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| Truth Tables Cheat SheetConjunction  |  |  |  | | --- | --- | --- | | *p* | *q* | *p* ∧ *q* | | T | T | T | | T | F | F | | F | T | F | | F | F | F |  Disjunction  |  |  |  | | --- | --- | --- | | *p* | *q* | *p* ∨ *q* | | T | T | T | | T | F | T | | F | T | T | | F | F | F |  Conditionals  |  |  |  | | --- | --- | --- | | *p* | *q* | *p* => *q* | | T | T | T | | T | F | F | | F | T | T | | F | F | T |  Biconditionals  |  |  |  | | --- | --- | --- | | *p* | *q* | *p <*=> *q* | | T | T | T | | T | F | F | | F | T | F | | F | F | T | | Logical Equivalence LawsCommutative Laws  1. ***p* ∨ *q* ≡ *q* ∨ *p*** 2. ***p* ∧ *q* ≡ *q* ∧ *p*** 3. ***p* <=> *q* ≡ *q* <=> *p***  Associative Laws  1. **(*p* ∨ *q*) ∨ *r* ≡ *p* ∨ (*q* ∨ *r*)** 2. **(*p* ∧ *q*) ∧ *r* ≡ *p* ∧ (*q* ∧ *r*)** 3. **(*p* <=> *q*) <=> *r* ≡ *p* <=> (*q* <=> *r*)**  Distributive Laws  1. ***p* ∨ (*q* ∧ *r*) ≡ (*p* ∨ *q*) ∧ (*q* ∨ *r*)** 2. ***p* ∧ (*q* ∨ *r*) ≡ (*p* ∧ *q*) ∨ (*p* ∧ *r*)** 3. ***p* => (*q* ∨ *r*) ≡ (*p* => *q*) ∨ (*p* => *r*)** 4. ***p* => (*q* ∧ *r*) ≡ (*p* => *q*) ∧ (*p* => *r*)**  Double Negative Law  1. **~ (~ *p*) ≡ *p***  De Morgan’s Laws  1. **~ (*p* ∨ *q*) ≡ ~ *p* ∧ ~ *q*** 2. **~ (*p* ∧ *q*) ≡ ~ *p* ∨ ~ *q***  Implication Laws  1. ***p* <=> *q* ≡ (*p* => *q*) ∧ (*q* => *p*)** 2. ***p* => *q* ≡ ~ *p* ∨ *q*** 3. ***p* => *q* ≡ ~ *q* => ~ *p*** 4. **~ (*p* => *q*) ≡ *p* ∧ ~ *q*** |

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| Set AlgebraClosed: A binary operation is closedif: Identity: An element is called an identity if: Inverse: If identity of S, an element is called invertible when : Commutative: A binary operation on S is commutativeif: Associative: A binary operation on S is associativeif: Distributive: A binary operation is distributiveover another if for all a, b, c ∈ S. Well-Ordered: A set S with order is called well-orderedif every nonempty subset T of S has at least one smallest element.  That is, if **, then** | Rules for ℤ: On ℤ, and are commutative and associative. On ℤ, and are not commutative and associative. However, if we define and , then we have commutativity and associativity.  **(assoc.)**  **(distrib.)**  Multiplication distributes over addition and subtraction on ℤ. Common Rules: An integer is **even** if  for some .  An integer is **odd** if  for some  An integer is **prime** if whenever  for , either or  An integer is **composite** if it is not prime  (i.e. with ) Dedekind Cuts Properties: A Dedekind Cut of ℚ is a pair of subsets (A,B) of ℚ that satisfy the following:   * and are nonempty * is closed downwards: If and , then * is closed upwards: if and , then * contains no greatest element:   Given , we can form a Dedekind Cut where:  AND |