



REASONING ABILITY

FORMULAE BOOK



For SSC, Railway, Defense and Other Government Exams

Analogy & Similarity

Analogy in reasoning refers to drawing similarities or relationships between different elements or concepts. It establishes a relationship between two or more terms or concepts based on their similarities. It involves identifying patterns, connections, or shared characteristics to draw logical comparisons and infer relationships between different elements.

THERE ARE THE FOLLOWING TYPES OF ANALOGY:

Type	Description
Letter/Word Based Analogy	Analogy based on the relationship between letters or words.
Number Based/ Numerical Analogy	Analogy based on the relationship between numbers or numerical patterns.
Letter and Number Based Analogy	Analogy that combines the relationship between both letters and numbers.
Image-Based Analogy	Analogy based on the relationship between images or visual patterns.
General Knowledge Based Analogy	Analogy that requires knowledge and understanding of general information or concepts.
Symbol and Meaning	Analogies where one word represents a symbol or sign, and the other word represents the meaning or interpretation.

Please note that this is a simplified classification, and some analogies may overlap multiple categories or fall into subcategories within each type.

There are some things that should be remembered while attempting the problems related to the ANALOGY as follows:

1. **Identify the Relationship:** Analyze the given pair of words or elements in the analogy and try to determine the underlying relationship between them. Pay attention to their characteristics, functions, or associations.

2. **Look for Patterns:** Look for patterns or trends in the given analogy. Identify any consistent changes or transformations between the elements and try to apply the same pattern to the second pair of words or elements.
3. **Consider Different Types of Analogies:** Analogies can be based on various relationships such as synonyms, antonyms, part-to-whole, cause-and-effect, function, category, or degree. Be open to different possibilities and consider multiple types of relationships.
4. **Use Contextual Clues:** Sometimes, the context or topic of the analogy can provide clues about the relationship between the words or elements. Pay attention to the subject matter and context to help you understand the analogy better.
5. **Avoid Assumptions:** Be cautious about making assumptions or jumping to conclusions based on your prior knowledge or personal biases. Rely on the information provided in the analogy and avoid introducing outside information or assumptions.
6. **Test All Options:** In multiple-choice questions, go through each option and evaluate its suitability based on the given analogy. Eliminate options that do not fit the relationship or have weak connections.
7. **Break it Down:** If the analogy seems complex, try breaking it down into smaller parts or comparing each element separately. Sometimes, understanding the relationship between individual elements can help you decipher the overall analogy.

We can understand the analogy by the following examples:

1. Ocean : Sea :: Mountain : ?
 (a) Hill (b) Valley
 (c) River (d) Plain

Sol. () In this analogy, Ocean is a larger body of water, and Sea is a smaller body of water that is part of the ocean.

Similarly, Mountain is a larger landform, and Hill is a smaller landform that is part of the mountain range.

Therefore, the correct answer is: Hill

2. Oxygen : Respiration :: Water : ?
- Sol.** Hydration (The relationship is the substance and its role in a specific process: oxygen is essential for respiration, and water is essential for hydration.)
3. Cat : Meow :: Dog : ?
- Sol.** Bark (The relationship is the animal sound commonly associated with the specific animal: a cat makes the sound “meow,” and a dog makes the sound “bark.”)
4. Moon : Satellite :: Earth : ?
- Sol.** Planet (The relationship is the celestial body and its classification: the moon is a satellite of the Earth, and the Earth is a planet.)
5. Rose : Red :: Sky : ?
- Sol.** Blue (The relationship is the color commonly associated with the specific object: a rose is often red, and the sky is often blue).
6. Sun : Day :: Moon : ?
- Sol.** Night (The relationship is the celestial body and the time period it is commonly associated with: the sun is associated with the day, and the moon is associated with the night).
7. Summer : Hot :: Winter : ?
- Sol.** Cold (The relationship is the season and the temperature commonly associated with it: summer is associated with hot temperatures, and winter is associated with cold temperatures.)

