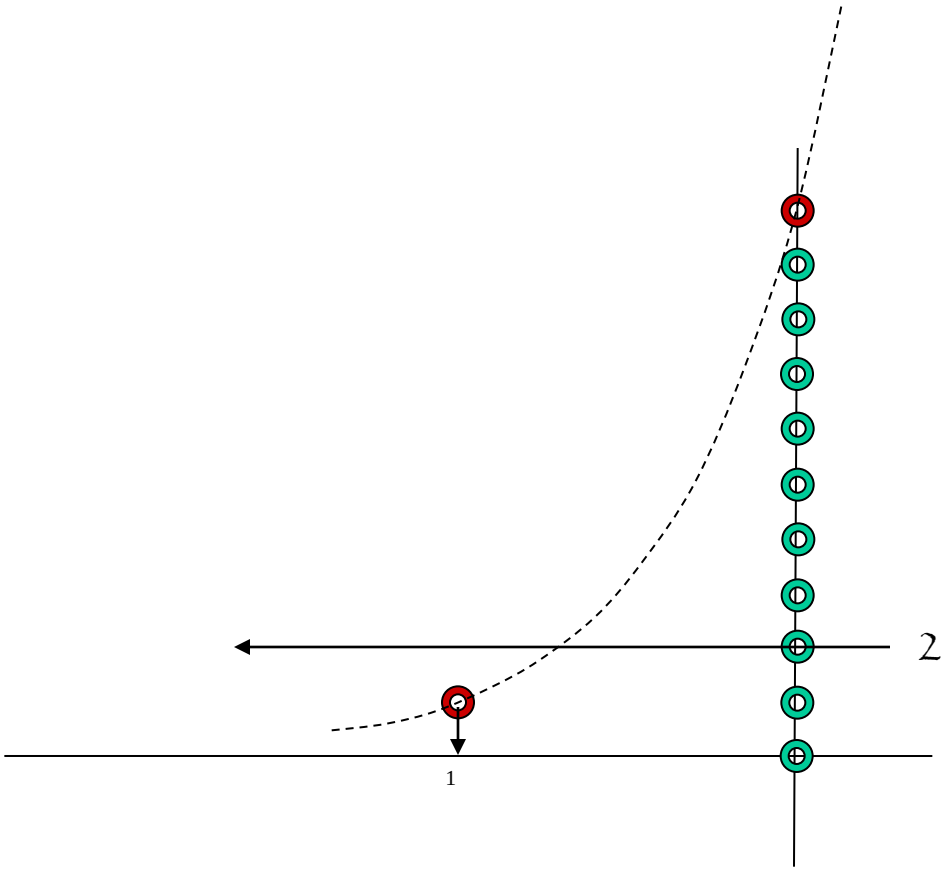


Mark the intersection of this line with the curve....

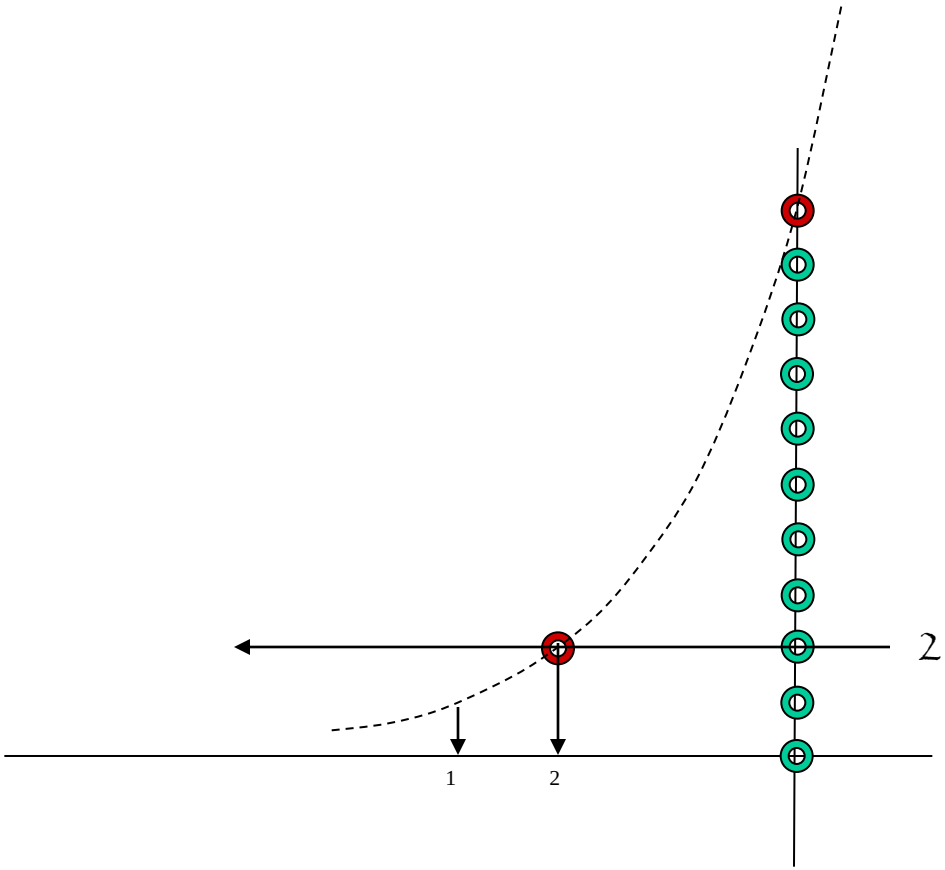


We are almost there...

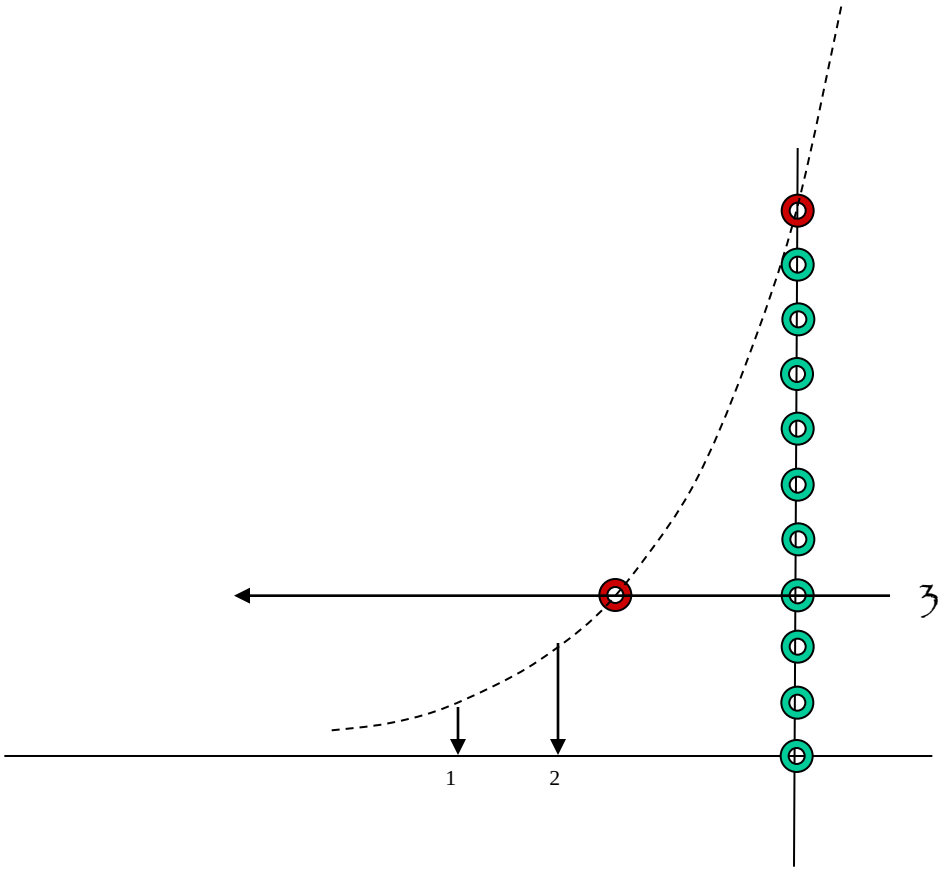
Drop a vertical line to the X-axis from the intersection and mark it "1"....



