MATHEMATICS 9TH

IMPORTANT DEFINITIONS

Chapter Wise Notes

Unit 1: Real Numbers

Question No. 1: Write the 7 Roman numeral letters for different numbers.
Answer: The 7 letters used in Roman numerals to represent different numbers are:

- ✓ **I** = 1
- ✓ **V** = 5
- ✓ **X** = 10
- ✓ **L** = 50
- ✓ **C** = 100
- ✓ **D** = 500
- ✓ **M** = 1000

Question No. 2: Who gave the concept of zero (0)?
Answer: The concept of zero (0) was developed by ancient **Indian mathematicians**. This invention is considered a monumental contribution to mathematics as it forms the basis of the decimal number system, which is fundamental to all modern mathematical advancements.

Question No. 3: Write the set of Rational numbers in builder form.
Answer: The set of rational numbers, denoted by Q, is written in set-builder form as follows: $Q = \{\frac{p}{q} \mid p, q \in Z \wedge q \neq 0\}$ This reads as "Q is the set of all numbers of the form p/q, such that p and q are integers and q is not equal to zero."

Question No. 4: Define the set of Real numbers.
Answer: The set of Real Numbers, denoted by **R**, is the union of the set of rational numbers (Q) and the set of irrational numbers (Q'). It includes all numbers that can be represented on a number line. $R = Q \cup Q'$

Question No. 5: Define terminating decimal numbers.
Answer: A terminating decimal number is a decimal number that has a finite number of digits after the decimal point. These numbers do not continue indefinitely. For example, 0.25, 0.8, and 0.375 are terminating decimals.

Question No. 6: Give any two examples of irrational numbers.
Answer: Irrational numbers are non-terminating and non-recurring decimals. Two common examples are:

1. **Pi (π)**: $\pi = 3.14159265\ldots$
2. **Euler's Number (e)**: $e = 2.71828182\ldots$

Question No. 7: Write the property of additive identity.
Answer: The additive identity property states that there exists a unique real number, zero (0), such that for any real number 'a', the sum of 'a' and 0 is 'a'. $\forall a \in R,\ a + 0 = a = 0 + a$

Question No. 8: Give an example of the associative law of addition.

Answer: The associative law of addition states that when three real numbers are added, the result is the same regardless of the grouping of the numbers. **Example:** For the numbers 2, 3, and 5: (2 + 3) + 5 = 2 + (3 + 5)$$$$5 + 5 = 2 + 8$$$$10 = 10

Question No. 9: Define surd.

Answer: A surd is an irrational number that is expressed using a radical sign ($\sqrt{\ }$, $\sqrt[3]{\ }$, etc.). It represents the root of a number that cannot be simplified into a whole number or a terminating decimal. For example, $\sqrt{2}$ and $\sqrt[3]{7}$ are surds.

Question No. 10: Define binomial surd.

Answer: A binomial surd is an algebraic expression containing the sum or difference of two surds, or the sum or difference of a rational number and a surd. For example, $\sqrt{3} + \sqrt{5}$ and $2 - \sqrt{7}$ are binomial surds.

Question No. 11: In which various fields are real numbers used?

Answer: The concepts of real numbers are applied to various real-world problems and fields, including:

- **Temperature:** Measuring temperature in Celsius or Fahrenheit.
- **Banking:** Calculating interest, account balances, and loans.
- **Measures of Gain and Loss:** Determining profit or loss in business transactions.
- **Income and Expenditure:** Managing personal or business finances.

Question No. 12: Write the conversion formula for temperature.

Answer: The formulas for converting temperature between Celsius (°C) and Fahrenheit (°F) are:

- **Celsius to Fahrenheit:** $F = \frac{9}{5}C + 32$
- **Fahrenheit to Celsius:** $C = \frac{5}{9}(F - 32)$

Question No. 13: Define profit.

Answer: Profit is the financial gain realized when the selling price (S.P.) of an item is greater than its cost price (C.P.). The formula is: Profit $=$ Selling Price $-$ Cost Price

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Question No. 14: Define loss.

Answer: Loss is the financial deficit incurred when the selling price (S.P.) of an item is less than its cost price (C.P.). The formula is: Loss $=$ Cost Price $-$ Selling Price

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Question No. 15: Is 0 a rational number? Explain.

Answer: Yes, 0 is a rational number. A number is rational if it can be expressed in the form $\frac{p}{q}$, where p and q are integers and $q \neq 0$. Zero can be written in this form, for example, as $\frac{0}{1}$, where $p = 0$ and $q = 1$. This fits the definition perfectly.

Question No. 16: State the trichotomy property of real numbers.

Answer: The Trichotomy Property states that for any two real numbers 'a' and 'b', exactly one of the following three relationships must be true:

1. $a < b$ (a is less than b)
2. $a = b$ (a is equal to b)
3. $a > b$ (a is greater than b)

Unit 2: Logarithms

Question No. 17: Define scientific notation.

Answer: Scientific notation is a way of expressing numbers that are too large or too small to be conveniently written in standard decimal form. A number is written in scientific notation when it is expressed as the product of a number 'a' (where $1 \leq a < 10$) and an integer power of 10 (10^n). The general form is $a \times 10^n$.

Question No. 18: Which mathematician introduced the word Logarithm?
Answer: The Scottish mathematician **John Napier** introduced the word "Logarithm" in the early 17th century.

