Discrete Mathematics and Proof Unit 1 practice: De Morgan's laws for statements

Name _____ Date _____ Period _____

1. Push the $\neg$ inside each statement with a De Morgan law, and cancel any double negation.

(a) $\neg(A \vee B)$

(b) $\neg(H \wedge \neg K)$

(c) $\neg(\neg A \wedge \neg B)$

(d) $\neg(\neg A \wedge B \wedge C)$

(e) $\neg(A \vee B \vee \neg C)$

(f) $\neg(\neg A \vee \neg B \vee C)$

2. Here x and y are real numbers. Use a De Morgan law to write the negation of each condition without the word "not".

(a) $x \geq -7$ and $x < 12$

(b) $x \leq -11$ or $x > 8$

(c) $-14 \leq x < 4$

(d) $x > 6$ or $y \leq 7$

(e) $x \neq 4$ and $y \geq 5$

(f) $x > 1$ and $y > 4$ and $x + y < 12$

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3. Each problem needs a De Morgan law and one more step.

(a) Rewrite $\neg\big(P \vee (Q \wedge \neg R)\big)$ so that every $\neg$ sits on a single letter.

(b) Hannah rewrote $\neg(\neg P \vee Q \vee R)$ as $P \wedge \neg Q \wedge R$. Find the mistake and write the correct statement.

(c) Write the negation of "56 is a multiple of 7 and 56 is not a multiple of 8" as a sentence, and say which of the two is true.

4. (a) A fair ride lets a rider on when the rider's height h is at least 105 cm and the rider's age a is at least 8 years. Write the condition for a rider to be turned away as an "or" of two inequalities.

(b) A mountain school stays closed when the snow depth d is more than 10 cm or the temperature c is below -13 degrees Celsius. Write the condition for the school to open as an "and" of two inequalities.

(c) In Hannah's grade of 137 students, 65 play a sport or play an instrument (or both). How many students play neither a sport nor an instrument?

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