Write a proof by contradiction of proposition stated below. 
\( \sqrt{2} \) is irrational.

In your proof, use the definition of rational number, and use this theorem: \( n^2 \) is even iff \( n \) is even.

Proof
Suppose \( \sqrt{2} \) is rational.
Then \( \exists a \in \mathbb{Z}, \exists b \in \mathbb{Z} \) such that \( \sqrt{2} = a/b \), where the quotient is in lowest terms and \( b \) is not 0.

Square both sides of the equation \( \sqrt{2} = a/b \):
\[
2 = \frac{a^2}{b^2}
\]
Now solve for \( a^2 \):
\[
2b^2 = a^2
\]
This means that \( a^2 \) is even.
Since \( a^2 \) is even, \( a \) is even, so there is an integer \( k \) such that \( a = 2k \).

Then
\[
2b^2 = (2k)^2
\]
\[
2b^2 = 4k^2
\]
So
\[
b^2 = 2k^2
\]
This says that \( b^2 \) is even.
Since \( b^2 \) is even, \( b \) is even.
We have shown that \( a \) and \( b \) are both even, meaning that they have a common factor of 2.
This contradicts the fact that the quotient \( a/b \) is in lowest terms, and the proof is complete.