Question No. 19: What do you mean by logarithm?
Answer: A logarithm is the inverse operation of exponentiation. If we have an equation $a^x = y$, the logarithm is the exponent 'x' to which the base 'a' must be raised to produce the number 'y'. It is written as $\log_a(y) = x$. Logarithms simplify complex calculations by converting multiplication into addition and division into subtraction.

Question No. 20: Write the general form of a logarithm.
Answer: The general form of a logarithm is derived from the exponential equation $a^x = y$. The logarithmic form is: $\log_a(y) = x$ where 'a' is the base, 'x' is the exponent (or logarithm), and 'y' is the number.

Question No. 21: Define common logarithm.
Answer: A common logarithm is a logarithm with a base of 10. It is commonly written as $\log_{10}(x)$ or simply $\log(x)$. It is widely used in scientific and engineering calculations.

Question No. 22: How many parts are there in a logarithm?
Answer: The common logarithm of any number consists of two parts:

1. **Characteristic:** The integer part of the logarithm.
2. **Mantissa:** The decimal or fractional part of the logarithm, which is always positive.

Question No. 23: Define characteristic.
Answer: The characteristic is the integer part of a logarithm. It indicates the position of the decimal point in the original number. The characteristic can be positive, negative, or zero.

Question No. 24: Define mantissa.
Answer: The mantissa is the decimal or fractional part of a logarithm. It is always a positive value and is determined from the sequence of digits in the number, not the position of the decimal point. The mantissa is found using a logarithm table.

Question No. 25: Define reference position.
Answer: The reference position is a concept used to determine the characteristic of a number's logarithm. It is the position immediately after the first non-zero digit in a number. The characteristic is the number of digits between the reference position and the actual decimal point.

Question No. 26: Define antilogarithm.
Answer: Antilogarithm is the inverse process of finding a logarithm. If $\log(y) = x$, then 'y' is the antilogarithm of 'x', written as $y = \text{antilog}(x)$. This is equivalent to finding the value of $y = 10^x$.

Question No. 27: Define natural logarithm.
Answer: A natural logarithm is a logarithm with the base 'e', where 'e' is an irrational and transcendental constant approximately equal to 2.718. The natural logarithm of a number 'x' is written as $\log_e(x)$ or more commonly as $\ln(x)$.

Question No. 28: Differentiate between common and natural logarithms.
Answer: The key difference between common and natural logarithms is their base.

Feature	Common Logarithm	Natural Logarithm
Base	The base is 10.	The base is 'e' (approx. 2.718).
Notation	Denoted by $\log(x)$.	Denoted by $\ln(x)$.
Application	Primarily used in calculations, science, and engineering.	Primarily used in theoretical mathematics, calculus, and physics.

Question No. 29: Write any two laws of logarithm.
Answer: Two fundamental laws of logarithms are:

1. **Product Law:** The logarithm of a product is the sum of the logarithms of its factors. $\log_a(mn) = \log_a(m) + \log_a(n)$
2. **Quotient Law:** The logarithm of a quotient is the difference between the logarithm of the numerator and the logarithm of the denominator. $\log_a\left(\frac{m}{n}\right) = \log_a(m) - \log_a(n)$

Question No. 30: Write the Fibonacci formula.
Answer: The Fibonacci sequence is a series of numbers where each number is the sum of the two preceding ones, starting from 0 and 1. The recursive formula for the n-th term (F_n) is: $F_n = F_{n-1} + F_{n-2}$ with the initial conditions $F_0 = 0$ and $F_1 = 1$.

Unit 3: Sets and Functions

Question No. 31: Define set.
Answer: A set is a well-defined collection of distinct objects. The objects within the set are called its **elements** or **members**.

Question No. 32: Who was George Cantor?
Answer: Georg Cantor was a German mathematician who is credited as the founder of **set theory**. He introduced the fundamental concepts of sets and did groundbreaking work on infinite sets.

Question No. 33: How many methods are there to describe a set?
Answer: There are three methods to describe a set:

1. **Descriptive Form:** The set is described using a statement in words.
2. **Tabular Form (or Roster Form):** All elements of the set are listed within curly braces {}.
3. **Set-Builder Form:** The set is described by stating the common property of its elements using symbols.

Question No. 34: Define a set in descriptive form.
Answer: In the descriptive form, a set is described by a verbal statement that specifies its elements. **Example:** A = The set of the first five natural numbers.

Question No. 35: Define a set in tabular form.
Answer: In the tabular (or roster) form, all the elements of a set are listed, separated by commas, and enclosed within curly braces {}. **Example:** A = {1, 2, 3, 4, 5}

Question No. 36: What is a set-builder method?
Answer: The set-builder method describes a set by specifying a property that its elements must satisfy. It uses a variable and a vertical bar or colon. **Example:** A = {x | x ∈ N ∧ x < 6}, which means "A is the set of all elements x such that x is a natural number and x is less than 6."

Question No. 37: How do we represent a set and its elements?
Answer:

- **Set:** A set is usually denoted by a capital letter, such as A, B, C.
- **Elements:** The elements of a set are usually denoted by lowercase letters, such as a, b, c.

Question No. 38: Define a singleton set.
Answer: A singleton set is a set that contains exactly one element. **Example:** A = {a}, B = {5}.

Question No. 39: Define an empty set.
Answer: An empty set (or null set) is a set that contains no elements. It is denoted by the symbols **{ }** or **∅**.

