# Math105 2005 Test 1

## September 21, 2005

Answer all questions and give complete reasons and checks for your answers. The parts of the questions are weighted as shown and can be answered in any order.

1. The universal set in this question is the set of integers from -4 to 9.

   (a) Draw the Venn diagram of these three sets: [4]

$$
\begin{aligned}
X &:= \{x \mid x \text{ is a multiple of } 3\} \\
Y &:= \{y \mid y = n^2 \text{ or } y = -n^2, n \in \mathbb{Z}\} \\
Z &:= \{0, 2, 3, 5, 7\}
\end{aligned}
$$

   (b) Name the largest subset of the Venn diagram which is empty. [1]

   (c) List the elements in $Y \cup \overline{X}$ and $X \cap Z$ by identifying the regions. [3]

   (d) Check the inclusion-exclusion formula for $X \cup Z$. [2]

2. (a) Gradually build the Venn Diagram for $(\overline{A} \cup B) \cap \overline{(B \cap C)}$ [5]

   (b) Prove that the set in (a) is a subset of $\overline{C} \cup \overline{A}$ [2]

   (c) Using pictures and words, explain why if $X \subseteq Y$ then $\overline{Y} \subseteq \overline{X}$. [3]