1.) (5pts) Find all the points of intersection of the polar curves $r = \tan \theta$ and $r = \cot \theta$, $0 < \theta < \frac{\pi}{2}$.

2.) (5pts) Find the equation of the tangent line to the curve $r = \tan \theta$ at $\theta = 0$.

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**Second method to solve (1)**

\[ \cos \theta = \frac{1}{\sqrt{2}} \]
\[ \sin \theta = \pm \frac{1}{\sqrt{2}} \]

Since $0 < \theta < \frac{\pi}{2}$, we have to solve only $\cos \theta = \frac{1}{\sqrt{2}} \Rightarrow \theta = \frac{\pi}{4}$

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**First method to solve (1)**

\[ \sin \theta = \cos \theta \quad \text{or} \quad \sin \theta = -\cos \theta \]

\[ \sin \theta = \cos \theta = \sin \left( \theta + \frac{\pi}{4} \right) \]

\[ \theta = \theta + \frac{\pi}{4} + 2k\pi \]
\[ \text{or} \quad \theta = \pi - \left( \theta + \frac{\pi}{4} \right) + 2k\pi, \quad k \in \mathbb{Z} \]

This is $2\theta = \frac{3\pi}{2} + 2k\pi$

\[ \theta = \frac{\pi}{4} + k\pi \]

\[ \theta = \frac{\pi}{4} \]

\[ \sin \theta = -\cos \theta = \sin \left( \theta - \frac{\pi}{2} \right) \]

\[ \theta = \theta - \frac{\pi}{2} + 2k\pi \]
\[ \text{or} \quad \theta = \pi - \left( \theta - \frac{\pi}{2} \right) + 2k\pi \]

This is $2\theta = \frac{5\pi}{2} + 2k\pi$

\[ \theta = \frac{3\pi}{4} + k\pi \]

There is no solution here, because $0 < \theta < \frac{\pi}{2}$.

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Another way to solve (1)

\[ \cos^2 \theta = \sin^2 \theta = \cos^2 \theta - \sin^2 \theta = 0 \]
\[ \cos 2\theta = 0 \Rightarrow 2\theta = \frac{\pi}{2} + k\pi \]

\[ \theta = \frac{\pi}{4} + \frac{k\pi}{2} \]

\[ \theta = \frac{\pi}{4} \], since $0 \leq \theta < \frac{\pi}{2}$.