Question No. 40: Write some important sets and their symbols.
Answer: Some important sets in mathematics are:

- **N**: The set of Natural numbers = {1, 2, 3, ...}
- **W**: The set of Whole numbers = {0, 1, 2, 3, ...}
- **Z**: The set of Integers = {..., -2, -1, 0, 1, 2, ...}
- **E**: The set of Even integers = {..., -2, 0, 2, 4, ...}
- **O**: The set of Odd integers = {..., -1, 1, 3, 5, ...}
- **P**: The set of Prime numbers = {2, 3, 5, 7, 11, ...}
- **Q**: The set of Rational numbers.
- **R**: The set of Real numbers.

Question No. 41: Define equal sets.
Answer: Two sets are said to be equal sets if they have exactly the same elements. The order of elements does not matter. If sets A and B are equal, we write $A = B$. **Example:** If A = {1, 2, 3} and B = {3, 1, 2}, then $A = B$.

Question No. 42: Define equivalent sets.
Answer: Two sets are said to be equivalent sets if they have the same number of elements (i.e., they have a one-to-one correspondence). The elements themselves do not need to be the same. **Example:** If A = {1, 2, 3} and B = {a, b, c}, then A and B are equivalent.

Question No. 43: Define a subset.
Answer: A set A is a subset of a set B if every element of A is also an element of B. This is denoted by $A \subseteq B$.

Question No. 44: Define a proper subset.
Answer: A set A is a proper subset of a set B if A is a subset of B, and B contains at least one element that is not in A. This is denoted by $A \subset B$. **Example:** If A = {1, 2} and B = {1, 2, 3}, then A is a proper subset of B.

Question No. 45: Define an improper subset.
Answer: An improper subset is a subset that is equal to the original set. Every set is an improper subset of itself. **Example:** If A = {1, 2, 3}, then {1, 2, 3} is an improper subset of A.

Question No. 46: Define a universal set.
Answer: A universal set, denoted by **U**, is a set that contains all the elements under consideration in a particular discussion. All other sets in that context are subsets of the universal set.

Question No. 47: Define a power set.
Answer: The power set of a set A, denoted by $P(A)$, is the set of all possible subsets of A, including the empty set and the set A itself. If a set A has 'n' elements, then its power set $P(A)$ will have 2^n elements.

Question No. 48: Define the union of two sets.
Answer: The union of two sets A and B, denoted by $A \cup B$, is the set of all elements that are in set A, or in set B, or in both.

Question No. 49: Define the intersection of two sets.

Answer: The intersection of two sets A and B, denoted by $A \cap B$, is the set of all elements that are common to both set A and set B.

Question No. 50: Define the difference of two sets.
Answer: The difference of two sets A and B, denoted by $A - B$ or $A \backslash B$, is the set of all elements that are in set A but are not in set B.

Question No. 51: Define disjoint sets.
Answer: Two sets are disjoint if they have no elements in common. In other words, their intersection is the empty set ($A \cap B = \emptyset$).

Question No. 52: Define overlapping sets.
Answer: Two sets are overlapping if they have at least one element in common, but neither set is a subset of the other. Their intersection is not an empty set.

Question No. 53: Define the complement of a set.
Answer: The complement of a set A, denoted by A' or A^c, is the set of all elements in the universal set (U) that are not in set A. It is defined as $A' = U - A$.

Question No. 54: What do you mean by a Venn diagram?
Answer: A Venn diagram is a pictorial representation of sets and their relationships. A rectangle typically represents the universal set, while circles or other closed shapes inside the rectangle represent subsets. The overlapping regions of circles show the intersection of sets.

Question No. 55: Write two properties of union and intersection.
Answer: Two fundamental properties involving union and intersection are:

1. **Commutative Property:**
   - $A \cup B = B \cup A$
   - $A \cap B = B \cap A$
2. **Associative Property:**
   - $(A \cup B) \cup C = A \cup (B \cup C)$
   - $(A \cap B) \cap C = A \cap (B \cap C)$

Question No. 56: Define De Morgan's laws.
Answer: De Morgan's laws describe the relationship between union, intersection, and complement. There are two laws:

1. The complement of the union of two sets is the intersection of their complements: $(A \cup B)' = A' \cap B'$
2. The complement of the intersection of two sets is the union of their complements: $(A \cap B)' = A' \cup B'$

Question No. 57: Write the principle of inclusion and exclusion for two sets.
Answer: The principle of inclusion-exclusion for two sets A and B allows us to find the number of elements in their union: $n(A \cup B) = n(A) + n(B) - n(A \cap B)$

Question No. 58: Write the principle of inclusion and exclusion for three sets.
Answer: For three sets A, B, and C, the principle of inclusion-exclusion is: $n(A \cup B \cup C) = n(A) + n(B) + n(C) - n(A \cap B) - n(B \cap C) - n(C \cap A) + n(A \cap B \cap C)$

Question No. 59: Define a binary relation.
Answer: A binary relation from a set A to a set B is any subset of the Cartesian product $A \times B$. It describes a relationship between elements of A and elements of B.

Question No. 60: Define Cartesian product.
Answer: The Cartesian product of two non-empty sets A and B, denoted by $A \times B$, is the set of all possible ordered pairs (a, b) where the first element 'a' is from set A and the second element 'b' is from set B. $A \times B = \{(a, b) | a \in A \wedge b \in B\}$

Question No. 61: What are domain and range?
Answer:

- **Domain:** In a binary relation, the domain is the set of all the first elements of the ordered pairs.
- **Range:** In a binary relation, the range is the set of all the second elements of the ordered pairs.

