Summary of proof methods

The following are valid ways to begin a proof of the statement,

$$\forall x \in D, P(x) \to Q(x)$$

1. Suppose for some $x \in D$, $P(x)$ is true.
   - This will be a GGP proof
   - Goal: SHOW (with some mathy stuff) that $Q(x)$ is true.
2. Suppose for some $x \in D$, $P(x)$ is TRUE, but $Q(x)$ is FALSE.
   - This will be a proof by contradiction
   - Goal: SHOW (with some mathy stuff) that the universe explodes.
3. Suppose for some $x \in D$, $Q(x)$ is FALSE (i.e. its negation is true).
   - This will be a proof by contrapositive
   - Goal: SHOW (with some mathy stuff) that $P(x)$ is also false (i.e. its negation is true)

IMPORTANT!!!

IT IS NEVER EVER EVER HELPFUL TO ASSUME THAT $Q(x)$ IS TRUE.

This is a proof-killing mistake. No good can come of it. Don't do it. You'll be sorry.

Also note: counter example, contradiction, contrapositive } All are very different!!