Solved by M.Said Alghabra (MTH 213, Fall 2017)

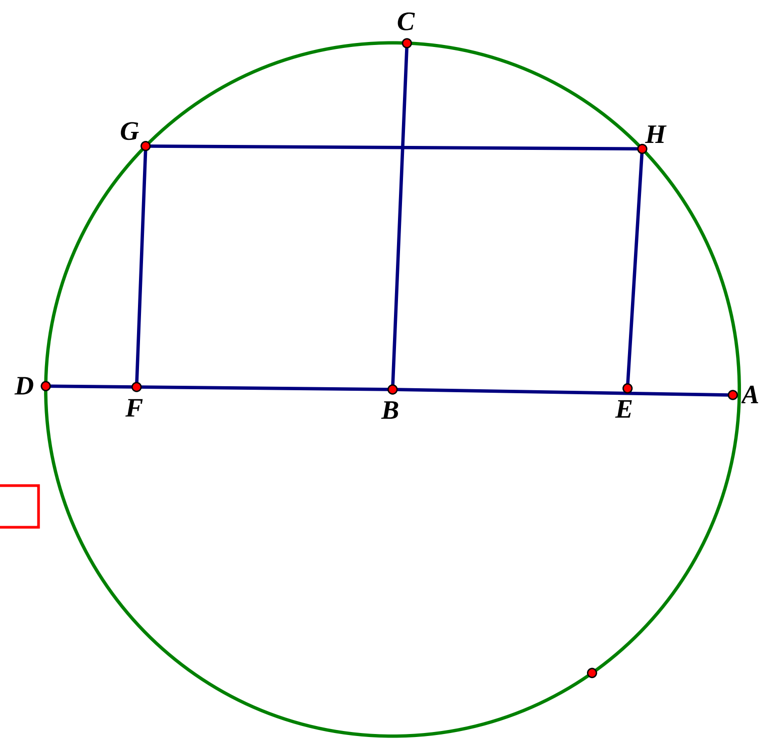
99.99 AED

Imagine that you found yourself in a desert, no TV, no Mobile, no ..... you saw a perfect circle that was drawn on sand (let us say flat-sand). You only have a piece of wood (let say UNMARKED RULER). assume that the length of the unmarked ruler is X. Using the unmarked ruler you were able to measure AB and you discovered that 2X< |AB| < 3X (Note |AB| = |CB| = |BD|). Imagine that your mathematical-knowledge does not exceed a 12th-grade student. Some how you were able to construct a rectangle HEFG inside the upper-half of the circle such that |HE| = (5/8)|EF|

Question:
State clearly the steps that you used in order to construct such rectangle. Assume that you can draw perpendicular line-segments to the line-segment AB just by using your finger + the unmarked ruler

Comment: This is not a hard problem at all (I guess). However, you need to use a very beautiful Mathematical concept that we all are familiar with !!!

:))))))))))) As usual: Calculators, Try and Error, and Computer programs are NOT ACCEPTED. You need to give me a correct mathematical argument that clarify your solution