Question No. 62: Define an ordered pair.
Answer: An ordered pair is a pair of objects, (a, b), in which the order of the objects is significant. The pair (a, b) is different from the pair (b, a) unless $a = b$.

Question No. 63: Define a function.
Answer: A function is a special type of binary relation between two sets, A and B, in which every element of set A is associated with exactly one element in set B. Set A is the domain, and the elements in B that are mapped to are the range.

Question No. 64: Define an into function.
Answer: An into function is a function where the range is a proper subset of the co-domain (set B). This means there is at least one element in the co-domain that is not the image of any element from the domain.

Question No. 65: Define an onto function or surjective function.
Answer: An onto function (or surjective function) is a function where every element in the co-domain (set B) is the image of at least one element from the domain (set A). In this case, the range is equal to the co-domain.

Question No. 66: Define a one-to-one function.
Answer: A one-to-one function (or injective function) is a function where distinct elements in the domain map to distinct elements in the co-domain. No two different elements in the domain have the same image.

Question No. 67: Define a bijective function.
Answer: A bijective function is a function that is both **one-to-one (injective)** and **onto (surjective)**. This means every element of the domain is paired with a unique element of the co-domain, and every element of the co-domain is paired with an element of the domain.

Unit 4: Factorization and Algebraic Manipulation

Question No. 68: Define quadratic equations.
Answer: A quadratic equation is a polynomial equation of the second degree, meaning it contains at least one term that is squared. The standard form is $ax^2 + bx + c = 0$, where $a, b,$ and c are real numbers, and $a \neq 0$.

Question No. 69: Define common factorization.
Answer: Common factorization is a method of factorization where the greatest common factor (GCF) of all the terms in an algebraic expression is identified and "factored out," with the remaining terms enclosed in parentheses. For example, in $ab + ac$, the common factor is a, so it is factorized as $a(b + c)$.

Question No. 70: How many methods are there to find H.C.F.?
Answer: There are two primary methods for finding the Highest Common Factor (H.C.F.) of two or more algebraic expressions:

1. **By Factorization:** Find the prime factors of all expressions and then multiply the common factors.
2. **By Division:** Use the long division method, which is especially useful for polynomials.

Question No. 71: What is the relationship between L.C.M. and H.C.F.?
Answer: For any two polynomials, $P(x)$ and $Q(x)$, the product of their Least Common Multiple (L.C.M.) and Highest Common Factor (H.C.F.) is equal to the product of the polynomials themselves. $L.C.M \times H.C.F = P(x) \times Q(x)$

Question No. 72: Define H.C.F.
Answer: The Highest Common Factor (H.C.F.) of two or more algebraic expressions is the greatest expression that is a factor of all of them. It is found by multiplying all the common factors.

Question No. 73: Define L.C.M.
Answer: The Least Common Multiple (L.C.M.) of two or more algebraic expressions is the smallest expression that is a multiple of all of them. It is found by multiplying the common factors and the non-common factors.

Question No. 74: Define square root.
Answer: The square root of a number or an algebraic expression is a value that, when multiplied by itself, gives the original number or expression. For example, the square root of 25 is 5 because $5 \times 5 = 25$.

Question No. 75: Define factorization.
Answer: Factorization is the process of breaking down an algebraic expression into a product of its factors, which are simpler expressions that cannot be factored further.

Unit 5: Linear Equations and Inequalities

Question No. 76: What is a linear equation in one variable?
Answer: A linear equation in one variable is an equation that can be written in the form $ax + b = 0$, where 'x' is the variable, and 'a' and 'b' are real numbers with $a \neq 0$.

Question No. 77: Define a linear inequality.
Answer: A linear inequality is a mathematical statement that compares two linear expressions using an inequality symbol such as < (less than), > (greater than), ≤ (less than or equal to), or ≥ (greater than or equal to). For example, $ax + b > c$.

Question No. 78: What is the feasible solution in a system of inequalities?
Answer: In a system of linear inequalities, a feasible solution is any ordered pair (x, y) that satisfies all the inequalities in the system simultaneously. The set of all such solutions forms the **feasible region** on a graph.

Question No. 79: What is the optimal solution in a linear programming problem?
Answer: In a linear programming problem, the optimal solution is the point within the feasible region where the objective function reaches its maximum or minimum value.

Question No. 80: What is an objective function?
Answer: An objective function is a linear function, typically of the form $f(x, y) = ax + by$, that is to be maximized or minimized subject to a set of constraints (linear inequalities) in a linear programming problem.

Question No. 81: What are the corner points of a feasible region?
Answer: The corner points (or vertices) of a feasible region are the points where the boundary lines of the region intersect. The optimal solution to a linear programming problem always occurs at one of these corner points.

Question No. 82: Explain the significance of test points in graphing inequalities.

Answer: When graphing a linear inequality, a test point (often the origin (0,0) if it is not on the line) is used to determine which side of the boundary line represents the solution set. If the test point satisfies the inequality, the entire region containing that point is shaded as the solution. If it does not, the region on the opposite side of the line is shaded.

