## Symbols

| | |
|---|---|
| ¬ | NOT |
| ∨ | OR |
| ∧ | AND |
| → | IMPLIES |
| ↔ | EQUAL |

## Truth table

| p | q | ¬ p | p ∨ q | p ∧ q | p → q | p ↔ q |
|---|---|---|---|---|---|---|
| T | T | F | T | T | T | T |
| T | F | F | T | F | F | F |
| F | T | T | T | F | T | F |
| F | F | T | F | F | T | T |

## Logical equivalences

| | | |
|---|---|---|
| ¬¬ p | ≡ | p |
| p ∧ q | ≡ | q ∧ p |
| p ∨ q | ≡ | q ∨ p |
| p ∧ (q ∧ r) | ≡ | (p ∧ q) ∧ r |
| p ∨ (q ∨ r) | ≡ | (p ∨ q) ∨ r |
| p ∧ p | ≡ | p |
| p ∨ p | ≡ | p |
| p ∧ (q ∨ r) | ≡ | (p ∧ q) ∨ (p ∧ r) |
| p ∨ (q ∧ r) | ≡ | (p ∨ q) ∧ (p ∨ r) |
| ¬ (p ∧ q) | ≡ | ¬ p ∨ ¬ q |
| ¬ (p ∨ q) | ≡ | ¬ p ∧ ¬ q |
| p → q | ≡ | ¬ p ∨ q |
| p → q | ≡ | ¬ (p ∧ ¬ q) |
| p ↔ q | ≡ | (p → q) ∧ (q → p) |
| p → q | ≡ | ¬ q → ¬ p |

## Tautology

always true

p ∧ (a tautology) ≡ p

p ∨ (a tautology) is a tautology

¬ (a tautology) is a contradiction

## Contradiction

always false

p ∧ (a contradiction) is a contradiction

p ∨ (a tautology) ≡ p

¬ (a contradiction) is a tautology

## Quantifier

| | |
|---|---|
| ∀ | for all |
| ∃ | for some |

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Not published yet.
Last updated 21st May, 2023.