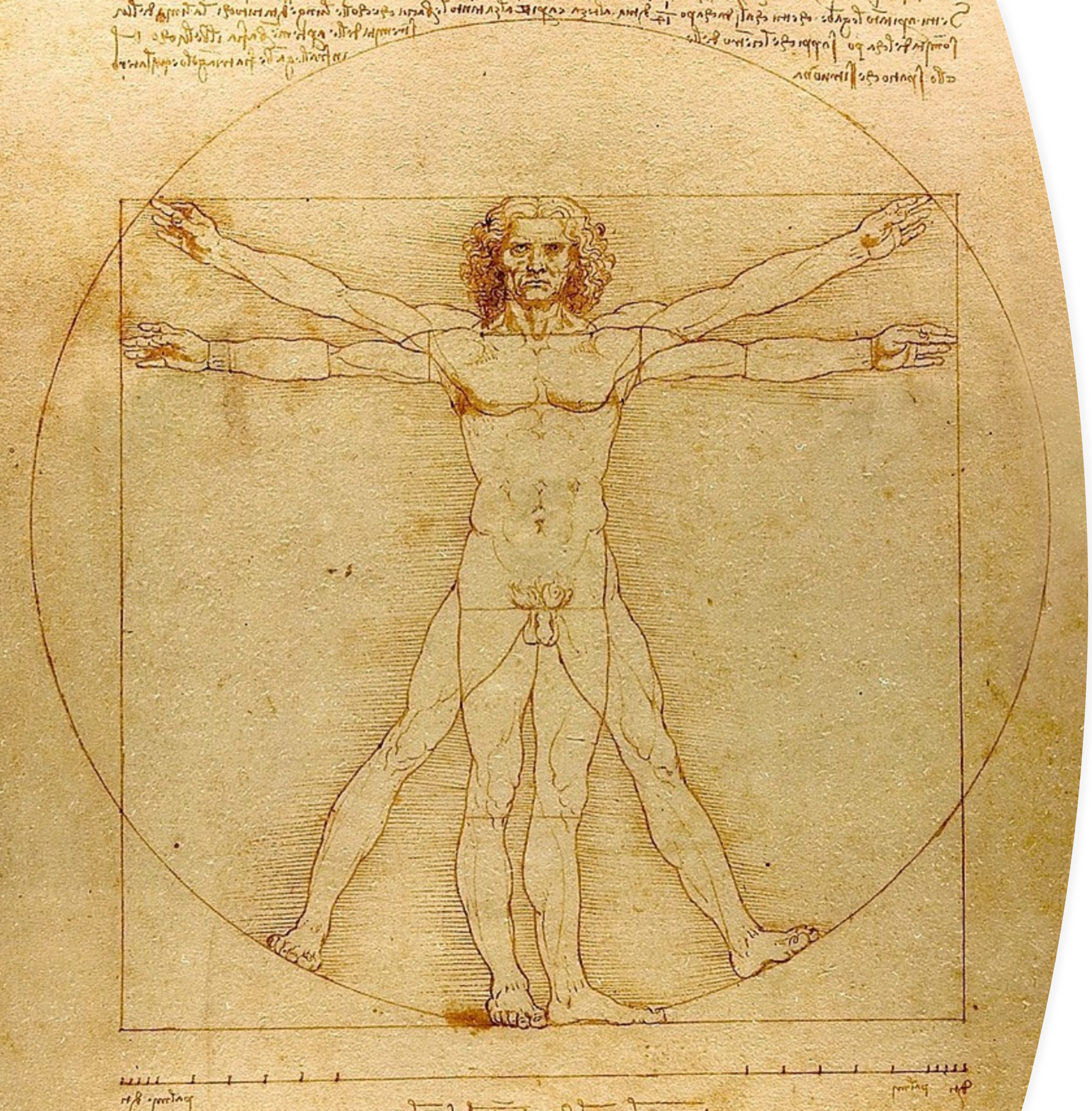


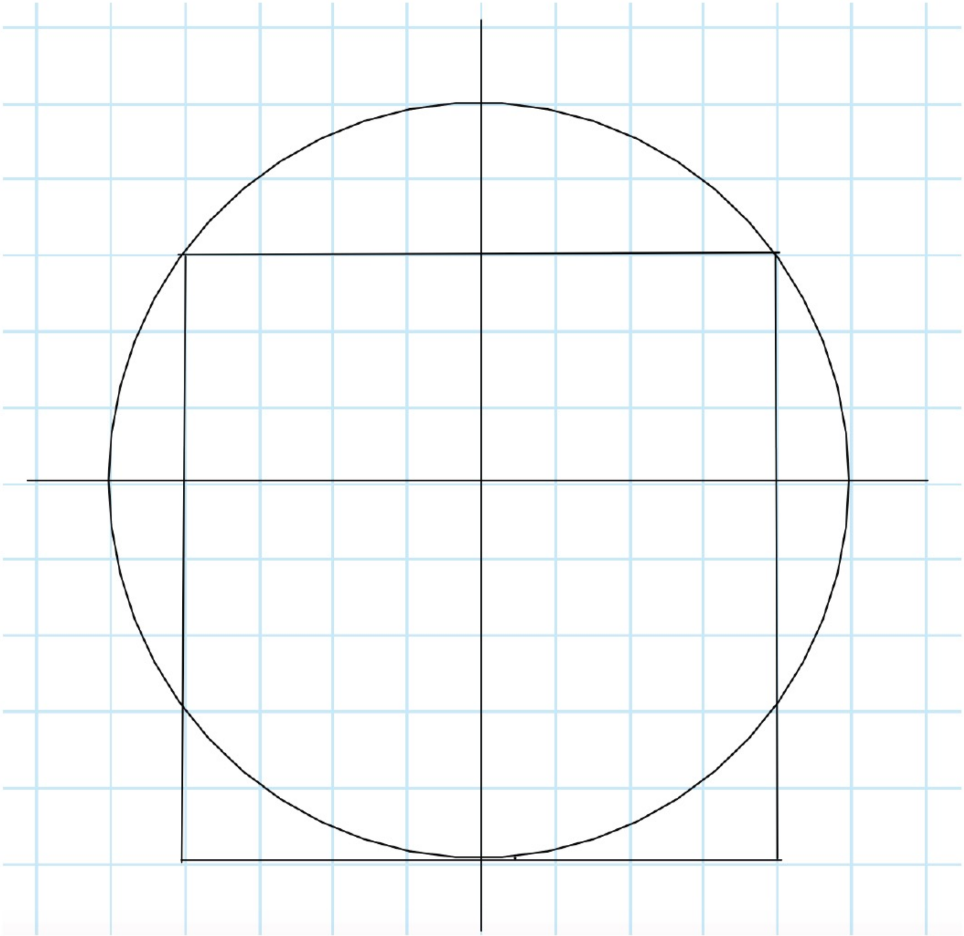
“Perfecting” Leonardo da Vinci diagram

- ***By Ivan Retamoso Ph.D. BMCC***

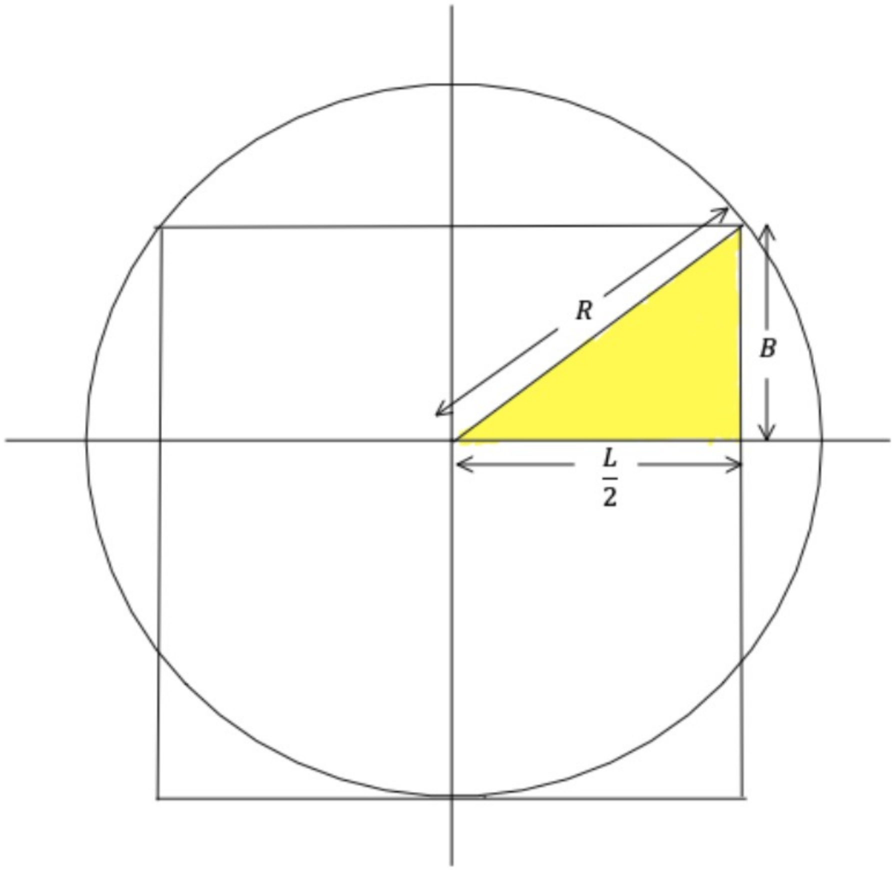
Method to construct a "Perfect da Vinci diagram"

1. In a Cartesian plane Draw a circle centered at $(0,0)$ with radius equal to 5 units.
2. Draw a segment tangent to the circle at the point $(0,-5)$ having length 8 units.
3. From the end points of the tangent segment to the circle raise two perpendiculars.
4. The perpendicular lines from step 3 will intercept the circle at two points, connect these two points with a segment.

The result of following the 4 steps is a "Perfect da Vinci diagram" and it is shown below:



In general, suppose we are given a “Perfect da Vinci diagram” constructed out of a circle of radius R and a square with L as the length of its side, see figure below.



Then by the Theorem of Pythagoras we have that

$$B^2 + \left(\frac{L}{2}\right)^2 = R^2$$

From the Figure

$$B = L - R$$

Then

$$(L-R)^2+\left(\frac{L}{2}\right)^2=R^2$$

Expanding

$$L^2-2LR+R^2+\frac{L^2}{4}=R^2$$

Subtracting R^2 from both sides of the equation, multiplying by 4 both sides of the equation and simplifying we get

$$5L^2-8LR=0$$

Factoring out L and eliminating it via division ($L \neq 0$ since it represents a length) we get

$$5L-8R=0$$

Equivalently

$$5L = 8R$$

Finally, we get

$$\frac{R}{L} = \frac{5}{8}$$

The above is a necessary condition for the “Perfect da Vinci diagram” to exist.

Conclusion:

A “Perfect da Vinci diagram” can be constructed using a circle and a square if and only if the ratio between the radius of the circle and the length of the side of the square is 5 to 8.

Using our “Perfect da Vinci diagram” above.