Unit 6: Trigonometry

Question No. 83: What is trigonometry?
Answer: Trigonometry is the branch of mathematics that studies the relationships between the angles and the side lengths of triangles. The word comes from the Greek words "tri" (three), "gonia" (angle), and "metron" (measure).

Question No. 84: Define an angle.
Answer: An angle is formed by the union of two rays that have a common starting point, called the vertex. The two rays are called the arms of the angle.

Question No. 85: Define an acute angle and write it symbolically.
Answer: An acute angle is an angle whose measure is greater than $0°$ and less than $90°$. **Symbolically:** $0° < \theta < 90°$

Question No. 86: Define an obtuse angle and also write it symbolically.
Answer: An obtuse angle is an angle whose measure is greater than $90°$ and less than $180°$. **Symbolically:** $90° < \theta < 180°$

Question No. 87: Define a right angle.
Answer: A right angle is an angle whose measure is exactly $90°$.

Question No. 88: How many types of angles are there? Name them.
Answer: Based on their measure, the main types of angles are:

1. Acute Angle
2. Right Angle
3. Obtuse Angle
4. Straight Angle (measures $180°$)
5. Reflex Angle (measures between $180°$ and $360°$)

Question No. 89: How can we measure an angle?
Answer: An angle can be measured using two common systems:

1. **Sexagesimal System:** The unit of measurement is the **degree (°)**, which is further divided into minutes (') and seconds (").
2. **Circular System:** The unit of measurement is the **radian**.

Question No. 90: Define a degree.
Answer: A degree is a unit of angle measurement. If the circumference of a circle is divided into 360 equal arcs, the angle subtended by one of these arcs at the center is called one degree (1°).

Question No. 91: Define a radian.
Answer: A radian is the measure of the angle subtended at the center of a circle by an arc whose length is equal to the radius of the circle.

Question No. 92: What is the relationship between a degree and a radian?
Answer: The relationship between degrees and radians is:

- $180° = \pi$ radians

- $1^\circ = \frac{\pi}{180}$ radians
- 1 radian $= \frac{180^\circ}{\pi}$

Unit 7: Coordinate Geometry

Question No. 93: Define a coordinate plane.
Answer: A coordinate plane is a two-dimensional plane formed by the intersection of two perpendicular number lines, called the axes. This plane is used to specify the location of any point using an ordered pair of numbers (x, y).

Question No. 94: Define the origin.
Answer: The origin is the point where the x-axis and the y-axis intersect in a coordinate plane. The coordinates of the origin are $(0,0)$.

Question No. 95: Define Abscissa and Ordinate.
Answer: For any point P(x, y) in a coordinate plane:

- **Abscissa:** The x-coordinate is called the abscissa. It represents the point's horizontal distance from the y-axis.
- **Ordinate:** The y-coordinate is called the ordinate. It represents the point's vertical distance from the x-axis.

Question No. 96: Define coordinate axes.
Answer: The coordinate axes are the two perpendicular number lines that form the coordinate plane. The horizontal axis is called the **x-axis**, and the vertical axis is called the **y-axis**.

Question No. 97: What is the distance formula?
Answer: The distance formula is used to find the distance 'd' between two points $P_1(x_1, y_1)$ and $P_2(x_2, y_2)$ in a coordinate plane. $d = \sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

Question No. 98: What is the midpoint formula?
Answer: The midpoint formula is used to find the coordinates of the midpoint $M(x, y)$ of a line segment connecting two points $P_1(x_1, y_1)$ and $P_2(x_2, y_2)$. $M(x, y) = \left(\frac{x_1+x_2}{2}, \frac{y_1+y_2}{2}\right)$

Question No. 99: What is the slope or gradient of a line?
Answer: The slope (or gradient) of a line is a measure of its steepness. It is the ratio of the change in the y-coordinate (rise) to the change in the x-coordinate (run) between any two points on the line. The formula for the slope 'm' is: $m = \frac{y_2-y_1}{x_2-x_1}$

Question No. 100: Define collinear points.
Answer: Collinear points are three or more points that lie on the same straight line. A way to check for collinearity is to see if the slope between any two pairs of points is the same.

Question No. 101: What is the equation of a straight line?
Answer: The most common form of the equation of a straight line is the **slope-intercept form**: $y = mx + c$ where 'm' is the slope of the line and 'c' is the y-intercept (the point where the line crosses the y-axis).

Question No. 102: What is the equation of a line (two-point form)?
Answer: The two-point form of the equation of a line that passes through two points (x_1, y_1) and (x_2, y_2) is: $y - y_1 = \frac{y_2-y_1}{x_2-x_1}(x - x_1)$

Question No. 103: Define parallel lines.
Answer: Parallel lines are lines in the same plane that never intersect. Two non-vertical lines are parallel if and only if they have the same slope ($m_1 = m_2$).

Question No. 104: Define perpendicular lines.
Answer: Perpendicular lines are lines that intersect at a right angle (90°). Two non-vertical lines are perpendicular if and only if the product of their slopes is -1 ($m_1 \times m_2 = -1$).

Question No. 105: What is the intercept form of a line?
Answer: The intercept form of the equation of a line is: $\frac{x}{a} + \frac{y}{b} = 1$ where 'a' is the x-intercept and 'b' is the y-intercept.

Question No. 106: What is the general form of a line?
Answer: The general form of the equation of a straight line is: $Ax + By + C = 0$ where A, B, and C are constants, and A and B are not both zero.