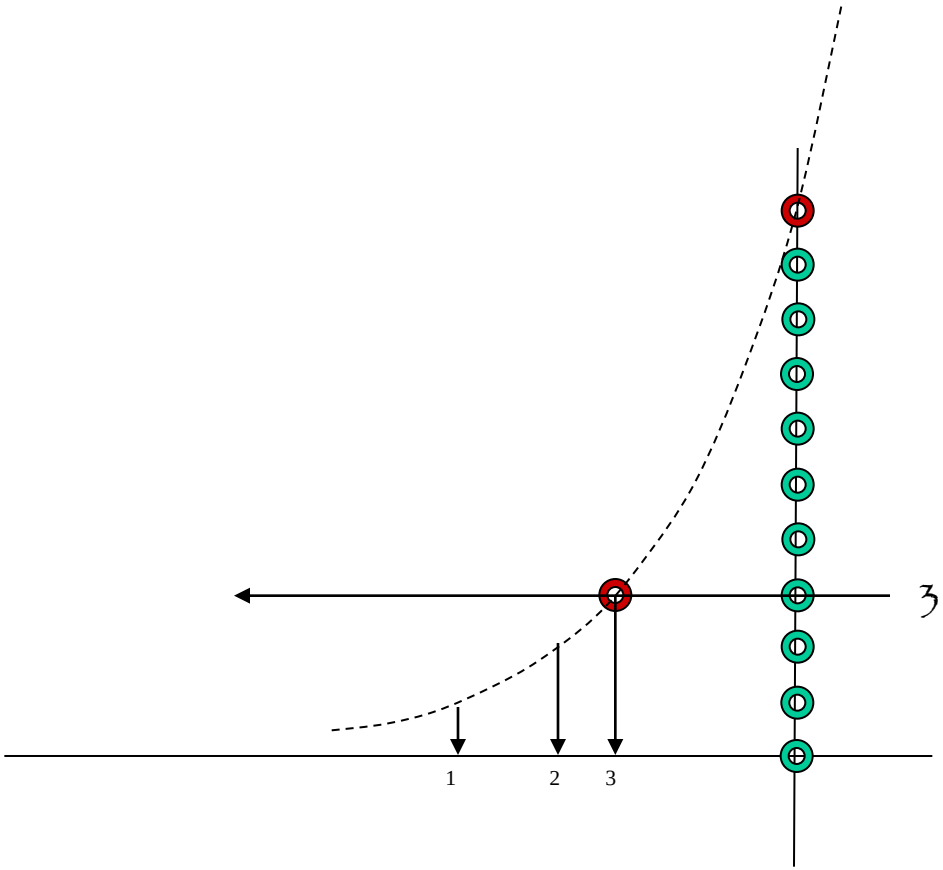
Now place a horizontal line through point #2 above the Y-axis



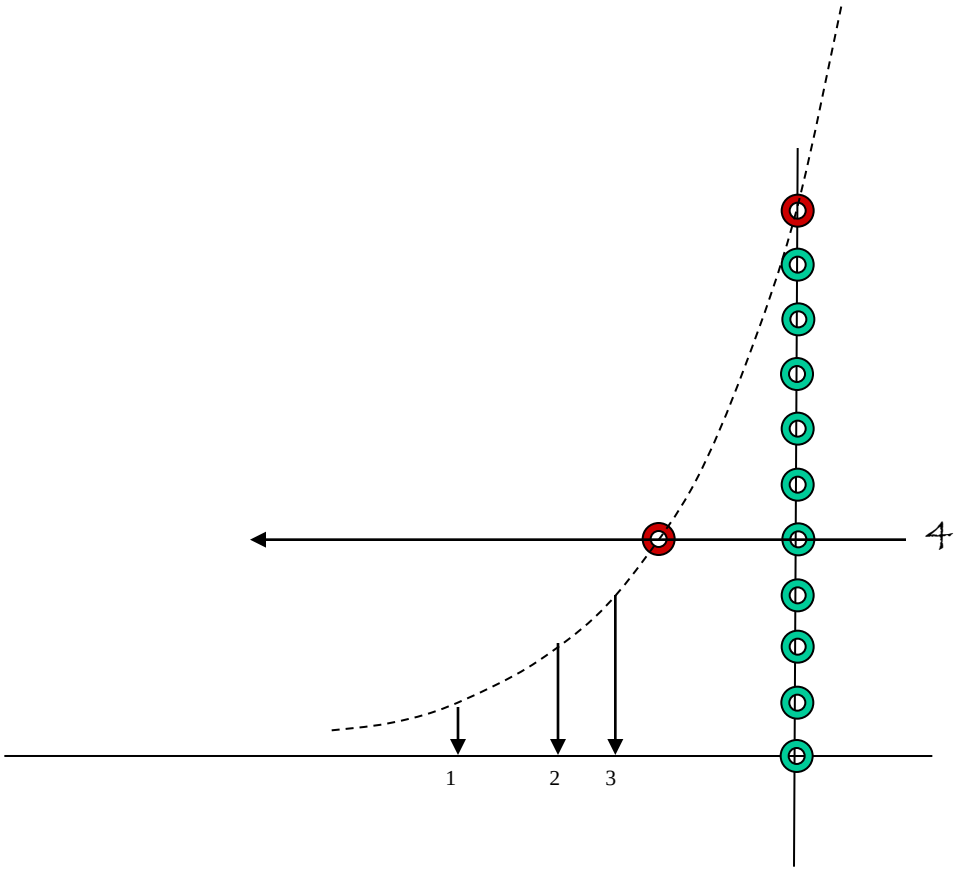
Drop a vertical line to the X-axis from the new intersection and mark it "2"....



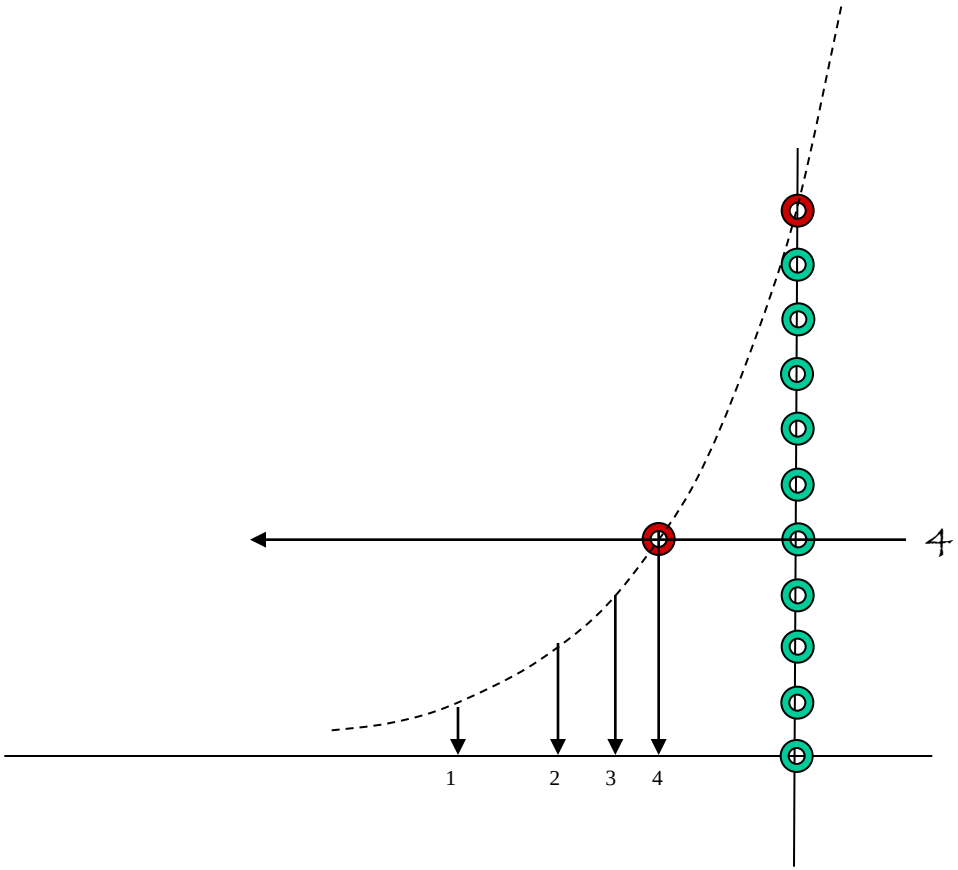
Now place a horizontal line through point #3 above the Y-axis



