Name: _____

Directions: Solve the following problems. Give supporting work/justification where appropriate.

1. Use any proof technique.

   (a) **[3 points]** An integer a is even if and only if a^2 is even.

   (b) **[2 points]** Let d and n be integers with $d \geq 2$. Show that $d \nmid n$ or $d \nmid 2n + 1$.

2. Irrational Numbers

   (a) **[3 points]** Prove that $\sqrt{6}$ is irrational.

   (b) **[2 points]** Prove that $\sqrt{2}+\sqrt{3}$ is irrational. (Hint: suppose for a contradiction that this number is rational. What can we say about $(\sqrt{2}+\sqrt{3})^2$?)