Unit 8: Logic

Question No. 107: Define logic.
Answer: Logic is the systematic study of the principles of valid reasoning and inference. It analyzes the structure of arguments to distinguish correct reasoning from incorrect reasoning.

Question No. 108: Define induction.
Answer: Induction is a method of reasoning in which a general conclusion is drawn from a set of specific observations or examples. The conclusion is probable but not guaranteed to be true.

Question No. 109: Define deduction.
Answer: Deduction is a method of reasoning in which a specific conclusion is derived from general principles or premises. If the premises are true, the conclusion is guaranteed to be true.

Question No. 110: Define a statement.
Answer: In logic, a statement (or proposition) is a declarative sentence that is either true or false, but not both simultaneously.

Question No. 111: Define negation.
Answer: The negation of a statement P, denoted by ~P, is a statement that is true when P is false, and false when P is true. It essentially reverses the truth value of the original statement.

Question No. 112: Define conjunction.
Answer: A conjunction is a compound statement formed by connecting two statements with the word "and". The conjunction of P and Q, written as $P \wedge Q$, is true only if both P and Q are true.

Question No. 113: Define disjunction.
Answer: A disjunction is a compound statement formed by connecting two statements with the word "or". The disjunction of P and Q, written as $P \vee Q$, is false only if both P and Q are false.

Question No. 114: What do you mean by implication or conditional?
Answer: An implication or conditional is a compound statement of the form "if P, then Q", written as $P \rightarrow Q$. It is false only when the first part (P) is true and the second part (Q) is false.

Question No. 115: Define biconditional.
Answer: A biconditional is a compound statement of the form "P if and only if Q", written as $P \leftrightarrow Q$. It is true only when both statements P and Q have the same truth value (both true or both false).

Question No. 116: Define tautology.
Answer: A tautology is a compound statement that is always true, regardless of the truth values of its individual component statements.

Unit 9: Similar Figures

Question No. 117: Define a polygon.
Answer: A polygon is a closed two-dimensional figure made up of three or more straight line segments. The segments are called **sides**, and the points where the sides meet are called **vertices**.

Question No. 118: Define similar polygons.
Answer: Two polygons are similar if their corresponding angles are equal and the lengths of their corresponding sides are in proportion.

Question No. 119: Define similar triangles.
Answer: Two triangles are similar if their corresponding angles are equal in measure, and their corresponding sides are proportional in length.

Question No. 120: Define congruent figures.
Answer: Congruent figures are geometric figures that have the exact same size and shape. If one figure can be placed on top of the other to match perfectly, they are congruent.

Question No. 121: Define a parallelogram.
Answer: A parallelogram is a quadrilateral (a four-sided polygon) in which both pairs of opposite sides are parallel.

Question No. 122: What is the area of a parallelogram?
Answer: The area of a parallelogram is the product of its base and its corresponding height (altitude). Area $=$ base $\times$ height

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Question No. 123: Define a diagonal of a polygon.
Answer: A diagonal of a polygon is a line segment that connects two non-consecutive vertices of the polygon.

Question No. 124: Define an interior angle of a polygon.
Answer: An interior angle of a polygon is an angle formed inside the polygon by two adjacent sides.

Question No. 125: Define an exterior angle of a polygon.
Answer: An exterior angle of a polygon is an angle formed by one side of the polygon and the extension of an adjacent side.

Question No. 126: Define a regular polygon.
Answer: A regular polygon is a polygon that is both equiangular (all angles are equal in measure) and equilateral (all sides have the same length).

Question No. 127: Find the measure of each interior angle of a regular pentagon.
Answer: The formula for the measure of each interior angle of a regular n-sided polygon is: Interior Angle $= \frac{(n-2)\times 180^\circ}{n}$For a regular pentagon, n = 5.Interior Angle $= \frac{(5-2)\times 180^\circ}{5} = \frac{3\times 180^\circ}{5} = 108^\circ$

Unit 10: Graphs of Functions

Question No. 128: What does the general form of a quadratic function look like?
Answer: The general form of a quadratic function is: $f(x) = ax^2 + bx + c$ where a, b, and c are real numbers, and $a \neq 0$.

Question No. 129: What does the graph of a quadratic function look like?
Answer: The graph of a quadratic function is a smooth, U-shaped curve called a **parabola**. If the leading coefficient 'a' is positive, the parabola opens upwards. If 'a' is negative, it opens downwards.

Question No. 130: What is a cubic function?
Answer: A cubic function is a polynomial function of degree 3. Its general form is: $f(x) = ax^3 + bx^2 + cx + d$ where $a \neq 0$.

Question No. 131: What does the graph of a cubic function generally look like?
Answer: The graph of a cubic function is generally an S-shaped curve that can have up to two turning points. Its end behavior depends on the sign of the leading coefficient 'a'.

Question No. 132: What is a reciprocal function?
Answer: A reciprocal function is a function of the form $f(x) = \frac{k}{x}$, where k is a non-zero constant. The simplest form is $f(x) = \frac{1}{x}$.

Question No. 133: How does the graph of a reciprocal function behave?
Answer: The graph of a reciprocal function like $f(x) = \frac{1}{x}$ is a **hyperbola**. It consists of two separate branches in opposite quadrants (the first and third). The graph approaches the x-axis and y-axis but never touches them (these are its asymptotes).

Question No. 134: What is an exponential function?
Answer: An exponential function is a function in which the variable appears in the exponent. Its general form is $f(x) = a^x$, where the base 'a' is a positive constant other than 1.