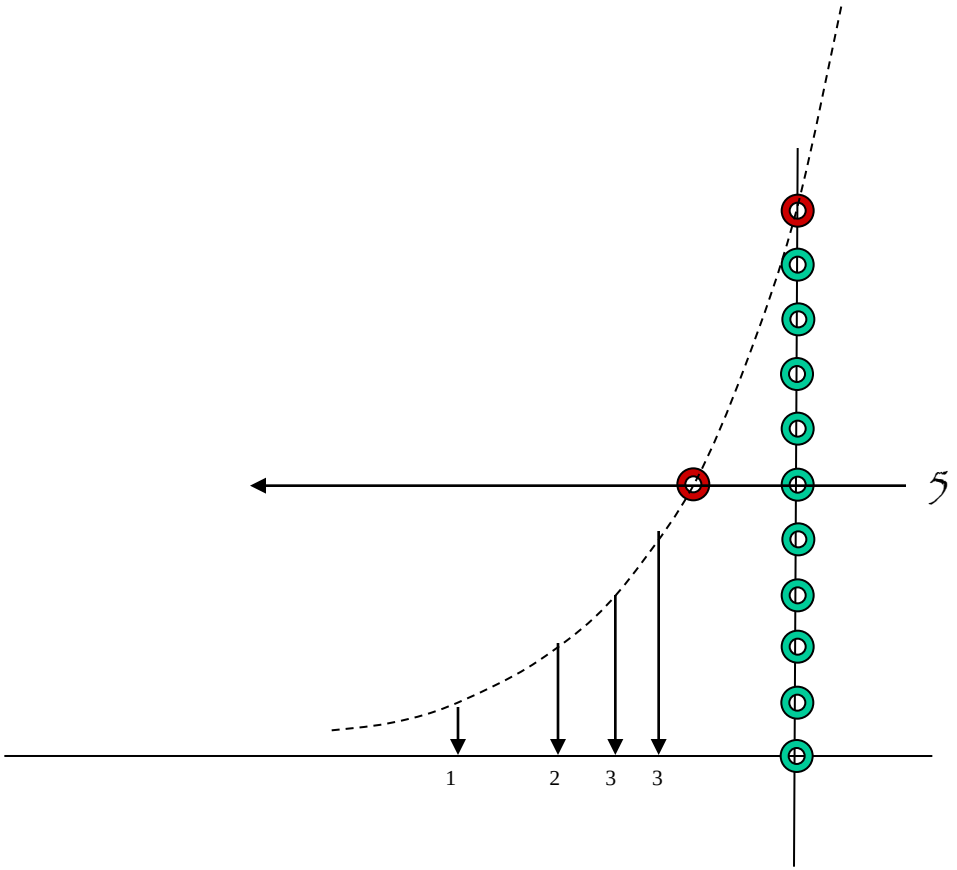
Drop a vertical line to the X-axis from the new intersection and mark it "3"....



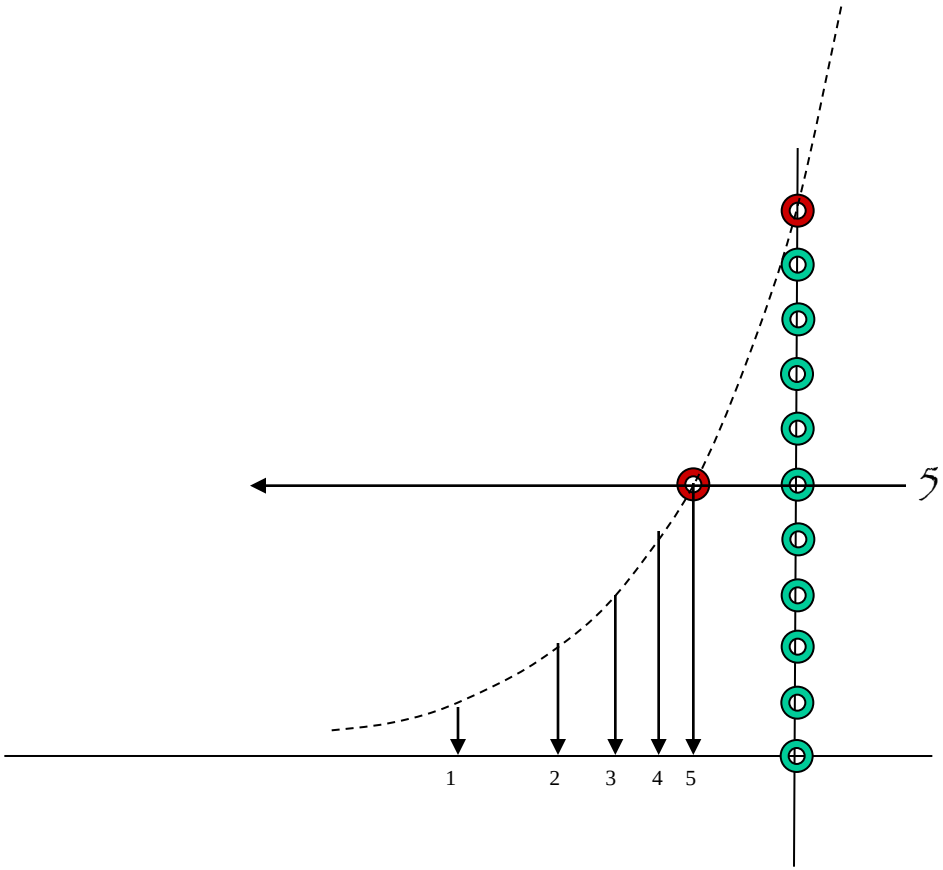
Now place a horizontal line through point #4 above the Y-axis



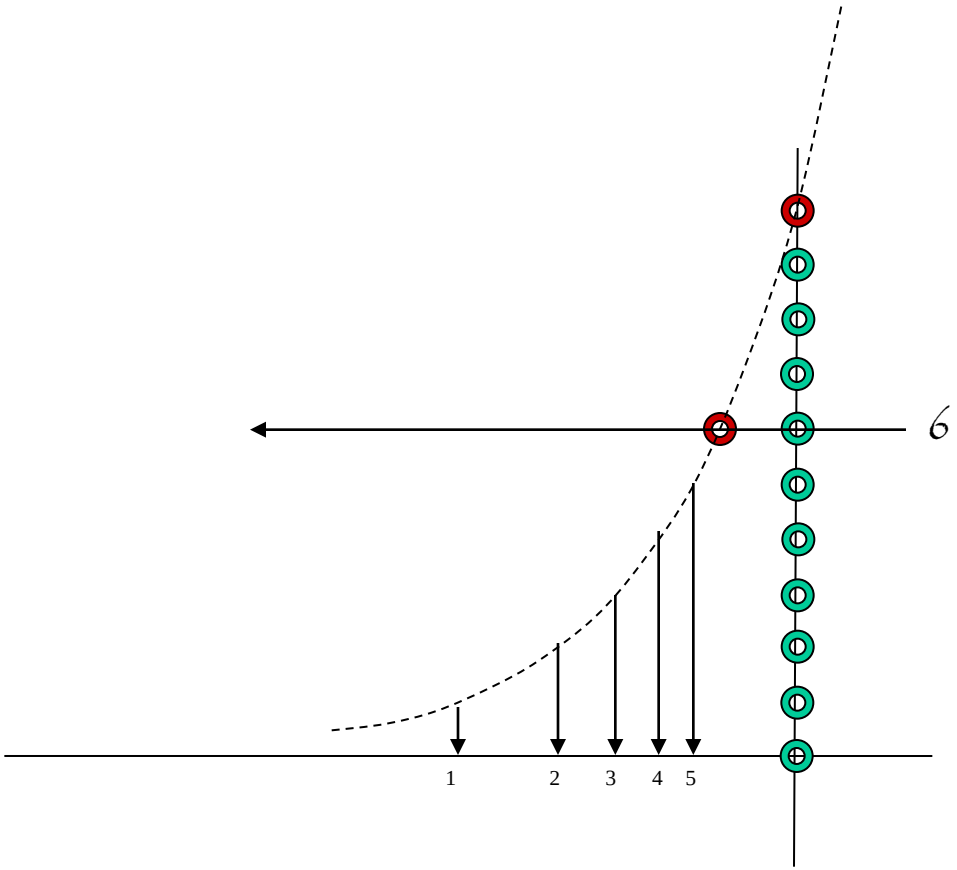
Drop a vertical line to the X-axis from the new intersection and mark it "4"....



