PHILADELPHIA UNIVERSITY

DEPARTMENT OF BASIC SCIENCES

**Exam 1** **Set Theory** **17–11–2014**

1. Find the elements of the set $A$.

   (a) $A = \{1, 2, 3, 4\} \oplus \{2, 4, 6\}$

   (b) $A = \{x \in \mathbb{N} \mid x^2 < 10\} \cup \{x \in \mathbb{R} \mid x^2 - x - 2 = 0\}$

   (c) $A = \{2n \mid n \in \mathbb{Z}\} - \{x \in \mathbb{Z} \mid x^2 \geq 5\}$

   (d) $A = P(\{1, 3\}) \cap P(\{2, 3, 4\})$

2. Prove the equivalent statement $(p \vee q) \rightarrow r \equiv (p \rightarrow r) \wedge (q \rightarrow r)$.

3. Prove that the product of two numbers is even if and only if one of them is even.

4. Use contrapositive to prove that if $x^2 + x + 1$ is irrational, then $x + 1$ is also irrational.

5. Use proof by cases to show that the number $x^2 - 3x - 5$ is odd for any integer $x$.

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