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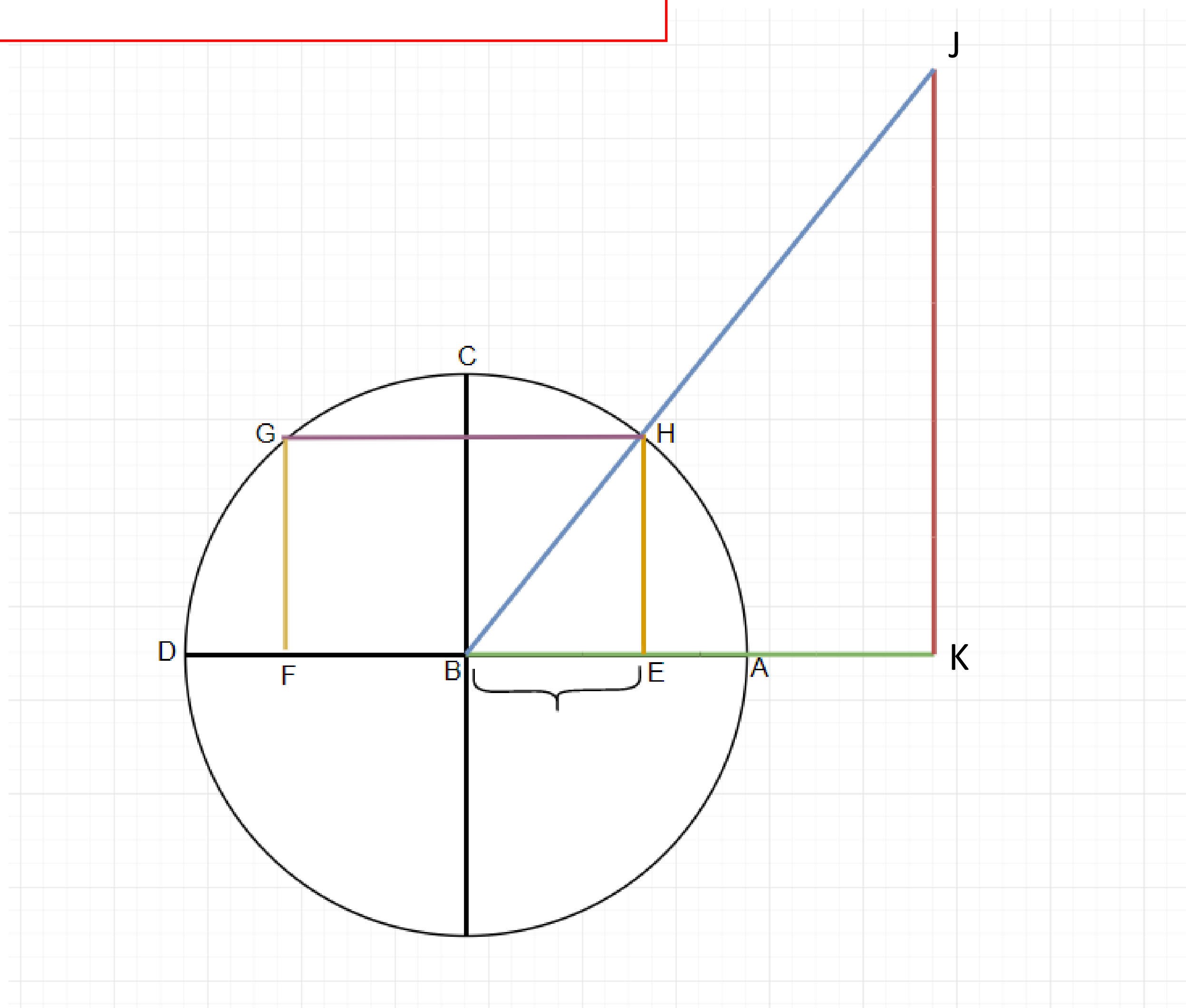

First of all, we can use the unmarked ruler (X) to draw a line segment of magnitude (4X) along the radius (BA) starting from the center B and going right. (This is the green line segment (BK) in the drawing)

Second, starting from the end of the green line segment, we draw a straight line that is perpendicular to the green line (also parallel to the radius BC of the circle) and has a magnitude of (5X) (This is the red line segment (JK) in the drawing). Therefore, we will have two lines (BK) and (JK) where

$$\frac{5}{4}\,|\mathrm{BK}| = |\mathrm{JK}|$$

Third we connect the new point (J) to the center of the circle (B) so we will have the triangle (BJK).

At the point (H), where BJ crosses the circle we draw the line (HE) perpendicular to BK and hence we have another triangle (BHE).

So the two triangles BJK and BHE share the same angle B and both are right angle triangles, therefore they are similar triangles and hence it also has the same ratio where

$$\frac{5}{4}\,|\mathrm{BE}| = |\mathrm{HE}|$$

Lastly, we draw a line (HG) parallel to the radius of the circle (AD) then we draw another line (GF) that is perpendicular to the radius (AD) so we will have the line (EF) which is twice the length of EB therefore we will have the new ratio

$$\frac{5}{8}\,|\mathrm{EF}| = |\mathrm{HE}|$$

And that’s how we can get the requested triangle!!