Question No. 135: What is the break-even point in business mathematics?
Answer: The break-even point is the level of production or sales at which a company's total revenue equals its total costs. At this point, there is no profit and no loss.

Question No. 136: What is the equation used to find the break-even point?
Answer: To find the break-even point, you set the total revenue function, R(x), equal to the total cost function, C(x): $R(x) = C(x)$ Solving this equation for 'x' gives the number of units that must be sold to break even.

Question No. 137: What is the function for exponential decay?
Answer: The function for exponential decay models a quantity that decreases at a rate proportional to its current value. A common form of the function is: $A(t) = A_0(1 - r)^t$ where A_0 is the initial amount, 'r' is the decay rate per time period, and 't' is the number of time periods.

Question No. 138: What is the function for exponential growth?
Answer: The function for exponential growth models a quantity that increases at a rate proportional to its current value. A common form of the function is: $A(t) = A_0(1 + r)^t$ where A_0 is the initial amount, 'r' is the growth rate per time period, and 't' is the number of time periods.

Question No. 139: How can the gradient of a curve be determined?
Answer: The gradient (or slope) of a curve at a specific point is determined by finding the slope of the **tangent line** to the curve at that point. In calculus, this is found by calculating the derivative of the function that defines the curve.

Question No. 140: What does the tangent line to a curve represent?
Answer: The tangent line to a curve at a given point represents the **instantaneous rate of change** or the **gradient** of the curve at that exact point.

Unit 11: Loci and Construction

Question No. 141: Define an equilateral triangle.
Answer: An equilateral triangle is a triangle in which all three sides are equal in length. Consequently, all three of its interior angles are also equal, each measuring 60°.

Question No. 142: Define an isosceles triangle.
Answer: An isosceles triangle is a triangle that has at least two sides of equal length. The angles opposite the equal sides are also equal in measure.

Question No. 143: Define a scalene triangle.
Answer: A scalene triangle is a triangle that has three unequal sides. Consequently, all three of its interior angles are also unequal.

Question No. 144: Define an acute-angled triangle.
Answer: An acute-angled triangle is a triangle in which all three interior angles are acute angles (each less than 90°).

Question No. 145: Define an obtuse-angled triangle.
Answer: An obtuse-angled triangle is a triangle that has one interior angle that is obtuse (greater than 90°).

Question No. 146: Define a right-angled triangle.
Answer: A right-angled triangle is a triangle that has one interior angle that is a right angle (exactly 90°).

Question No. 147: What is a triangle?
Answer: A triangle is a polygon with three edges (sides) and three vertices (corners). It is one of the basic shapes in geometry.

Question No. 148: How can a triangle be constructed?
Answer: A unique triangle can be constructed if at least three of its parts (sides or angles) are known, provided at least one of them is a side. Common cases include knowing: (i) three sides (SSS), (ii) two sides and the included angle (SAS), or (iii) two angles and one side (ASA or AAS).

Question No. 149: What is a perpendicular bisector?
Answer: A perpendicular bisector of a line segment is a line that is perpendicular to the segment and passes through its midpoint, dividing it into two equal parts at a 90° angle.

Question No. 150: Define a median of a triangle.
Answer: A median of a triangle is a line segment that connects a vertex to the midpoint of the opposite side.

Question No. 151: Define a point of concurrency.
Answer: A point of concurrency is a point where three or more lines, rays, or segments intersect.

Question No. 152: Define the circumcenter of a triangle.
Answer: The circumcenter of a triangle is the point of concurrency of the perpendicular bisectors of the three sides. It is the center of the circle (circumcircle) that passes through all three vertices of the triangle.

Question No. 153: Define the centroid of a triangle.
Answer: The centroid of a triangle is the point of concurrency of the three medians. It is the triangle's center of gravity or balance point.

Question No. 154: Define the incenter of a triangle.
Answer: The incenter of a triangle is the point of concurrency of the angle bisectors of the three interior angles. It is the center of the circle (incircle) that is inscribed within the triangle, touching all three sides.

Question No. 155: What is the altitude of a triangle?
Answer: An altitude of a triangle is a perpendicular line segment from a vertex to the line containing the opposite side (the base).

Question No. 156: What is the orthocenter of a triangle?
Answer: The orthocenter of a triangle is the point of concurrency of the three altitudes of the triangle.

Question No. 157: What is an ambiguous case in triangle construction?
Answer: The ambiguous case occurs in triangle construction when we are given two sides and a non-included angle (SSA). Depending on the given values, it may be possible to construct zero, one, or two different triangles.

Question No. 158: What is the purpose of medians in triangle construction?
Answer: The primary purpose of medians is to locate the centroid of the triangle, which is its center of mass. A median also divides the triangle into two smaller triangles of equal area.

Question No. 159: What is the purpose of altitudes in a triangle?
Answer: The primary purpose of altitudes is to determine the height of the triangle relative to a chosen base, which is essential for calculating the triangle's area using the formula: Area $= \frac{1}{2} \times$ base $\times$ height.

Question No. 160: What is the purpose of a perpendicular bisector in triangle construction?
Answer: The purpose of constructing the perpendicular bisectors of the sides of a triangle is to find the circumcenter. The circumcenter is equidistant from all three vertices and is the center of the circumscribed circle.

