

Name: \_\_\_\_\_

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

1. [4 points] Let  $A$  and  $B$  be sets. Prove that  $A \subseteq B$  if and only if  $A \cup B = B$ .

2. **[3 points]** Prove or disprove: Let  $A$  and  $B$  be sets. We have  $(A \times B) \cup (B \times A) = (A \cup B) \times (A \cup B)$ .

3. **[3 points]** Prove or disprove: Let  $A$  and  $B$  be sets. We have  $(A \times B) \cap (B \times A) = (A \cap B) \times (A \cap B)$ .