

**HAWASSA UNIVERSITY**  
**Collage of Natural and Computational Science**  
**Department of Mathematics**

**Work sheet -I**  
**Basic Mathematics for Natural Sciences (2014EC)**

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- Show that the following propositions are equivalent
  - $(P \implies Q) \text{ and } \neg P \vee Q$
  - $P \text{ and } P \wedge (Q \vee \neg Q)$
- For statements  $p, q$ , and  $r$ , show that the following compound statements are tautology.
  - $(p \wedge (p \implies q)) \implies q$ .
  - $((p \implies q) \wedge (q \implies r)) \implies (p \implies r)$ .
- Let  $p$  and  $q$  be statements. Which of the following implies that  $p \vee q$  is false?
  - $\neg p \vee \neg q$  is false.
  - $\neg p \vee q$  is true.
  - $p \implies q$  is true.
  - $p \wedge \neg q$  is true.
- Suppose that the statements  $P, Q, R$ , and  $S$  are assigned the truth values  $T, F, F$ , and  $T$ , respectively. Find the truth value of each of the following statements
  - $R \implies (S \wedge P)$
  - $P \implies (R \implies S)$ .
  - $Q \wedge \neg S \implies (P \iff S)$ .
  - $(R \wedge S) \implies (P \implies \neg Q \vee S)$
- If the value of  $P \implies Q$  is  $F$ , then what is the truth value of  $(\neg P \wedge Q) \iff (P \vee Q)$ ?
  - If the value of  $P \iff Q$  is  $T$ , then what is the truth value of  $P \iff \neg Q$  and  $\neg P \iff Q$ ?
  - If the value of  $P \iff Q$  is  $F$ , then what is the truth value of  $P \iff \neg Q$  and  $\neg P \iff Q$ ?
- Find the truth value of following compound statements using the given information.
  - $(p \implies q) \implies r$ , where  $r = T$ .
  - $\neg(p \vee q) \iff (\neg p \wedge \neg q)$ , where  $p \vee q = T$ .
  - $(p \wedge q) \implies (p \vee s)$ , where  $p = T$ .
  - $p \vee (q \implies r)$ , where  $r = T$ .
  - $(p \implies q) \implies (\neg q \implies \neg p)$ , where  $q = T$ .
- Let  $P(x, y): \frac{x}{y} < 1$ , where the domain of  $x$  is  $A = \{2, 3, 5\}$  and the domain of  $y$  is  $B = \{2, 4, 6\}$ . Then determine the truth value of the following quantified statement.
  - $(\forall x \in A)(\exists y \in B)P(x, y)$ .
  - $(\exists x \in A)(\exists y \in B)P(x, y)$ .
  - $(\exists y \in B)(\forall x \in A)P(x, y)$
- Determine the truth value of the following statements.
  - $(\exists x \in \mathbb{R})(x^2 - x = 0)$ .
  - $(\forall x \in \mathbb{N})(x + 1 \geq 2)$ .
  - $(\forall x \in \mathbb{R})(\sqrt{x^2} = x)$ .
  - $(\exists x \in \mathbb{Q})(3x^2 - 27 = 0)$ .
  - $(\exists y \in \mathbb{R})(\exists x \in \mathbb{R})(x^2 + y^2 = 9)$ .
  - $(\exists y \in \mathbb{R})(\forall x \in \mathbb{R})(x + y + 3 = 8)$
  - $(\forall x \in \mathbb{R})(\exists y \in \mathbb{R})(x + y = 5)$
  - $(\exists x \in \mathbb{R})(\forall y \in \mathbb{R})(x + y = 5)$
- Investigate the validity of the following argument forms using truth table method.
  - $\neg p \implies \neg q, q \vdash p$ .
  - $p \implies \neg p, p, r \implies q \vdash \neg r$ .
  - $p \implies q, \neg r \implies \neg q \vdash \neg r \implies \neg p$ .
- Investigate the validity of the following argument forms using formal proof (rule of inference)
  - $\neg p \implies \neg q, q \vdash p$ .
  - $p \implies \neg q, p, r \implies q \vdash \neg r$ .
  - $\neg r \wedge \neg s, (\neg s \implies p) \implies r \vdash \neg p$ .
  - $\neg q \implies \neg p, r \implies p, \neg q \vdash r$ .
  - $p \implies q, \neg r \implies \neg q \vdash \neg r \implies \neg p$ .

# Nmacmilla Mathematic Question And Answer 2014

**RS Peters**



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