

① Which of the following are propositions?

(a) $\sin 30^\circ = \sqrt{2}$.

(b) π is irrational or $x < 10$.

(c) The tooth fairy and Santa Claus are real.

(3 pts) (a) or (c) are propositions.

(b) is not because the truth of " $x < 10$ " depends on what x is.

② Use a truth table to show that $\sim(P \vee Q) \equiv (\sim P) \wedge (\sim Q)$.

(5 pts)

| P | Q | $P \vee Q$ | $\sim(P \vee Q)$ | $\sim P$ | $\sim Q$ | $(\sim P) \wedge (\sim Q)$ |
|---|---|------------|------------------|----------|----------|----------------------------|
| T | T | T | F | F | F | F |
| T | F | T | F | F | T | F |
| F | T | T | F | T | F | F |
| F | F | F | T | T | T | T |

← same

③ Write a useful denial:

(a) Jack and Jill went up the hill.

(2 pts)

Jack did not go up the hill or Jill did not go up the hill.

(The negation of an "and" statement is an "or" statement.)

Another way to say it:

Jack or Jill did not go up the hill.

(b) The relation R is reflexive and symmetric but not transitive.

(2 pts) The relation R is not reflexive or not symmetric or it is transitive.