First, read the paragraph in the problem section of the textbook about the logical operators NAND and NOR and practice with the NOR operator (problems 48, 49, 50, 51). Then do the following problems.

(a) Use a truth table to verify each of the following.

(i) $\neg p = p \downarrow p$

(ii) $p \vee q = (p \downarrow q) \downarrow (p \downarrow q)$

(b) Write $p \wedge q$ in terms of NOR alone, and verify with a truth table.

(c) Use the known relations between the standard five logical symbols and part (a) to write each of the following in terms of NOR (that is, $\downarrow$) alone.

(i) $p \rightarrow q$

(ii) $p \leftrightarrow q$

(d) Rewrite $p \wedge (q \rightarrow \neg r)$ in terms of just NOR.

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