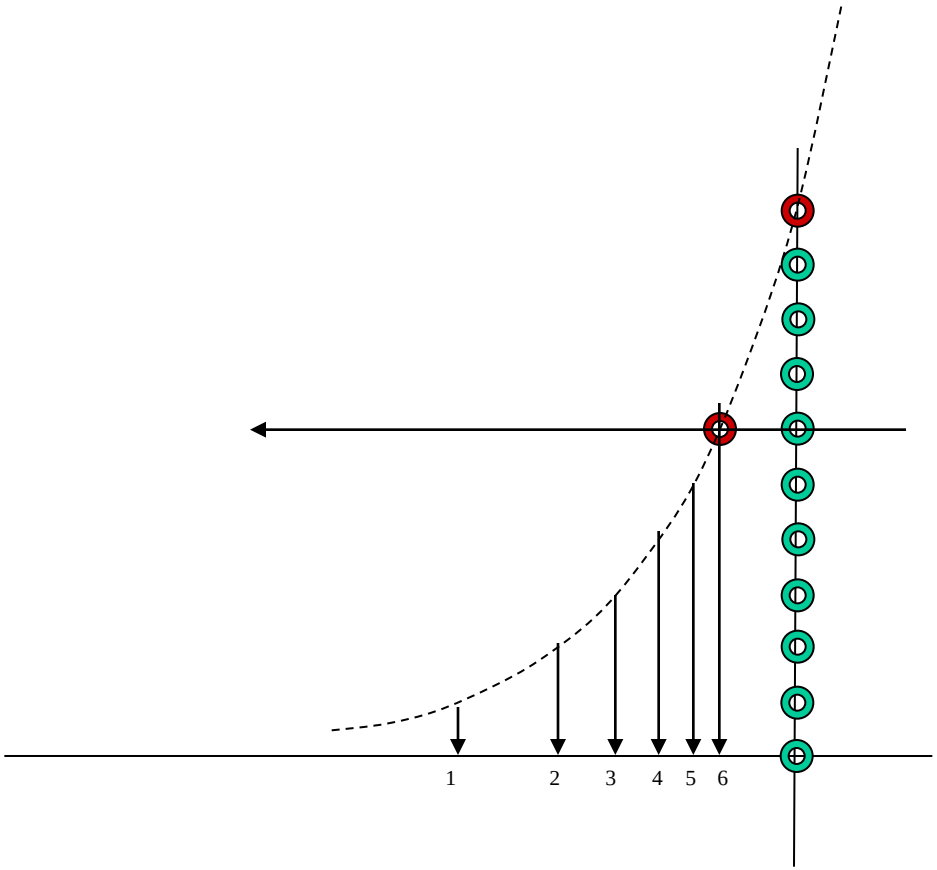
Now place a horizontal line through point #5 above the Y-axis



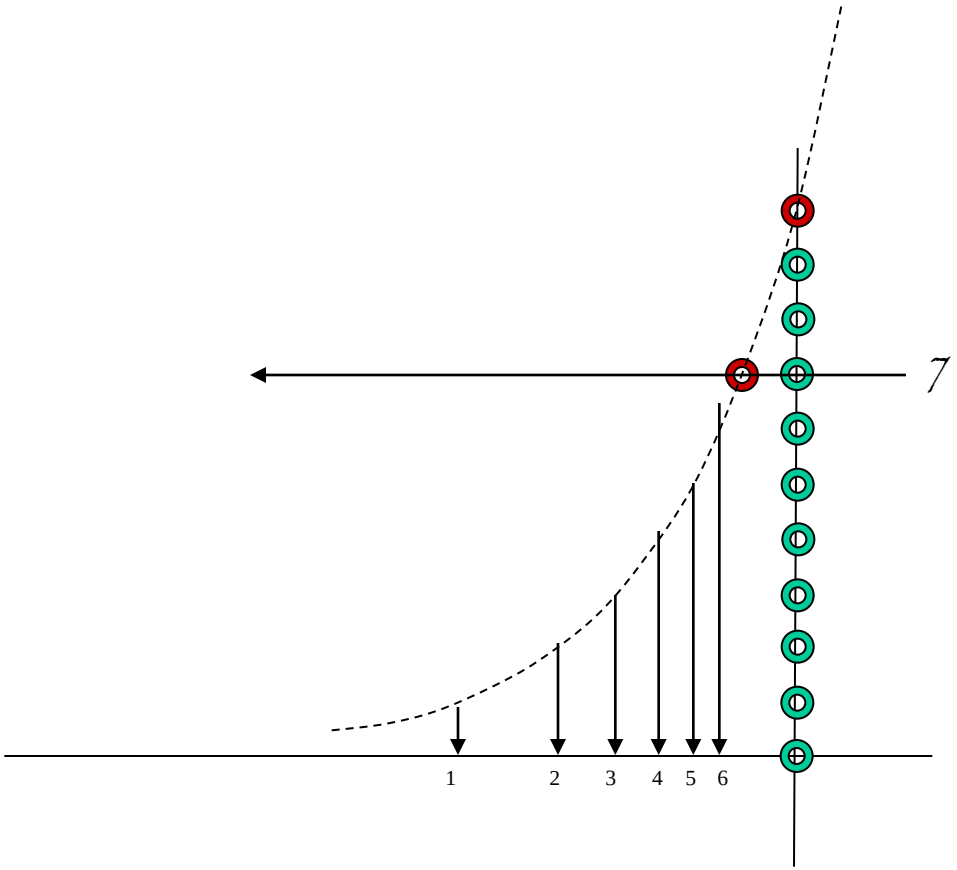
Drop a vertical line to the X-axis from the new intersection and mark it "5"....



