Discrete Mathematics and Proof Unit 1 worksheet: And and or: conjunction and disjunction

Name _____ Date _____ Period _____

1. Suppose P is true, Q is false and R is true. Find the truth value of each statement.

(a) $Q \vee R$

(b) $P \wedge \neg R$

(c) $\neg P \vee Q$

(d) $(P \vee Q) \wedge (Q \vee \neg R)$

(e) $\neg(P \wedge Q) \wedge R$

(f) $(\neg P \vee \neg Q) \wedge (Q \vee R)$

2. A park posts a daily trail report. Let S be "the trail is snowy" and M be "the trail is muddy". Write each sentence in (a) to (d) in symbols.

(a) The trail is snowy, but it is not muddy.

(b) The trail is neither snowy nor muddy.

(c) The trail is not both snowy and muddy.

(d) The trail is snowy or muddy, but not both.

(e) Write $\neg S \vee M$ as an English sentence.

(f) On a day when the trail is snowy and not muddy, which of the sentences (a) to (d) are true?

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3. Here x and y are real numbers. Write each condition as a sentence with the same meaning whose parts are joined by "and" or "or". Use no absolute value bars, no $\neq$ sign and no chained inequality such as $a < x < b$.

(a) $|x - 2| < 5$

(b) $|x + 1| \geq 4$

(c) $x \neq 6$

(d) $xy = 0$

(e) $x^2 + y^2 = 0$

(f) $xy > 0$

4. A film streaming service has this rule: a member may watch a film when the member has a subscription, or when the member has no subscription and has rented that film. Let S be "the member has a subscription" and R be "the member has rented the film".

(a) Write the rule as a statement in S and R.

(b) Make its truth table, with a helper column for each piece.

(c) Find a shorter statement in S and R with the same column, and explain in a sentence or two why the words "has no subscription and" can be dropped from the rule.

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5. Each statement below is made from the four letters P, Q, R, S, so its truth table has 16 rows. Without writing out the table, find how many rows make each statement true, and explain how you counted.

(a) $(P \vee Q \vee R) \wedge S$

(b) $(P \wedge Q \wedge R) \vee S$

(c) $(P \vee Q) \wedge (R \vee S)$

6. Prove that for every real number x, the statement "$x \geq 1$ or $(x-1)(x-2) > 0$" is true.

Statements	Reasons

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