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## A silly geometry problem: length of side of square in circular quadrant

Problem from Solving a geometry question that no one can figure out.
My solution (before numerical reduction), using basic trig and complex numbers, is illustrated in fig. 1.1.


Figure 1.1: With complex numbers.
We have

$$
\begin{align*}
s & =x \cos \theta \\
y & =x \sin \theta \\
p & =y+x e^{i \theta} \\
q & =i s+x e^{i \theta}  \tag{1.1}\\
|q| & =y+5 \\
|p-q| & =2 .
\end{align*}
$$

This can be reduced to

$$
\begin{align*}
\left|x e^{i \theta}-5\right| & =2 \\
x\left|i \cos \theta+e^{i \theta}\right| & =x \sin \theta+5 . \tag{1.2}
\end{align*}
$$

My wife figured out how to do it with just Pythagoras, as illustrated in fig. 1.2.


Figure 1.2: With Pythagoras.

$$
\begin{align*}
(5-s)^{2}+y^{2} & =4 \\
(s+y)^{2}+s^{2} & =(y+5)^{2}  \tag{1.3}\\
x^{2} & =s^{2}+y^{2} .
\end{align*}
$$

Either way, the numerical solution is 4.12. The geometry looks like fig. 1.3.
A mathematica notebook to compute the numerical part of the problem (either way) and plot the figure to scale can be found in my mathematica github repo.


Figure 1.3: Lengths to scale.