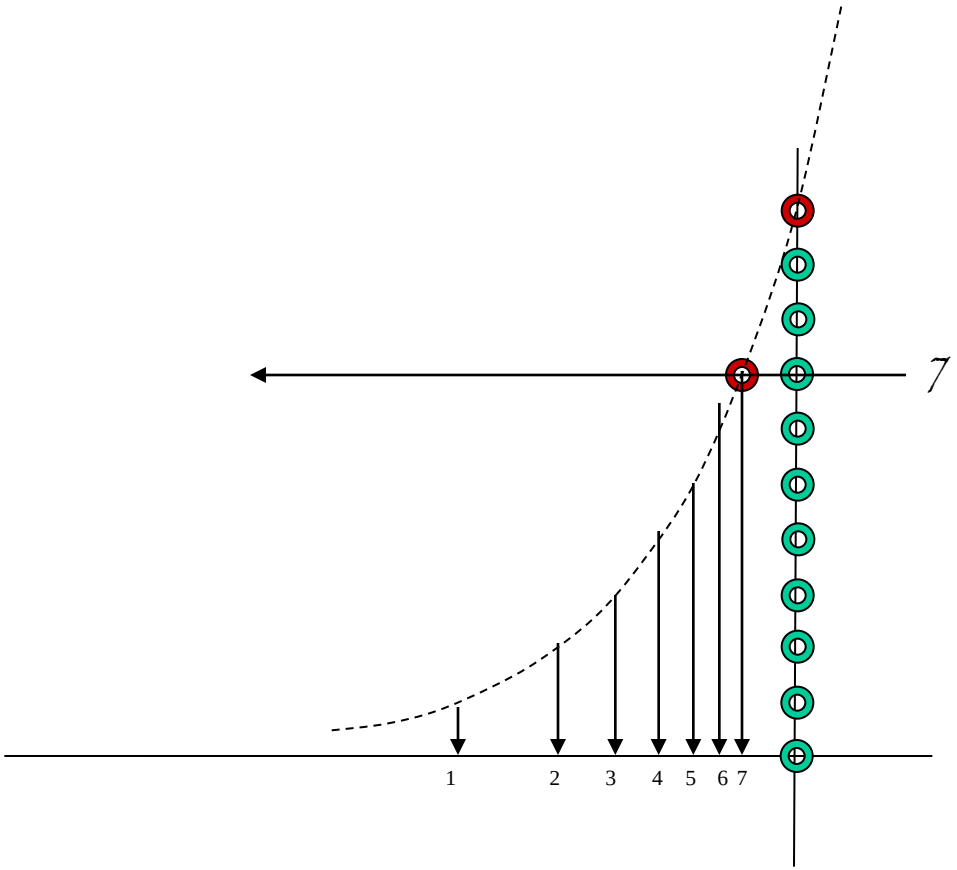
Now place a horizontal line through point #6 above the Y-axis



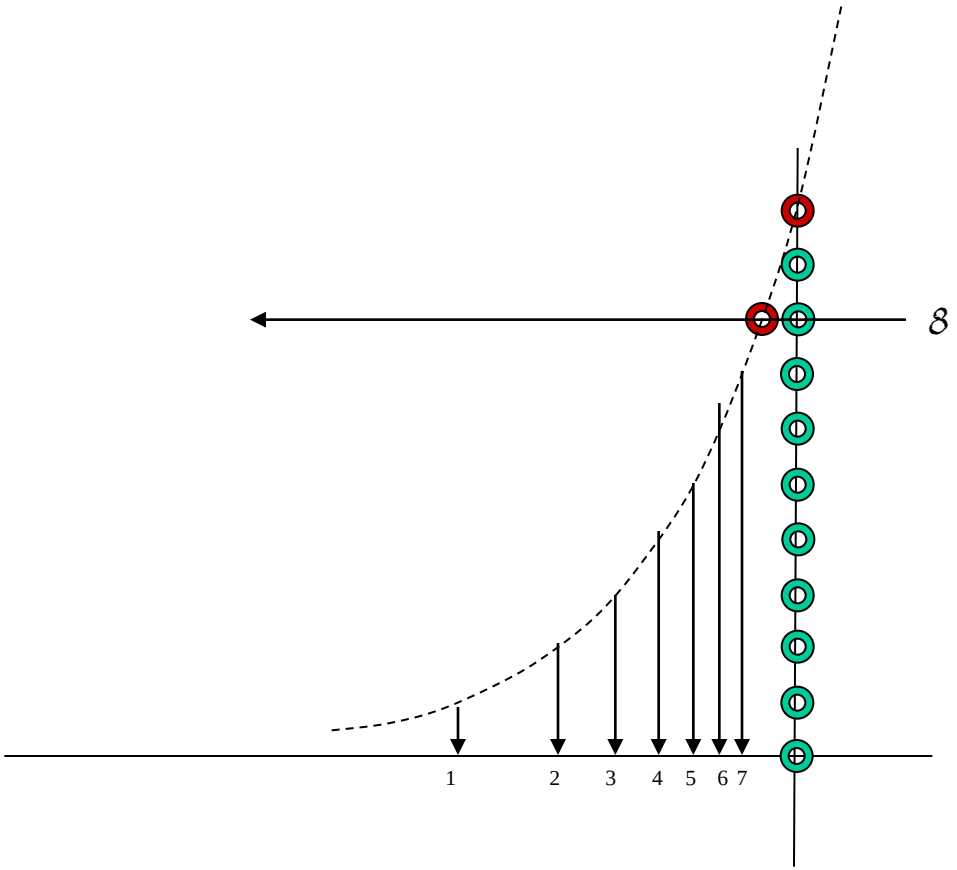
Drop a vertical line to the X-axis from the new intersection and mark it "6"....



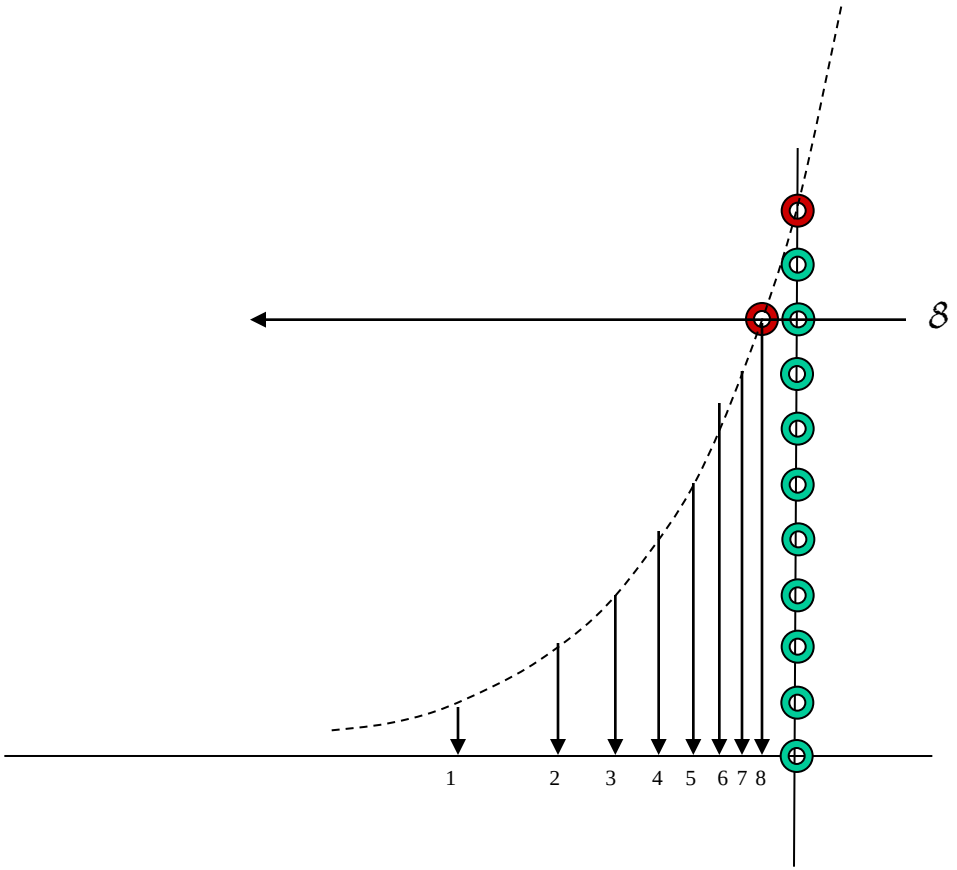
Now place a horizontal line through point #7 above the Y-axis



