

Instructions: This is a group activity. You must work together with your assigned group to answer these questions. Write a proof by contradiction for each of the following propositions. The following definitions will be helpful to you as you work to write these proofs:

Definitions:

- A real number r is **rational** if $r = \frac{a}{b}$ for some $a, b \in \mathbb{Z}$ with $b \neq 0$.
- A real number r is **irrational** if $r \neq \frac{a}{b}$ for every $a, b \in \mathbb{Z}$.

1. **Proposition 1:** Let $a \in \mathbb{Z}$. If a^2 is even, then a is even.

2. **Proposition 2:** $\sqrt{3}$ is irrational.

3. **Proposition 3:** If s is rational and st is irrational, then t is irrational.

4. **Proposition 4:** If A and B are sets, then $A \cap (B - A) = \emptyset$.

5. **Proposition 5:** If a and b are positive real numbers, then $a + b \geq 2\sqrt{ab}$.