Classification

Classification in reasoning refers to the process of categorizing or grouping items based on their shared characteristics or properties. It involves identifying patterns, similarities, or relationships among different elements and organizing them into distinct categories or classes. By understanding the underlying attributes or features of the items, classification allows us to make sense of complex information, recognize patterns, and draw logical conclusions. It is a fundamental reasoning skill that involves sorting and organizing data to facilitate understanding and analysis.

In reasoning, there are several types of classification or odd one out problems. These include:

Type	Description
Number/ Alphanumeric Classification	Identify the odd one out in a series of numbers or alphanumeric characters based on a specific pattern or rule.
Letter/Alphabet Classification	Identify the odd one out in a series of letters or alphabets based on their position or arrangement in the series.
Word Classification	Identify the word that does not belong to the same category or share the same relationship as the others in a group.
Image Classification	Identify the image that does not fit into the given category or share the same characteristics as the others in a set.
Conceptual/Logical Classification	Identify the item or concept that does not belong to the same group based on logical or conceptual criteria.

Here are some of the examples of each type of the classification:

- 1. Number/Alphanumeric Classification:** In this type, a series of numbers or alphanumeric characters are presented, and the task is to identify the odd one out based on a specific pattern or rule.

Exa. 2, 4, 10, 16, 32. Which is the odd one out?

Sol. 10 is the odd one out because it is the only number that is not a power of 2.

- 2. Letter/Alphabet Classification:** In this type, a series of letters or alphabets are given, and the objective is to identify the odd one out based on certain rules or patterns related to their position or arrangement in the series.

Exa. A, C, E, F, G. Which is the odd one out?

Sol. F is the odd one out because it is the only letter that has an even place value which is 6 while the place value of the rest of the alphabet are odd.

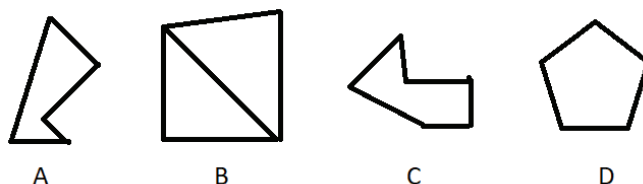
- 3. Word Classification:** In this type, a group of words is provided, and the task is to identify the word that does not belong to the same category or does not share the same relationship as the others.

Exa. Apple, Orange, Banana, Carrot. Which is the odd one out?

Sol. Carrot is the odd one out because it is a vegetable, whereas the others are fruits.

- 4. Image Classification:** In this type, a set of images or pictures is presented, and the goal is to identify the image that does not fit into the given category or does not share the same characteristics as the others.

Exa. Which of the following images is an odd one out?



Sol. As we can see that,
Number of lines in each image is = 5 except the image C. That has the number of lines = 6
Hence, the correct answer is image C.

- 5. Conceptual/Logical Classification:** In this type, a group of items or concepts is given, and the task is to identify the item that does not belong to the same group based on certain logical or conceptual criteria.

Exa. Circle, Square, Triangle, Apple. Which is the odd one out?

Sol. Apple is the odd one out because it is not a geometric shape, whereas the others are.

These are just a few examples of the types of classification or odd one out problems that can be encountered in reasoning.

We can understand the classification by the following examples:

Number/Alphanumeric Classification:

Series: 3, 6, 9, 15, 18

Odd one out: 15

Solution: The pattern followed in the series is that each number is only divisible by 3, except for 15, which is divisible by 5 and 3 both instead.

Letter/Alphabet Classification:

Series: A, C, E, G, J

Odd one out: J

Solution: The letters in the series have the odd place value, except for J, which has the place value that is even = 10.

Symbols and Notations

In reasoning, symbols and notation are used to represent relationships, operations, or concepts in a concise and standardized manner. They provide a shorthand way of expressing ideas, making logical statements, and solving problems, allowing for clearer communication and logical analysis.