Question No. 161: Define a circle.
Answer: A circle is the set of all points in a plane that are at a fixed distance (the radius) from a fixed point (the center).

Unit 12: Information Handling

Question No. 162: Define information handling.
Answer: Information handling, also known as statistics, is the branch of mathematics concerned with the methods of collecting, organizing, analyzing, interpreting, and presenting data.

Question No. 163: What is discrete data?
Answer: Discrete data is a type of data that can only take specific, distinct values and is usually counted. These values are typically integers. For example, the number of students in a class.

Question No. 164: What is continuous data?
Answer: Continuous data is a type of data that can take any value within a given range and is measured. It can have fractional or decimal values. For example, the height of a person or the temperature of a room.

Question No. 165: Differentiate between discrete and continuous data.
Answer:

Discrete Data	Continuous Data
Can only take specific, separate values.	Can take any value within a range.
It is counted.	It is measured.
Finite or countably infinite values.	Infinite values within an interval.
Number of cars in a parking lot.	Weight of a person.

Question No. 166: Define ungrouped data.
Answer: Ungrouped data (or raw data) is data that has been collected but has not been organized into any categories, classes, or groups.

Question No. 167: Define grouped data.
Answer: Grouped data is data that has been organized and summarized into different classes or intervals, typically presented in a frequency distribution table.

Question No. 168: Define frequency distribution.
Answer: A frequency distribution is a table that displays the frequency (the number of occurrences) of various outcomes or data points within different classes or intervals.

Question No. 169: How do we find the size of a class?
Answer: The size or width of a class interval is the difference between the upper and lower class boundaries of that class. For a dataset, it can be estimated by:

$$\text{Class Size} = \frac{\text{Range (Max Value - Min Value)}}{\text{Number of Classes}}$$

Question No. 170: Define class limits.
Answer: Class limits are the smallest and largest data values that can be included in a particular class. Each class has a **lower class limit** and an **upper class limit**.

Question No. 171: What are Tally marks?
Answer: Tally marks are a simple way of counting and keeping track of frequencies. Each occurrence is marked with a vertical line (|), and every fifth occurrence is marked with a diagonal line across the previous four, forming a group of five (||||).

Question No. 172: Define frequency.
Answer: Frequency is the number of times a particular value or observation occurs in a data set or falls within a specific class interval.

Question No. 173: Define class boundary.
Answer: Class boundaries are the precise points that separate one class from another, leaving no gaps between them. They are found by taking the average of the upper limit of one class and the lower limit of the next class.

Question No. 174: What is a histogram?
Answer: A histogram is a graphical representation of a frequency distribution for continuous data. It consists of a series of adjacent rectangles, where the width of each rectangle represents the class interval and the height represents the frequency of that class.

Question No. 175: Define midpoint or class mark.
Answer: The midpoint (or class mark) is the middle value of a class interval. It is calculated by adding the lower and upper class limits (or boundaries) and dividing by 2.

$$\text{Midpoint} = \frac{\text{Lower Class Limit} + \text{Upper Class Limit}}{2}$$

Question No. 176: Write the measures of Central Tendency.
Answer: Measures of central tendency are single values that attempt to describe the central position of a set of data. The main measures are:

1. **Arithmetic Mean**
2. **Median**
3. **Mode**

Question No. 177: Define arithmetic mean.
Answer: The arithmetic mean (or simply the mean) is the sum of all values in a data set divided by the total number of values. $\bar{X} = \frac{\sum X}{n}$

Question No. 178: Define median.
Answer: The median is the middle value in a data set that has been arranged in ascending or descending order. It divides the data into two equal halves.

Question No. 179: Define mode.
Answer: The mode is the value that appears most frequently in a data set. A data set can have one mode, more than one mode, or no mode at all.

Question No. 180: Define weighted mean.
Answer: The weighted mean is an average in which each value in the data set is assigned a weight according to its relative importance. It is calculated as the sum of the products of each value and its weight, divided by the sum of the weights. $\bar{X}_w = \frac{\sum(w \times X)}{\sum w}$

Unit 13: Probability

Question No. 181: Define probability.
Answer: Probability is a numerical measure of the likelihood or chance that a particular event will occur. Its value is always between 0 and 1, where 0 indicates impossibility and 1 indicates certainty.

Question No. 182: What is an experiment in probability?
Answer: An experiment is any process or action that can be repeated and has a well-defined set of possible outcomes. For example, tossing a coin or rolling a die.

Question No. 183: What is an outcome?
Answer: An outcome is a single possible result of an experiment. For example, getting a '4' when rolling a die is an outcome.

Question No. 184: What is a favorable outcome?
Answer: A favorable outcome is an outcome that corresponds to a specific event of interest. For example, if the event is "getting an even number" when rolling a die, the favorable outcomes are 2, 4, and 6.

Question No. 185: What is a sample space?

Answer: A sample space, denoted by S, is the set of all possible outcomes of an experiment. For example, the sample space for rolling a single die is S = {1, 2, 3, 4, 5, 6}.

Question No. 186: What is an event?
Answer: An event is any subset of the sample space. It consists of one or more outcomes of an experiment. For example, the event of "getting an odd number" when rolling a die is the set {1, 3, 5}.

Question No. 187: What is meant by the complement of an event?
Answer: The complement of an event A, denoted by A', is the set of all outcomes in the sample space that are not in event A. The probability of the complement is $P(A') = 1 - P(A)$.