

- (1) Consider the following implication (assume that x, y and z are integers):

If x is odd and y is odd then $x + y$ is even.

- (a) What is the conclusion of the implication?
 - (b) Write the contrapositive of the implication:
 - (c) Write the negation of the implication:
 - (d) Write the implication using only the symbols $\forall, \exists, \implies, \wedge, \vee, \neg$ and variables:
- (2) Label each of the following as true, false, or not decidable from the information given (assume that x and y are real numbers):
- (a) $x + 7y = 52$.
 - (b) $\forall x, \exists y \ni x + 7y = 52$.
 - (c) $\forall x \forall y, x + 7y = 52$.
 - (d) $\exists x \ni \forall y, x + 7y = 52$.
- (3) Let $A = \{1, 2, 3, 4, 5, 6\}$.
- (a) Give an example of a set in the power set $\mathcal{P}(A)$ and an example of a set not in $\mathcal{P}(A)$. Briefly explain your answers.
 - (b) How many elements are there in $\mathcal{P}(A)$ that do not contain the element 3? Justify your answer.
- (4) Let $f : A \rightarrow B$ be a function.
- (a) Define what it means for f to be surjective.
 - (b) Give an example of a function that is surjective but not injective.
- (5) For each of the following statements, write whether it is true or false and write a short explanation (either a short proof or a counterexample).
- (a) For any two sets A and B , $\overline{(\overline{A} \cup \overline{B})} = A \cap B$.
 - (b) If $f : A \rightarrow B$ is a function, then $f^{-1}(B) = A$.
 - (c) If $f : A \rightarrow B$ is a function and $X \subset A$, then $f(A \setminus X) = B \setminus f(X)$.