**IDX G9 MATH H+ STUDY GUIDE ISSUE 1**

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1.Sets and Venn Diagrams

Sets:

Definitions:

-Set: A collection of distinct objects, considered as an object in its own right.

-Element or Member: An object that makes up the set.

-Subset: A set A is a subset of set B if every element of A is also an element of B.

-Universal Set: The set of all possible elements from which subsets are formed.

-Empty Set (Null Set): A set that does not contain any elements.

Formulas & Symbols:

-Intersection ⋂: A ∩ B is the set containing elements common to both set A and set B. Also written in the form

-Union ⋃: A ∪ B is the set containing all elements of A and B.

-Difference -: A - B is the set containing elements that are in A but not in B.

-Cardinality |A|: Number of elements in the set A.

-Element (∈): If set A contains a certain element, it is symbolized as x ∈ A. It reads x is an element of A.

-Not an Element (∉): If set A does not contain a certain element, it is symbolized as x ∉ A. It reads x is not an element of A.

-Subset (⊂ or ⊆): A set A is a subset of set B if every element of A is also an element of B. It is symbolized as A ⊂ B or A ⊆ B. A ⊂ B means A is a proper subset of B (B has elements not in A), while A ⊆ B can also mean A equals B.

-Superset (⊃ or ⊇): A set B is a superset of set A if every element of A is also an element of B. It is represented as B ⊃ A or B ⊇ A. This can be understood as the opposite of a subset in which the second set is a subset of the first set and not the other way around.

-Intersection (⋂): A ∩ B is the set containing elements common to both set A and B.

-Union (⋃): A ∪ B is the set containing all elements in either A, B, or both.

-Complement ('): The complement of set A, denoted by A', is the set of elements in the universal set that are not in A. (In textbooks its also denoted as a bar on top of the name of the set, but it couldn’t be entered on a computer so I went with the other representation.)

-Difference (-): The difference of set A and B, denoted by A - B, is the set of all elements which are in A but not in B. This could also be achieved through operations: For a set C C=A-B when for every n∈C, n∈A, n∉B or

C={n丨n∈A, n∉B}

Laws (For sets A, B and C):

1.Commutative Laws of Sets:

A ∪ B = B ∪ A (Union of sets)

A ∩ B = B ∩ A (Intersection of sets)

2.Associative Laws of Sets:

(A ∪ B) ∪ C = A ∪ (B ∪ C)

(A ∩ B) ∩ C = A ∩ (B ∩ C)

3.Distributive Laws of Sets:

A ∪ (B ∩ C) = (A ∪ B) ∩ (A ∪ C)

A ∩ (B ∪ C) = (A ∩ B) ∪ (A ∩ C)

4.Identity Laws of Sets:

A ∪ ∅ = A (Empty set is the identity element for union)

A ∩ U = A (Universal set is the identity for intersection)

5.Complement Laws of Sets:

A ∪ A' = U (Union of a set and its complement is Universal set)

A ∩ A' = ∅ (Intersection of a set and its complement is an empty set)

6.Idempotent Laws of Sets:

A ∪ A = A

A ∩ A = A

7.Null Laws of Sets:

A ∪ U = U (A union with Universal set is a Universal set)

A ∩ ∅ = ∅ (A intersection with an empty set is an empty set)

8.Absorption Laws of Sets:

A ∪ (A ∩ B) = A

A ∩ (A ∪ B) = A

9.Difference Laws:

A - B = A ∩ B' (Difference of A and B is the intersection of A and the complement of B)

10.De Morgan's Laws\*\*\*:

(A ∪ B)' = A' ∩ B'

(A ∩ B)' = A' ∪ B'

Venn Diagrams:

Definitions:

-Venn Diagram: A diagram that shows all possible logical relations between a finite collection of different sets.

-Circle: Each set is represented by a circle usually inside a rectangular field (Universal Set).

Formula & Applications:

-n(A ∪ B) = n(A) + n(B) - n(A ∩ B)

-n(A') = n(U) - n(A): Number of elements not in set A.

