

Directions:

- Complete the exercises below and either write up or type up your solutions. Solutions must be submitted as PDF or Word documents, uploaded to the appropriate assignment area on Blackboard.
 - If you choose to submit handwritten work, it must be neat and legible; if you do your handwritten work on paper, it must be **scanned to a PDF file** and submitted to Blackboard. Instructions and practice for scanning work to PDFs is given in the Startup Assignment. **Do not just take a picture, and do not submit a graphics file (JPG, PNG, etc.)** — such submissions will not be graded.
 - Your work will be graded using the EMRN rubric and evaluated **not just on the basis of a right or wrong answer, but on the quality, completeness, and clarity of your work**. Therefore you need to show all work and explain your reasoning on each item.
 - Every item must have a good-faith effort at a complete and correct response. If any item is left blank, or shows minimal effort (such as answering "I don't know"), or is significantly incomplete, the entire assignment will be graded "N" (Not Assessable) and you will have to spend a token to revise it.
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1. Use DeMorgan's Laws to find the negation of each of the following statements. (You do not need to explain your answers, but they must all be correct.)
 - (a) Alice will take a job in industry or go to graduate school.
 - (b) Bob knows how to program in both Haskell and Python.
 - (c) Chuck will move to either Lansing or Muskegon.
2. Show that each of the pairs of propositions below are logically equivalent. (You do not need to explain your answers, but they must all be correct.)
 - (a) $(\neg p) \rightarrow (q \rightarrow r)$ and $q \rightarrow (p \vee r)$
 - (b) $p \leftrightarrow q$ and $(\neg p) \leftrightarrow (\neg q)$
3. Below are some statements; the domain of each is the set of all integers (positive, negative, and zero — but only integers). For each one, state whether the statement is TRUE, FALSE, or UNDERDETERMINED and explain your reasoning.
 - (a) $\exists n(n^2 = 1)$
 - (b) $\forall n(n^2 = 1)$
 - (c) $n + 5 = 10$
 - (d) $\forall a((-a)^2 = a^2)$
4. Write a clear negation of each of the following quantified statements. Do not just write "It is not that case that..." in front of the statement.
 - (a) All dogs have fleas.
 - (b) There is a professor in the GVSU math department who graduated from MIT.
 - (c) No monkeys can speak French.
 - (d) For every professor in the math department, there is a mailbox for that professor in MAK A-2-178.
5. (*Often in Weekly Practice, the last question will ask you to think about your work this week and respond to a survey. This item is not only needed for the Weekly Practice, but completing it will also earn you 1 Engagement Credit.*) Think back over your work this week and how things went for you in class. Then go to this form and complete the survey: <http://gvsu.edu/s/1sC>.