When attempting questions based on symbols and notation in reasoning, it is important to keep the following things in mind:

1. **Understand the Symbols:** Familiarize yourself with the symbols and notations used in the given question. Take note of their meanings and any specific rules or operations associated with them.
2. **Analyze the Context:** Consider the context in which the symbols and notations are presented. Look for any patterns, relationships, or logical rules that can help you interpret and solve the problem effectively.
3. **Follow Order of Operations:** If the question involves multiple symbols or operations, make sure to apply the correct order of operations (e.g., exponents, BODMAS) to evaluate the expressions accurately.
4. **Pay Attention to Detail:** Symbols and notations can be intricate, and a small error in interpretation or execution can lead to incorrect answers. Be diligent in your understanding and application of the symbols to avoid mistakes.
5. **Check for Consistency:** Ensure that you apply the symbols and notations consistently throughout the problem-solving process. Avoid mixing up symbols or misinterpreting their intended use.
6. **Review Solutions Carefully:** Once you have solved the problem using symbols and notations, review your solution carefully to check for any errors or inconsistencies. Cross-verify your answer to ensure it aligns with the given problem and the intended meaning of the symbols.

Here are some examples of symbol and notation :

1. If '+' denotes multiplication, '-' denotes division, 'x' denotes addition, and '÷' denotes subtraction, what is the value of $8 + 4 \times 2 \div 6 - 3$?

Sol. Using the given symbols, the expression can be rewritten as:

$$\begin{aligned} & 8 \times 4 + 2 - 6 \div 3 \\ &= 32 + 2 - 2 \\ &= 34 - 2 \\ &= 32 \end{aligned}$$

2. If '@' denotes addition, '#' denotes subtraction, '\$' denotes multiplication, and '%' denotes division, what is the value of $12 @ 4 \% 3 \$ 2 \# 5$?

Sol. Using the given symbols, the expression can be rewritten as:

$$\begin{aligned} & 12 + 4 \div 3 \times 2 - 5 \\ &= 12 + 1.333 \times 2 - 5 \\ &= 12 + 2.666 - 5 \\ &= 14.666 - 5 \\ &= 9.666 \end{aligned}$$

4. If 'Δ' denotes addition, '○' denotes subtraction, '□' denotes multiplication, and '◇' denotes division, what is the value of $9 \Delta 2 \square 4 \diamond 2 \circ 5$?

Sol. Using the given symbols, the expression can be rewritten as:

$$\begin{aligned} & 9 + 2 \times 4 \div 2 - 5 \\ &= 9 + 8 \div 2 - 5 \\ &= 9 + 4 - 5 \\ &= 13 - 5 \\ &= 8 \end{aligned}$$

5. If '%' denotes addition, '\$' denotes subtraction, '#' denotes multiplication, and '@' denotes division, what is the value of $10 \% 5 @ 3 \$ 2 \# 4$?

Sol. Using the given symbols, the expression can be rewritten as:

$$\begin{aligned} & 10 + 5 \div 3 - 2 \times 4 \\ &= 10 + 1.666 - 8 \\ &= 11.666 - 8 \\ &= 3.666 \end{aligned}$$

6. If '*' denotes division, '+' denotes subtraction, '/' denotes multiplication, and '-' denotes addition, what is the value of $8 * 4 + 6 / 3 - 2$?

Sol. Using the given symbols, the expression can be rewritten as:

$$\begin{aligned} & 8 \div 4 - 6 \times 3 + 2 \\ &= 2 - 18 + 2 \\ &= -16 + 2 \\ &= -14 \end{aligned}$$

8. If '@' denotes division, 'o' denotes subtraction, '□' denotes multiplication, and 'Δ' denotes addition, what is the value of $18 @ 6 \square 3 \Delta 2 \circ 4$?

