

Name: _____

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

1. In each part, give a direct proof or a contrapositive proof.

(a) **[4 points]** Let $x, y \in \mathbb{Z}$. Prove that if xy is even, then x is even or y is even.(b) **[3 points]** Let $a, b \in \mathbb{Z}$. Use part (a) to show that if $b \mid 2a$ and b is odd, then $b \mid a$.

2. [**3 points**] Let $a, a', b, b' \in \mathbb{Z}$ and let $m \in \mathbb{N}$. Show that if $a \equiv a' \pmod{m}$ and $b \equiv b' \pmod{m}$, then $a + b \equiv a' + b' \pmod{m}$.