1. Inductive and Deductive Reasoning:

-Inductive Reasoning: A type of logical thinking that involves forming generalizations based on specific incidents you've experienced, observations you've made, or facts you know to be true or false.

-Deductive Reasoning: A type of logical thinking where you start with a general fact, rule, or premise and then deduce or infer certain specific details or conclusions.

1. Logic Statements

-Proposition: Also known as a statement, a proposition is a declarative sentence that is either true or false but not both.

-Compound Proposition: This is a combination of two or more propositions using logical operators. They include conjunctions, disjunctions, implications, and biconditionals.

-Conjunction: A conjunction is a compound proposition that uses the logical operator AND. For the conjunction p ∧ q to be true, both p and q must be true.

-Disjunction: A disjunction is a compound proposition that uses the logical operator OR. For the disjunction p ∨ q, it is enough for either p or q to be true for the entire disjunction to be true.

-Negation: The negation of a proposition p is "not p", denoted as ~p or ¬p. If p is true, then ~p is false, and vice versa.

-Conditional Statement (Implication): This is a compound proposition of the form "if p then q" represented as p → q. It is false only when p is true and q is false; otherwise, it is true.

-Biconditional Statement: A biconditional statement of the form "p if and only if q" is true when p and q have the same truth values, and false when they are different. It is represented as p ↔ q or p ≡ q.

-Contradiction: A compound proposition that is always false regardless of the truth values of the individual propositions that constitute it.

-Contingency: A compound proposition that could be either true or false depending on the truth values of its constituent propositions.

-Satisfiability: A proposition is satisfiable if there is at least one assignment of truth values to its variables that makes it true.

-Sufficient: When given A, we can know B then A is sufficient for B

-Neccesary: When given A, we can know B then B is neccesary for A.

Operations:

In a conditional statement of the form "if p then q", also written as "p → q", we have different forms created by switching or negating the hypothesis and conclusion:

-Converse: The converse of "if p then q" is "if q then p", or q → p. This is formed by switching the hypothesis and the conclusion.

-Inverse: The inverse of "if p then q" is "if not p then not q", or ¬p → ¬q. This is formed by negating both the hypothesis and conclusion.

-Contrapositive: The contrapositive of "if p then q" is "if not q then not p", or ¬q → ¬p. This is formed by both switching and negating the hypothesis and conclusion.

In terms of the truth values, there are certain relationships that always hold true:

-A statement and its contrapositive are logically equivalent. This means that they are both either true or false. If "if p then q" is true, then "if not q then not p" is also true, and vice versa.

-Similarly, a converse and an inverse are logically equivalent. This means that they are both either true or false. If "if q then p" is true, then "if not p then not q" is also true, and vice versa.

1. Geometric Theorms and Postulates:

-Ruler Postulate: The points on a line can be paired with the real numbers in such a way that any given point can always be paired with zero and any other with a positive number.

-Segment Addition Postulate: If B is between A and C, then AB + BC = AC.

-Protractor Postulate: Consider OA and OB to be opposite rays in a plane. Then we can measure angles AOB for every rotation about point O.

-Angle Addition Postulate: If point B lies in the interior of ∠AOC, then ∠AOB + ∠BOC = ∠AOC.

-Parallel Postulate (Euclidean geometry): Given a line and a point not on the line, there is exactly one line through the point that is parallel to the given line.

-Vertical Angles Theorem: Vertical angles are always congruent.

-Linear Pair Postulate: If two angles form a linear pair, then they are supplementary (their sum is 180°).

-Alternate Interior Angles Theorem: If two parallel lines are cut by a transversal, then the alternate interior angles are congruent.

-Triangle Angle-Sum Theorem: The sum of the interior angles in any triangle is 180°.

-Isosceles Triangle Theorem: If two sides of a triangle are congruent (the triangle is isosceles), then the angles opposite those sides are congruent.

-Corresponding Angles Postulate: If two parallel lines are cut by a transversal, then the pairs of corresponding angles are congruent.

\*The converses of the alternate-interior angle theorm, corresponding angles postulate and other paralell lines theorms and postulates all hold up.