Logic: Laws and Transformations

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Learning Objectives

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- Apply basic laws of logic.
- Construct the negation, converse, and contrapositive of simple statements.

Translating English into logical shorthand

Example 1:

- If s is a square, then s is a rectangle.

Translating English into logical shorthand

Example 2:

- x is less than six, and x is prime or x is not equal to 1.

Translating English into logical shorthand

Example 3:

- For every natural number n, n is even or n is odd.

Translating English into logical shorthand

Example 4:

- There exists an integer y such that y squared is 3.

Basic laws of logic

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- Double negation:

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- Distributive laws:

Basic laws of logic

- Double negation:
- Distributive laws:
- DeMorgan's laws:

Application: Negating an implication

Ex. 1: If s is a square, then s is a rectangle.
Negation:

Application: Logical equivalence

Are the following two statements logically equivalent?

- $r \rightarrow (p \wedge \neg q)$
- $(\neg r \vee p) \wedge (\neg r \vee \neg q)$

Converse

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Converse

Reversal of an implication

Converse

Reversal of an implication
Ex. 1: If s is a square, then s is a rectangle.
Converse:

Contrapositive

Reverse implication and negate both sides

Contrapositive

Reverse implication and negate both sides
Ex. 1: If s is a square, then s is a rectangle.
Contrapositive:

Recap: Learning Objectives

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