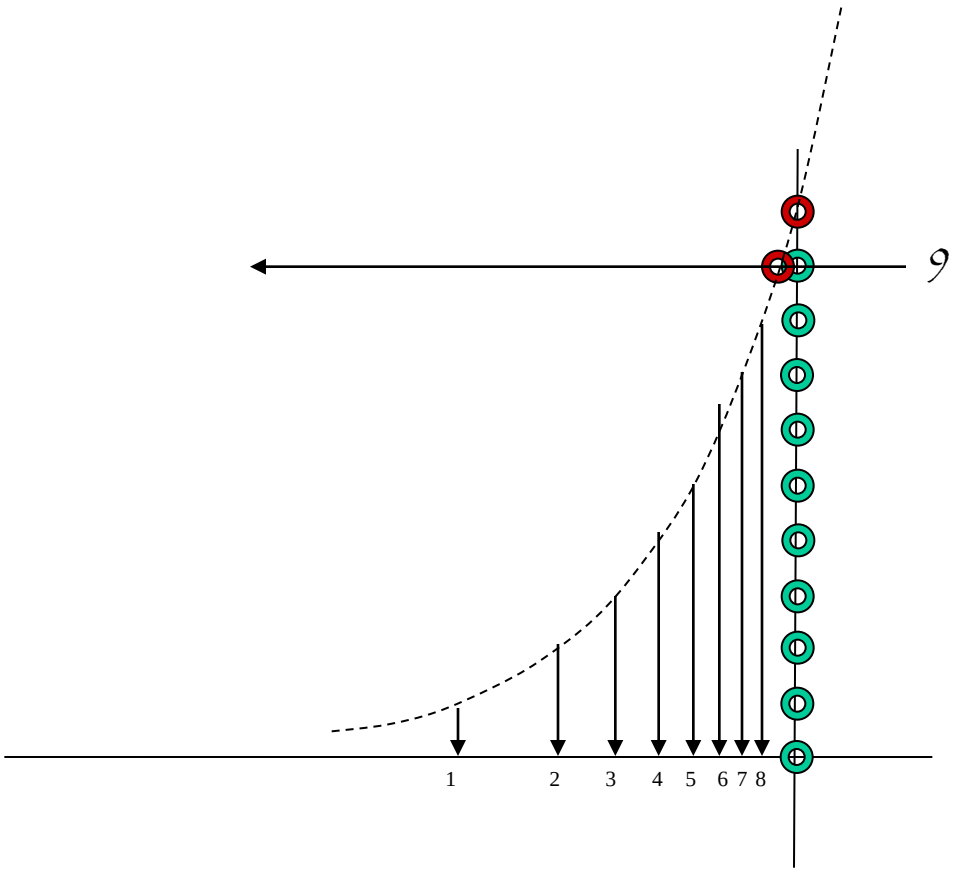
Drop a vertical line to the X-axis from the new intersection and mark it "7"....



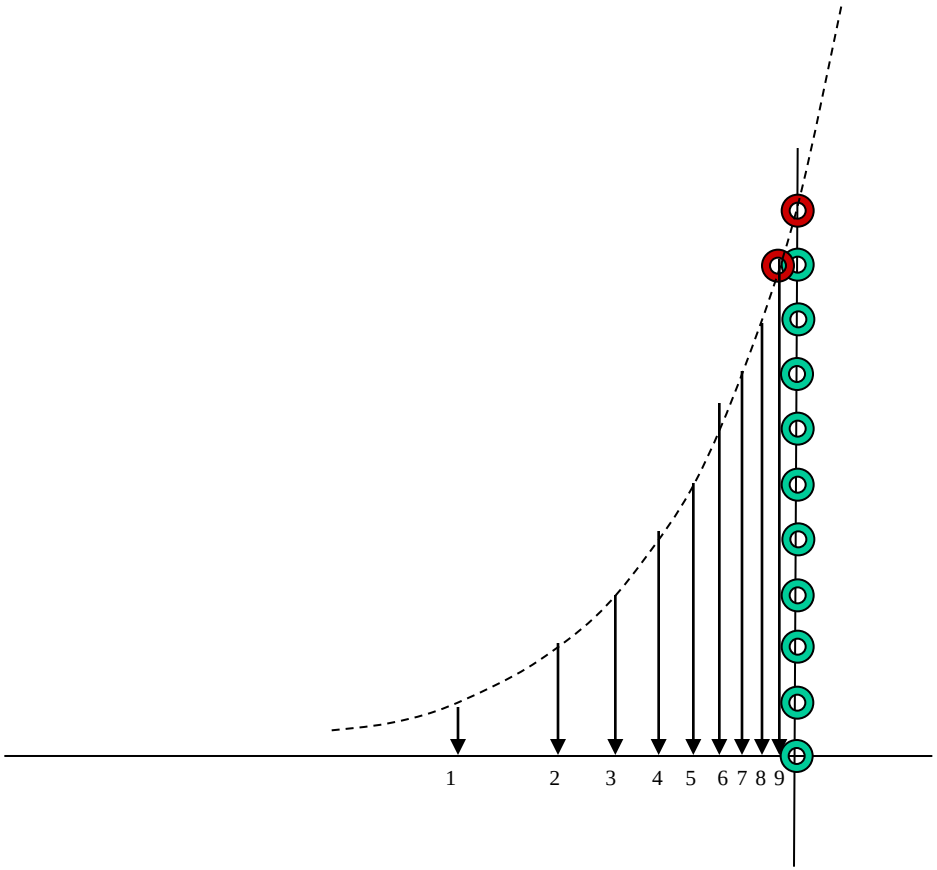
Now place a horizontal line through point #8 above the Y-axis



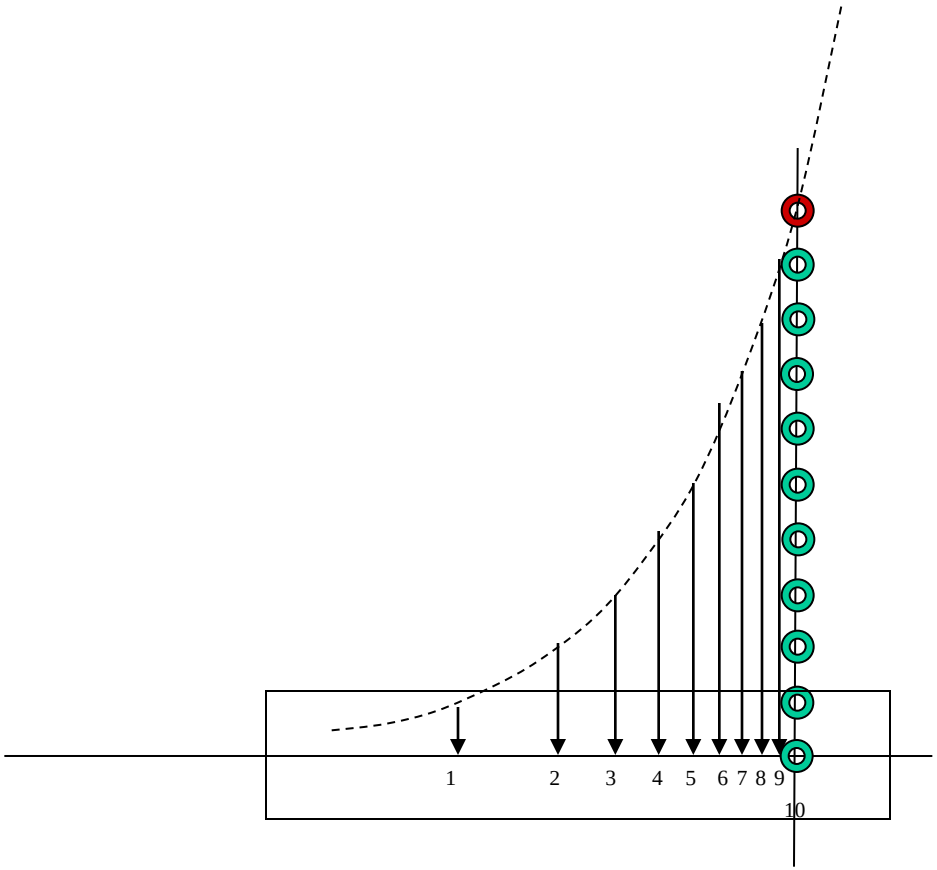
Drop a vertical line to the X-axis from the new intersection and mark it "8"....



