1. 3 marks for each statement, 27 marks in total. For each symbolic sentence, 1 mark for the natural language expression in English, 1 mark for correct T/F, and the last 1 mark goes for the correct explanation or the counterexample.

Remarks: Quit a few students made mistakes in (f) and (h). The statement in (f) is false, a counter example is $0/3 = 0$. Most of the student know that the statement in (h) is wrong, but they failed to give the correct explanation. Here is a counter example from some student: $y = 1, x = 2, x + y = 3 \neq 0$. This counter example is not convincing at all. Please go over the lecture notes to find out the right way to show this.

2. 2 marks for a correct expression in English, and 3 marks for a correct proof. In the proof, if the students failed to give $w = 3y^2$, 2 marks will
be deducted; if they derived $w = 3y^2$, but didn’t mention why $w \in \mathbb{N}$, 1 mark will be deducted.

3. 1 mark for (a), 4 marks for (b), and 2 marks for (c). In (b), a student gets 4 marks only when the final simplified expression is $p \iff q$, otherwise, some marks are deducted. For (c), if a student gives “correct” answers based on his/her solution in (b), I will give his/her full marks no matter whether the answers are really the right solution or not for (c).

4. 4 marks for each sentence, in particular, 3 marks for a correct negation of the sentence in symbolic notation, 1 mark for a correct Venn diagram. If the negation is correctly derived from a wrong symbolic expression, 1 mark will be given.

5. 2 marks for the first question, 1 mark for a counter example.