M E T U
Department of Mathematics

Group	Fundamentals of Mathematics **Midterm 1**	List No.

Code : *Math 111* Acad. Year : *2013* Semester : *Fall* Instructor : *G.Ercan, S.Finashin, M.Kuzucuoğlu, Ö.Küçüksakallı.* Date : *November 7, 2013* Time : *17:40* Duration : *100 minutes*	Last Name : Name : Student No. : Department : Section : Signature : 6 QUESTIONS ON 6 PAGES 60 TOTAL POINTS

1	2	3	4	5	6		

1. (10pts) Using truth tables, determine if the statement $(P \to \neg Q) \leftrightarrow (R \to (\neg Q \vee P))$ is a tautology, a contradiction, or neither.

2. (10pts) Assume that x and y take real values. Determine whether the following statements (1)–(4) are true or false. Explain your answers briefly.

$$P(x, y) = \text{“}x^2 + y = 5\text{''}$$

1. $\exists x\ \forall y\ P(x, y)$

2. $\forall y\ \exists x\ P(x, y)$

3. $\exists y\ \forall x\ P(x, y)$

4. $\forall x\ \exists y\ P(x, y)$

3. (10pts) Give a derivation for the following argument (which is known to be valid).

$$\begin{array}{l} P \to (Q \to R) \\ T \to Q \\ P \vee S \\ \underline{\neg S \qquad\qquad\qquad} \\ \neg R \to \neg T \end{array}$$

4. (10pts) Let a, b and c be integers. Prove that if a does not divide bc, then a does not divide b.

5. (10pts) Prove that the following three statements about an integer n are equivalent.

1. $3 \nmid n$
2. $3 \mid n^2 - 1$
3. there exists an integer k such that $n = 3k + 1$, or $n = 3k + 2$.

6. (10pts) Let A, B and C be sets. Prove that if $A \subseteq B$ and $B \cap C = \varnothing$, then $A \cap C = \varnothing$.