Sol. Using the given symbols, the expression can be rewritten as:

$$\begin{aligned} & 18 \div 6 \times 3 + 2 - 4 \\ &= 3 \times 3 + 2 - 4 \\ &= 9 + 2 - 4 \\ &= 7 \end{aligned}$$

Alphabet test

In reasoning, an alphabet test is a type of question that assesses your ability to identify patterns or relationships between alphabets or letters. These tests often involve a series of alphabets or letters, and you are required to find the next letter or predict a missing letter based on the given pattern or rule.

We can understand this by following examples:

Example 1. If the letters of the English alphabet series are written as shown below then which letter should come next in the following series?

A E I M Q _ _

- (a) U (b) V
(c) W (d) X

Explanation: In this example, the letters are progressing in a pattern where each subsequent letter is four positions ahead of the previous one.

Following this pattern, the next letter after Q would be U.

Therefore, the correct answer is option U.

Alphabet tests can vary in complexity, and the patterns or rules can be based on letter positions, alphabetical sequences, numerical values, alternating patterns, and other logical relationships. These tests require logical reasoning and pattern recognition skills to identify the correct answer.

While attempting questions of alphabet tests in reasoning, here are some things that should be taken care of:

1. Analyze the given pattern: Carefully examine the given series of alphabets and try to identify any underlying pattern or rule. Look for relationships such as alphabetical order, position in the alphabet, alternate patterns, numerical values, or any other logical sequence.
2. Consistency in applying the pattern: Once you identify a pattern, ensure that it consistently applies to the entire series. Check if the pattern is maintained throughout or if there are any exceptions or variations.
3. Consider multiple patterns: Sometimes, a series of alphabets may exhibit more than one possible pattern. In such cases, analyze all possible patterns and choose the most logical and consistent one based on the given context or any additional clues provided in the question.
4. Look for incremental or decremental changes: Pay attention to the incremental or decremental changes between consecutive letters. It could be based on alphabetical order, numerical values, or positional changes within the alphabet.

Here are some examples of the Alphabet test:

Example 2. Which letter in this alphabet is the eighth letter to the right of the letter which is the tenth letter to the left of the last second letter of the alphabet?

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

- (a) X (b) I
(c) W (d) H

Explanation: In the given alphabet, the last but second letter of the alphabet is Y.

- The 10th letter to the left of Y is O
- The 8th letter to the right of O is W.

Example 3. If all the vowels are replaced by their respective positions in the English alphabet and all consonants are replaced by their next letter, what will be the fourth letter from the left of the resulting arrangement of the word “COMPLEX”?

Explanation: The new arrangement of “COMPLEX” will be “DONQMEY”. The fourth letter from the left is “Q”.

Example 4. If the positions of the first and second halves of the English alphabet are interchanged, which letter will be the 15th letter to the right of the 9th letter from the left?

Explanation: The new arrangement of the alphabet will be “NOPQRSTUVWXYZABCDEFGHIJKLM”. The 9th letter from the left is “I”. The 15th letter to the right of “I” is “X”.

Example 5. In a certain code language, if A is coded as Z, B is coded as Y, C is coded as X, and so on, what will be the code for the word “SCHOOL”?

Explanation: The code for “SCHOOL” will be “HXSLLO”.

Example 6. If every alternative letter starting from A is removed from the English alphabet, which letter will be the 7th letter to the right of the 13th letter from the left?

Explanation: After removing alternate letters, the new arrangement will be “BDFHJLNPRTVXZ”. The 13th letter from the left is “Z”. The 7th letter to the right of “Z” is “N”.

Example 7. If the first and last letters of the word “CRICKET” are interchanged, and then if letters are written in the reverse order, what will be the third letter from the left?

Explanation: Interchanging the first and last letters of “CRICKET” gives “TRICKEC”. Writing the remaining letters in reverse order gives “CEKCI RT”. The third letter from the left is “K”.

Missing Number in 2d forms

In reasoning, the concept of a missing number in 2D form refers to a type of question where you are presented with a grid or matrix containing numbers, and one or more numbers are missing. Your task is to analyze the given numbers, identify the pattern or rule that governs their arrangement, and determine the missing number(s) based on that pattern.