If $L = 8\,units$ then

$$\frac{L}{2} = 4\,units$$

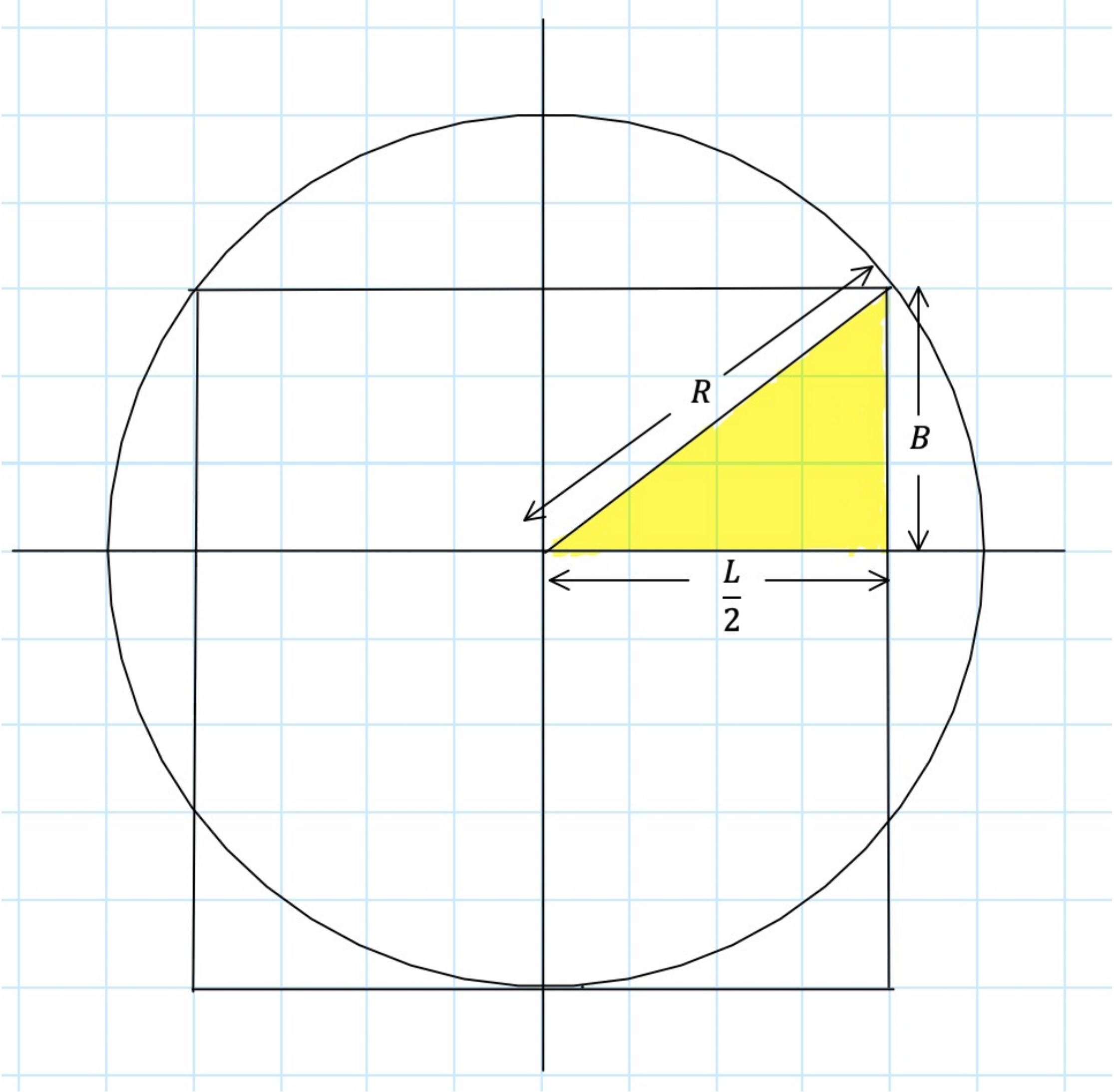
Using the ratio stated above

$$R = 5\,units$$

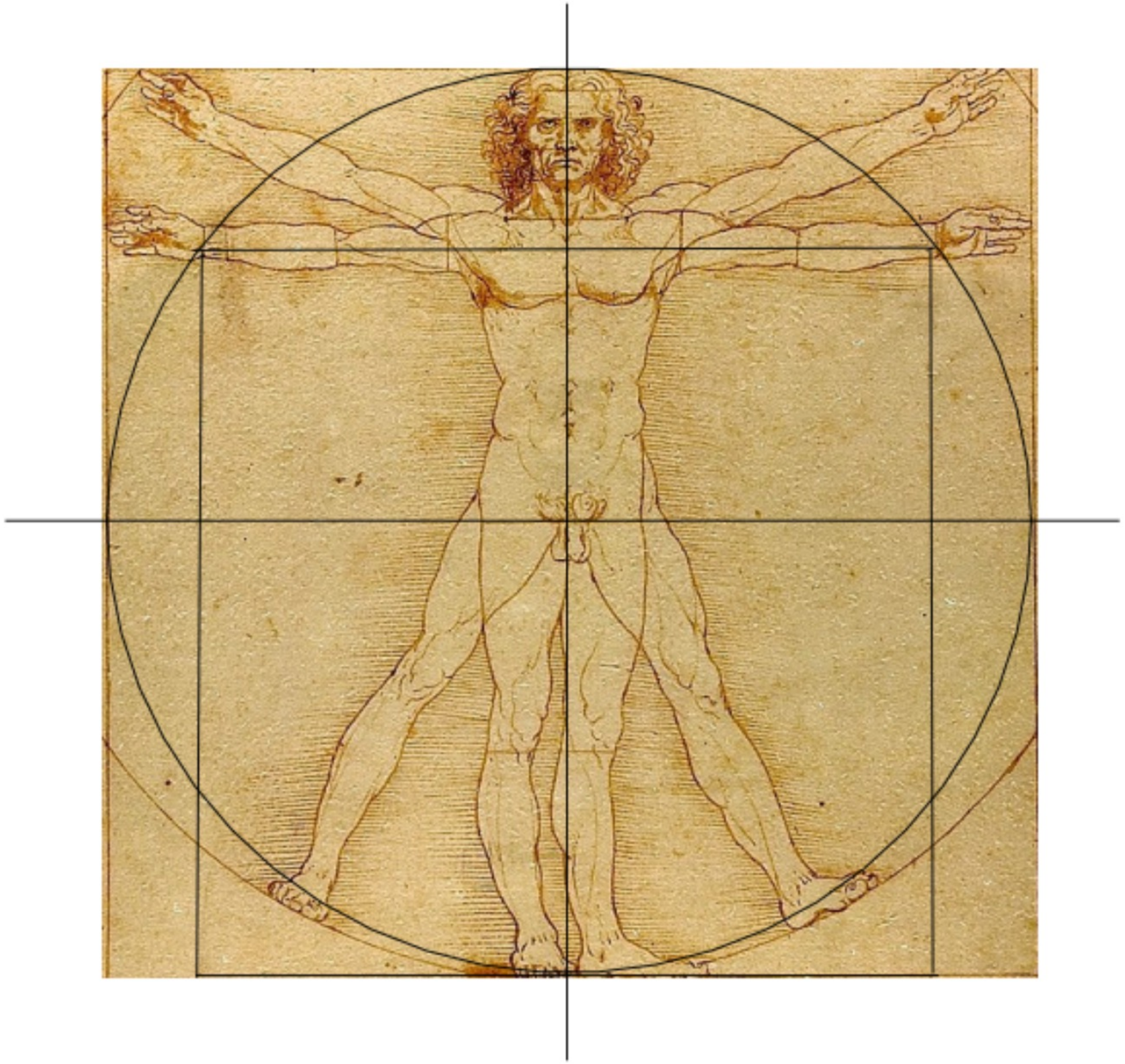
And from $B = L - R$

$$B = 3\,units$$

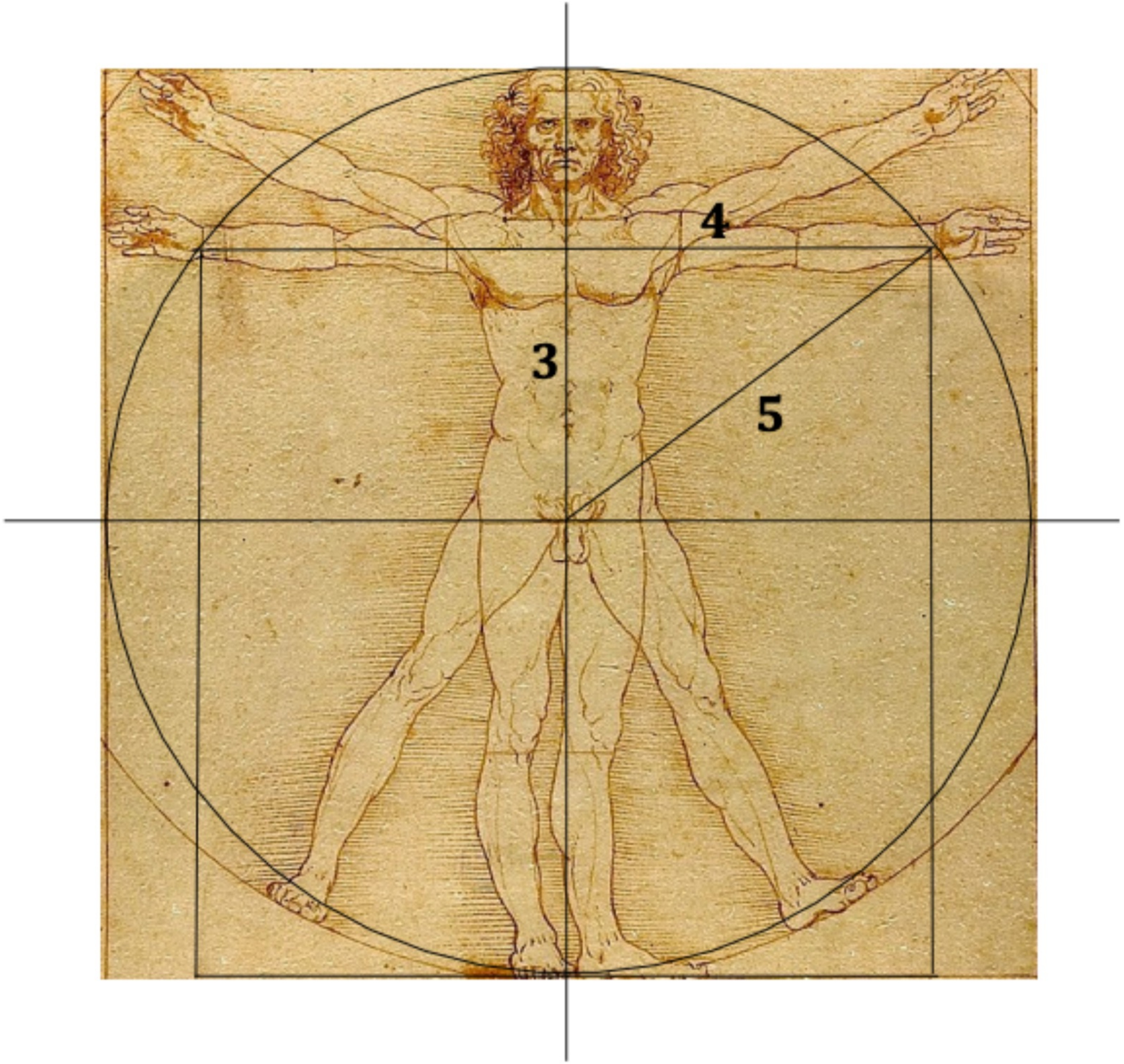
Which means that the shaded triangle is a Pythagorean $3 - 4 - 5$ triangle. This suggests to me that the Pythagorean numbers may be embedded in the proportions of the measurements of a human body, at least in average.



Lastly, I superimposed the "Perfect da Vinci diagram" into the "Vitruvian Man diagram" and this is what happened, notice how the horizontally extended arms almost perfectly fit up to the wrists when properly chosen proportional circle of the "Perfect da Vinci diagram" is tangent to the circle of the "Vitruvian Man diagram" on the base.



Moreover, the Pythagorean $3-4-5$ triangle mentioned before, is clearly now embedded in the proportions of an average human body as shown in the figure below.



It is left to the reader to continue analyzing this “superposition” of figures to discover more properties that were not noticed when studying the proportions of an average human body.

Thanks!

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