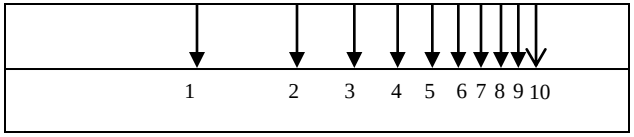
Now place a horizontal line through point #9 above the Y-axis



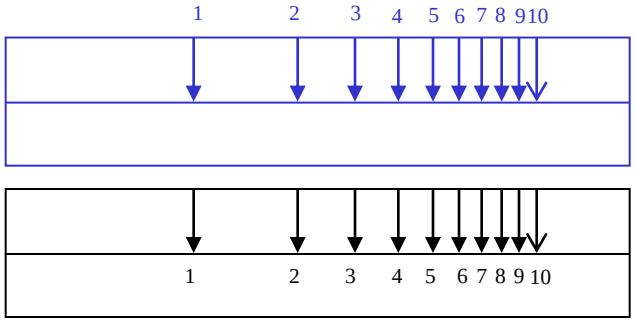
Drop a vertical line to the X-axis from the new intersection and mark it "9"....



DONE! Copy the X-axis markings to the Tick Strip



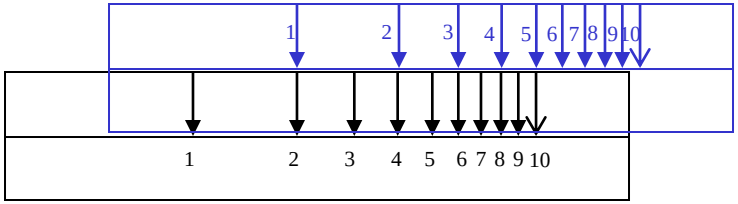
You have marked the function $\log_b(x)$, the slide rule scale, on your Tick Strip



A slide rule uses two such scales; so, take a second tick strip and make a copy (shown here in blue) of the first scale (black)

Multiply

For example: Multiply by **2**



To Use your new Tick Strip Slide Rule

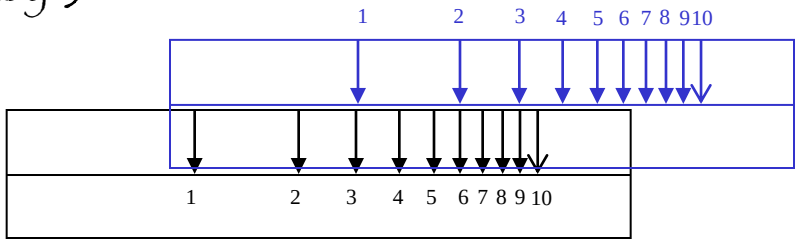
To multiply by 2:

Slide the strips to put the "1" mark of the blue scale over the "2" on the first scale,
you will see that :

under the blue 3 there is a 6 = (2x3) on the first scale
under the blue 4 there is a 8 = (2x4) on the first scale

Multiply

For example: Multiply by 3

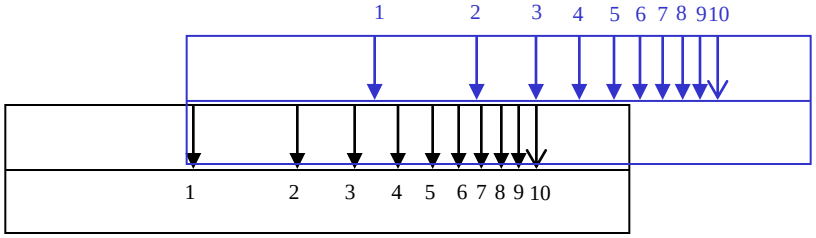


To Use your new Tick Strip Slide Rule

To multiply by 3:

Slide the strips to put the "1" mark of the blue scale over the "3" on the first scale,
you will see that :

under the blue 2 there is a 6 = (3x2) on the first scale
under the blue 3 there is a 9 = (3x3) on the first scale

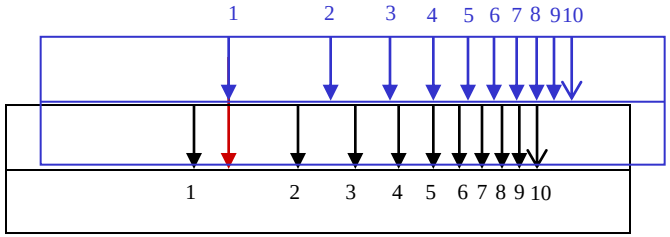


Etc...

All the rules for a regular slide rule apply.....

Division,

For example 5/4 = 1.25

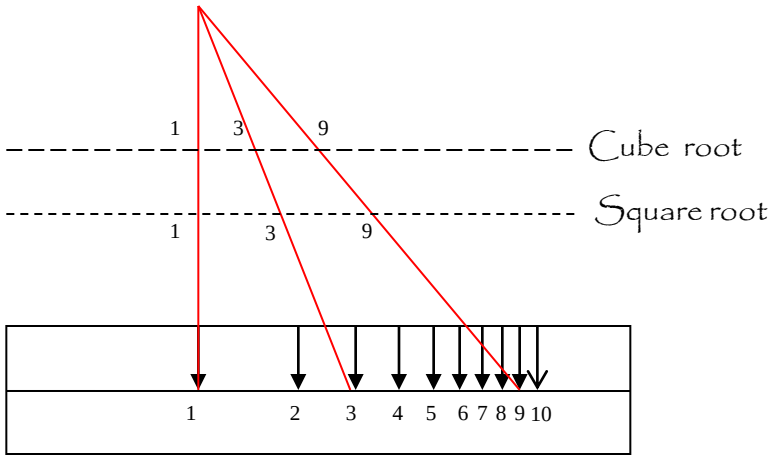


To divide 5 by 4 :

Slide the strips to put the "4" mark of the blue scale over the "5" on the first scale,

Under the "1" on the blue scale you will see 1.25 = (5/4) on the first scale

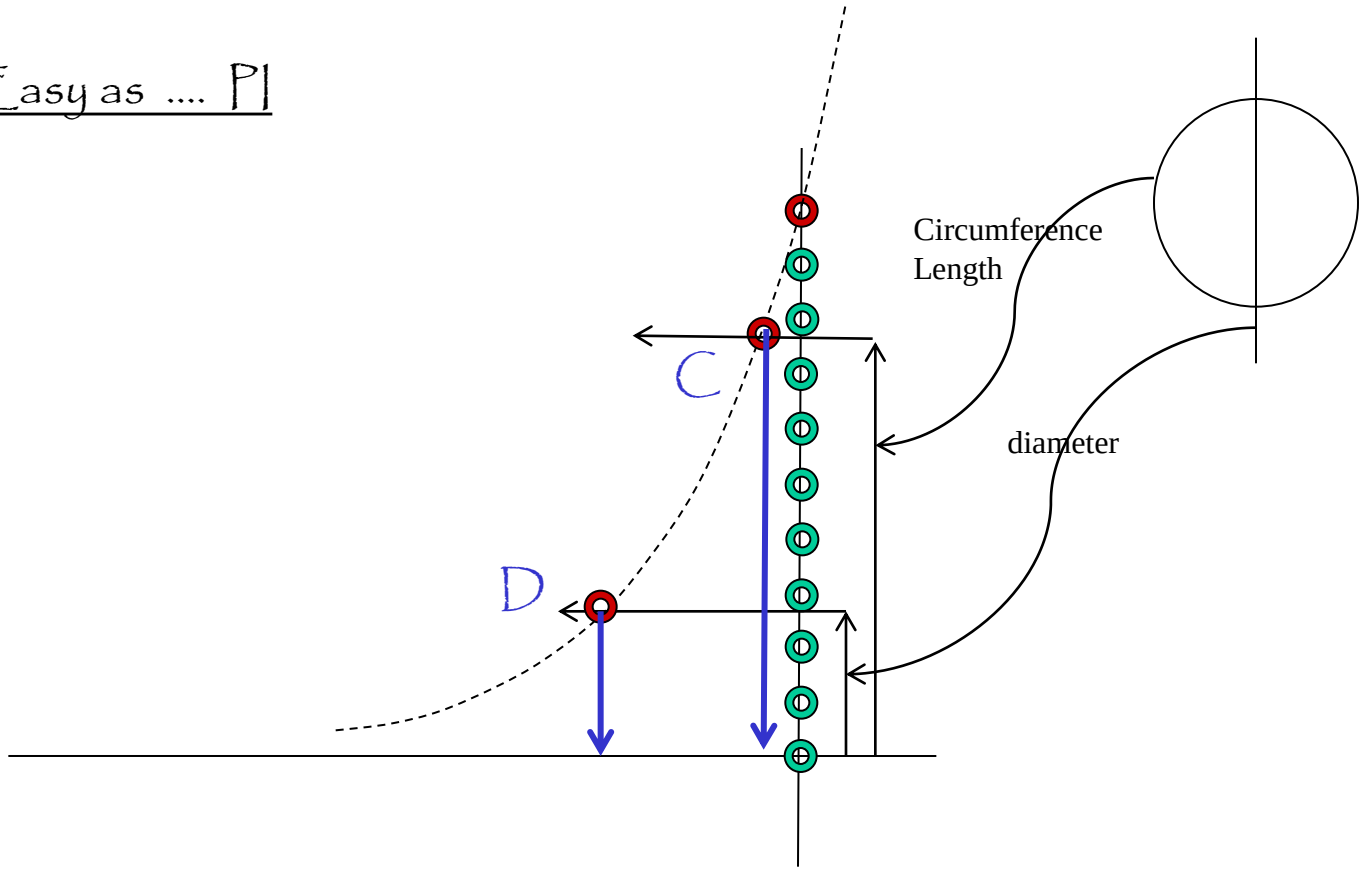
And there could be MORE!