These types of questions test your ability to recognize numerical patterns, sequences, and relationships within a 2D grid. The missing number is typically derived by applying the same pattern or rule observed in the given numbers.

Here's an example of a missing number in 2D form question:

1	2	1
4	5	?
7	8	1

To find the missing number in this 2D grid, you need to observe the pattern or rule that governs the arrangement of the numbers.

In this case, we can see that the numbers are following the following pattern:

First number X third number + 1 = second number.

Applying this pattern, the missing number in the second row would be the number after $5 + 1$, which is 6. Therefore, the missing number is 6.

It's important to carefully analyze the arrangement of numbers in the 2D grid, consider different directions (rows, columns, diagonals), and think critically to identify the pattern. Sometimes, the patterns may involve mathematical operations, alternate sequences, or a combination of different rules.

Regular practice and exposure to different types of missing numbers in 2D form questions can improve your ability to quickly recognize and solve them.

Order and Ranking test

Order and ranking in reasoning involve arranging elements in a specific sequence or hierarchy based on given clues or conditions. These questions test your ability to interpret information, deduce logical relationships, and establish the correct order or ranking. By analyzing the provided clues and drawing conclusions, you can determine the relative positions of the elements. Regular practice with order and ranking questions enhances your analytical skills and logical reasoning abilities.

Here's an example of an order and ranking question:

Five friends—Alice, Bob, Claire, David, and Emily—participate in a race. Based on the given information, determine their finishing positions.

1. Claire finishes ahead of Bob.
2. Alice finishes ahead of David.
3. Emily finishes ahead of Alice.
4. Bob finishes ahead of Emily.

To solve this question, you need to carefully analyze the given clues and establish the order of the participants. By examining the information, you can deduce that Claire must be the first, followed by Bob, Emily, Elice and David.

➔ If the position from the left and from the right is given then the total number of people in the row can be calculated by the following formula:

○ $\text{Total} = [\text{Left} + \text{Right}] - 1$

➔ When overlapping happens then the total number of people can be calculated by the following formula:

○ $\text{Total} = \text{Left side rank} + \text{Right side rank} - 2,$

We can understand this by the following examples:

1. Tinish ranks tenth from the top and twenty-sixth from the bottom in the class. How many students are there in the class?

Sol. Clearly, the whole class consists of:



So, total students = $(9 + 1 + 25) = 35$ students.

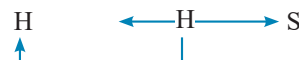
Or,

Total students = Left + Right - 1 = 10 + 26 - 1 = 35

Few more concept of ranking test can be understood by the following examples:

2. In a row of 40 girls, when Hansa was shifted to her left by 4 places her number from the left end of the row became 11. What was the number of Savita from the left end of the row if Savita was three places to the right of Hansa's original position?

Sol. Savita is 3 places to the right of Hansa's original position.
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18.....



Clearly, Savita is 18th from the left end.

3. In a row of girls, Kanika is fifth from the left and Priya is sixth from the right. When they exchange their positions, then Kanika becomes thirteenth from the left. What will be Priya's position from the right?



Thus, the row consists of $(12 + 1 + 5) = 18$ girls.

Now, Priya's new position is Kanika's earlier position which is 5th from the left.

Number of girls to the right of Priya = $(18 - 5) = 13$

So, Priya's new position is 14th from the right.

4. If Akash finds that he is tenth from the right in a line of boys and third from the left, how many boys should be added to the line such that there are 28 boys in the line?

Sol. Clearly, number of boys in the line = $(9 + 1 + 2) = 12$

$\therefore$ Number of boys to be added = $(28 - 12) = 16$.

5. In a class of 90, where girls are twice that of boys, Kanishq ranked seventeenth from the top. If there are 9 girls ahead of Kanishq, how many boys are after him in rank?

- (a) 3 (b) 7
(c) 12 (d) 23

Sol. Let the number of boys be x .

