The main things to keep in mind are $CD = CH$, $EH = HI$, and $HI = CJ (= EH)$. To do this without trigonometry you need to notice that

$$\frac{CE}{CD} = \frac{HI}{HJ}$$

Since they are both regular pentagons. Note that that $CD = 1$ and $HI = EH = CE - CD = CE - 1$. Furthermore, $CH + EJ = 2CD$ and $CH + EJ = CE + HJ$, so $HJ = 2CD - CE = 2 - CE$. So we have the equation,

$$\frac{CE}{1} = \frac{CE - 1}{2 - CE}$$

replacing $CE$ with $x$,

$$x = \frac{x - 1}{2 - x}$$

Solving this

$$x = \frac{x - 1}{2 - x}$$

$$2x - x^2 = x - 1$$

$$x^2 - x - 1 = 0$$

$$x = \frac{1 \pm \sqrt{1 - 4(1)(-1)}}{2}$$

$$x = \frac{1 \pm \sqrt{5}}{2}$$

Since $x$ is a length we must have $x = \frac{1 + \sqrt{5}}{2}$, the golden ratio or golden mean.