Square Roots: A new scale ½ the proportions of the log scale would give the square roots.... This can be made with the tick strip.

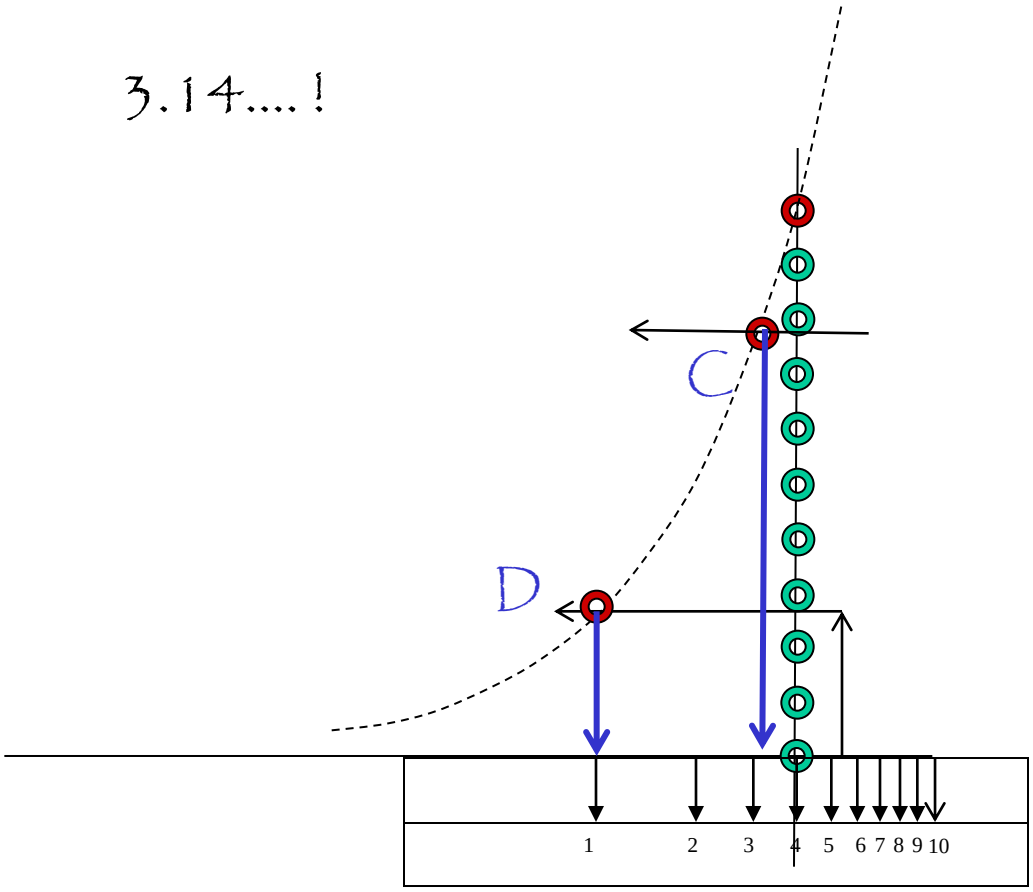
Cube Roots, Another new scale 1/3 the proportions of the log scale would give cube roots..... This can be made with the tick strip.

Easy as .... PI



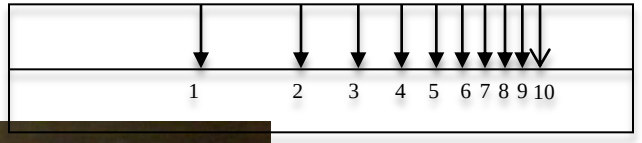
Measure the length of a circle's circumference and diameter with a tick strip and mark them as D and C on the Y-axis and the curve

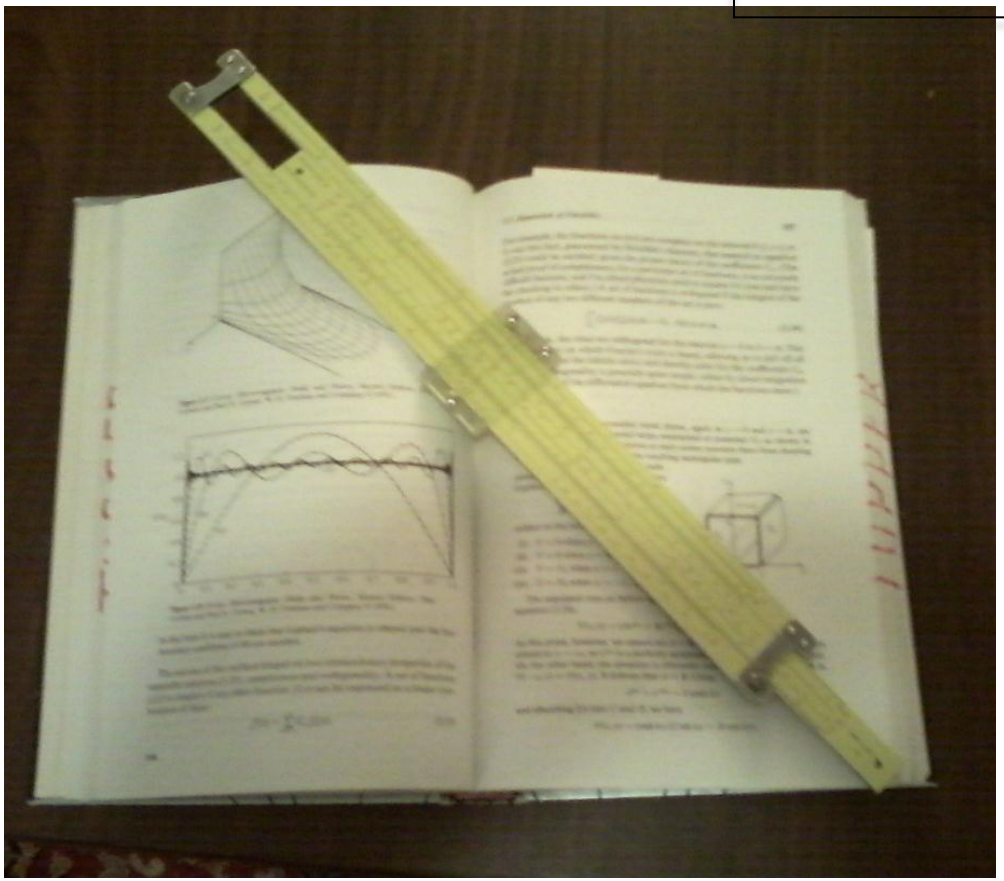
3.14.... !



Place the 1 of your log scale on the D point of the X-axis,
Find (3.14 =PI) under the C point, because PI * diameter = circumference....
You can mark PI on your log scale for later use.

Enjoy your own....





.....Tick Strip Slide Rule