Then, number of girls = $2x$

$\therefore x + 2x = 90$ or $3x = 90$ or $x = 30$

So, number of boys = 30 and number of girls = 60

Number of students behind Kanishq in rank = $(90 - 17) = 73$

Number of girls ahead of Kanishq in rank = 9

Number of girls behind Kanishq in rank = $(60 - 9) = 51$

$\therefore$ Number of boys behind Kanishq in rank = $(73 - 51) = 22$

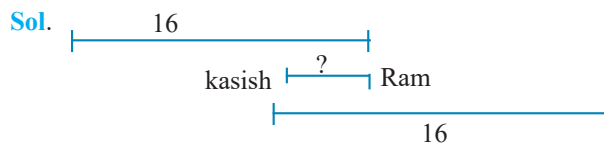
6. Raaj is 7 ranks ahead of Sumer in a class of 39. If Sumer's rank is seventeenth from the last, what is Raaj's rank from the start?

Sol. So, Raaj is 24th from the last.

Number of students ahead of Raaj in rank = $(39 - 24) = 15$

So, Raaj is 16th from the start.

7. Ram is seventeenth from the left end of a row of 29 boys and Kasish is seventeenth from the right end in the same row. How many boys are there between them in the row?



Total number of boys = 29

Number of boys to the left of Kasish = $(29 - 17) = 12$

So, Kasish is 13th from the left end. Also, Ram is 17th from the left end.

Clearly, there are 3 boys between Ram and Kasish.

Logical Venn Diagrams

A logical Venn diagram is a graphical representation used in reasoning to depict the relationships between different sets or categories.

It consists of overlapping circles or ovals, each representing a set, with the overlapping regions representing the intersections or relationships between the sets. The diagram helps visualize the logical connections and dependencies between various elements, enabling a clearer understanding of the logical relationships within a given context.

Logical venn diagram can be of the following types:

Type	Description
Euler diagrams	Use closed curves to represent sets, with overlapping regions indicating intersections between sets.
Boolean Venn diagrams	Use rectangles or circles to represent sets, and employ Boolean operations to show relationships between sets.
Shading Venn diagrams	Use shading or coloring to represent different regions and illustrate complex relationships between sets.
Syllogistic Venn diagrams	Used in traditional syllogistic reasoning to analyze categorical propositions and evaluate logical statements.

But from the exam point of view the types of the venn diagram are shown below:



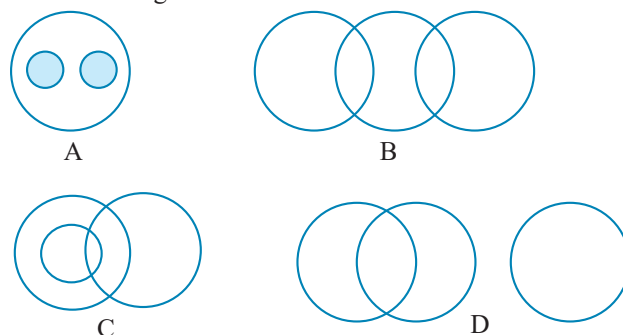
Please note that this provides the overview of the types. There may be many other types of venn diagrams considering the combination of the types given.

Few points to consider while attempting the problem related to the logical venn diagram:

1. Clearly define the sets: Start by identifying and clearly defining the sets involved in the problem. Understand the elements or categories that each set represents.
2. Determine the relationships: Analyze the problem statement or information given to determine the relationships between the sets. Identify whether the sets intersect, overlap, or are disjoint.

3. Represent the sets: Use appropriate shapes, such as circles or rectangles, to represent the sets. Make sure to label each set appropriately for clarity.
4. Consider overlapping regions: If there are intersections between sets, pay attention to the overlapping regions and understand their significance in relation to the problem.
5. Follow logical reasoning: Use deductive reasoning to draw conclusions based on the given information and the relationships depicted in the Venn diagram. Make logical inferences and deductions to arrive at the solution.
6. Check for consistency: Ensure that your Venn diagram representation is consistent with the problem statement and the given information. Double-check the accuracy of your diagram before proceeding with the solution.

