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

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**Chapter 0: Sets and Venn Diagrams**

1. **Sets and Elements**

* Set: collection of distinct numbers or objects
* Elements: a number of sets

∈ 🡪 “is an element of”, “is in”

∈ 🡪 “is not an element of”

N(A), |A| 🡪 number of elements in set A

∅ 🡪 empty set

* Important Sets:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  |  |  |  |  |
| Natural Numbers | Integers | Positive Integers | Rational Numbers | Real Numbers |

* *Properties of Sets:*
  + An element is either in a set or it isn’t
  + Same elements appear only once
  + Two sets are equal if the elements are the same

1. **Relationships between sets:**

* Assume A and B are sets

1. Subsets
   * A⊆B 🡪 A is a subset of B
   * If all elements of A are in B, then A⊆B
   * *Properties:*
     + Any set is the subset of itself
     + A=B if A⊆B and B⊆C
     + ∅ is a subset of any set
   * Proper Subset:
     + A⊂B 🡪 A is a proper subset of B
     + If all elements of A are in B and n(A) < n(B) then A⊂B
2. Intersections
   * A∩B 🡪 the intersection of A and B
   * Intersection: elements in both A and B
   * Mutually Exclusive: A∩B = ∅
   * *Properties:* 
     + A∩B = B∩A
     + A∩A = A
     + A∩∅= ∅
     + A∩B = A if A⊆B
     + (A∩B) ∩C = A∩(B∩C)
3. Unions:
   * A∪B 🡪 the union of A and B
   * Union: elements in either set A or B
   * *Properties:*
     + A∪B = B∪A
     + A∪A = A
     + A∪∅= A
     + A⊆A∪B, B⊆A∪B
     + A∪B = B if A⊆B
     + (A∪B)∪C = A∪ (B∪C)
4. Complement
   * A' 🡪 not A

**Chapter 1: Reasoning**

* 1. **Patterns and Inductive Reasoning:**
* Inductive Reasoning: reasoning based on patterns you observe
* Conjecture: rule
* Counterexample: used to prove that a conjecture is incorrect
  1. **Conditional Statements**
* Conditional Statements: if-then statements

If p, then q

* Hypothesis 🡪 p, Conclusion 🡪 q
* Converse: if q, then p
* Truth Value: whether the conditional is true or false
  1. **Biconditionals and Definitions**
* Biconditional: when a conditional and its converse are both true, combine them by joining them as a biconditional
  + p, if and only if q
* Definition:
  + Basic Elements of a good definition:
    - Uses clearly understood terms
    - Precise
    - Reversible
  1. **Inverses, Contrapositives, and Indirect Reasoning**
* Negation: ~p (not p)
  + Given “The Earth is round”, the negation would be “The Earth is not round”
* Inverse: if ~p then ~q
  + Given “if the fruit is red, then it’s an apple”, the inverse would be “if the fruit isn’t red, then it’s not an apple
* Contrapositive: if ~q then ~p:
  + Give “if the fruit is red, then it’s an apple”, the contrapositive would be “if the fruit isn’t an apple, then it isn’t red”
* Conditionals and Contrapositives are equal statements (have the same truth value)
* The negation of a statement always has the opposite truth value
* Indirect Proof:
  + Start with assuming negation, the prove that the negation by proving that the negation contradicts the given information, and then use that to prove the original statement you needed to prove is correct
  1. **Deductive Reasoning**
* Deductive Reasoning: process of reasoning logically from given statements to a conclusion
* Law of Detachment: if p 🡪 q is a true statement and p is true, then q is true.
  + Example: if you get 95 or above on an exam, you get an A+

Bob gets 96 on his math quiz.

Bob gets an A+ on his math quiz

* Law of Syllogism: if p🡪 q and q🡪r are true statements, then p🡪r is true
  + Example: if you study well, then you’ll get a good score

If you get a good score, then your parents will be happy

If you study well, then your parents will be happy

**Chapter 2: Basic Geometric Elements and Constructions**

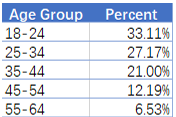
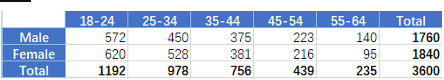
**2.1 Points, Lines and Planes**

* Points: a location, represented by a capital letter
* Lines: a series of points that extends in two directions without end, named by any two points on the line, or by a single letter
  + Line 🡪 
  + Line segment 🡪 
* Collinear points: points that lie on the same line
* Plane: a flat surface that has no depth, contains many lines, extends without end in the directions of all of its line, named by a capital letter, or by at least 3 lines
* Coplanar: point and lines in the same plane
* A postulate or axiom is an accepted state of fact

**2.2 Segments, Rays, Parallel Lines, and Planes**

* Segment: a part of the line consisting of 2 endpoints and all points between
* Ray: part of a line consisting of 1 endpoint and all the points of the line on one side of the endpoint
  + Ray 🡪 
* Opposite rays: two collinear rays with common endpoints
  + Always form a line
* Parallel Lines: coplanar lines that don’t intersect
* Skew Lines: noncoplanar lines

**G9 Statistics:**

* Unstructured Data: data are easy to read and contain great information, but they are usually given in natural language
  + can vary greatly in length, style, and content, making them difficult to analyze
  + common in daily life
* Structured Data: any data that is organized in a predefined manner, typically in a table format with rows and columns
  + Data table
* Variables: characteristics recorded about each individual are called variables
  + Categorical Variables: related to the category of what is measured
  + Quantitative Variables: related to the quantity of what is measured
* *How to Display Data:*
  + Frequency table:
    - 
    - Gender is categorical
  + Relative Frequency table:
    - 
    - Displays percentages instead of the actual numbers
  + Bar chart: displays distribution of categorical variables, showing the counts for each
  + Pie Chart: whole group of cases as a circle, where each “slice” is proportional to the fraction of the whole in the category
    - Area Principle: the area occupied by a part of the graph should correspond to the magnitude of the value it represents.
* *Data Analysis*:
  + Contingency Table/ Crosstabulation:
    - shows how the individuals are distributed along each variable, contingent on the value of the other variable
    - margins of a contingency table, the frequency distribution of one of the variables is called its Marginal Distribution
    - Cell: gives the count for a combination of values of the two variables.
    - 
  + Conditional Distributions: show the distribution of one variable for just those cases that satisfy a condition on another variable
  + Segmented Bar Charts: each bar is a whole, divides it proportionally into segments corresponding to the percentage in each group
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