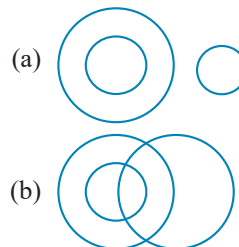
Few venn diagram used for the solution are as follows:

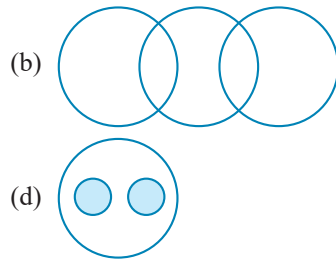


We can understand this by the following examples:

Example 1. Which of the following diagrams indicates the best relation between the following

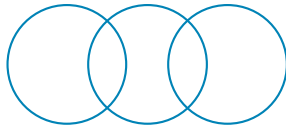
Bus, Aeroplane, Traveler?





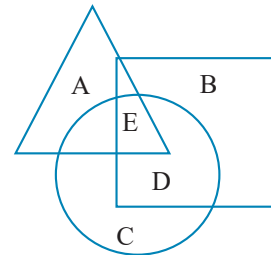
Sol. Bus and Aeroplane are different from each other but some travelers travel by bus and some travel by Aeroplane.

That can be shown by the following diagram:



Mathematical venn diagram can be understood by the following example:

Example: In the following figure, the circle represents the Educated, triangle represents scholars and square represents employed. Which set of letters represents all the three elements?



The area which is common in three of the diagrams is = E.

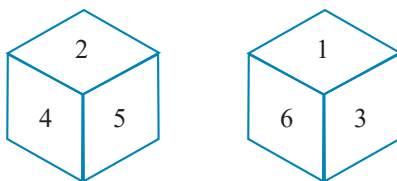
Hence, E is the correct representation of all the three elements.

Dice

In reasoning, a dice (singular of dice) refers to a small, usually cubical object marked with different numbers or symbols on each of its faces.

The most common type of dice used in reasoning is a six-sided dice, often referred to as a standard die. The faces of a standard die are typically numbered from 1 to 6, with each number appearing on a separate face.

Dice are commonly used as a tool in various forms of games and decision-making processes. In reasoning, dice can be used as a randomization device to introduce an element of chance or unpredictability. By rolling a die, one can obtain a random outcome or result, which can be used in different ways depending on the context.



There are majorly two types of questions can be asked:

1. **Folded cube**
2. **Unfolded cube**

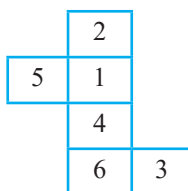
In folded cube we can be asked :

1. The opposite face.
2. The dice that can be or can not be formed.
3. The possible combination.

In Unfolded cube we can be asked:

1. The possible formation of a cube.
2. What is opposite to what.

For example:



This is an unfolded cube;

By observing the cube we can say that,

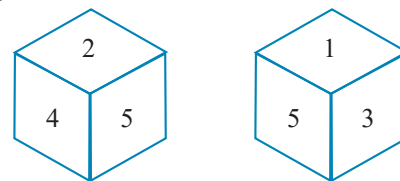
- ➔ 1 is opposite to 6.
- ➔ 4 is opposite to 2.
- ➔ 5 is opposite to 3.

There are few things to be considered while solving the problems related to dice:

1. Two opposite faces can not be adjacent to each other.
2. To see both the opposite faces at the same time and the place being unchanged is not possible.
3. If one side is common then by going in any of the directions whether clockwise or anticlockwise we see that the respective faces are opposite to each other.

The problems can be understand by the following examples:

Example1. If the two positions of a standard dice are as shown below, then find which of the following faces is opposite to the face having 1 on it?



Sol. As we can see that,

The face which is common is = 5

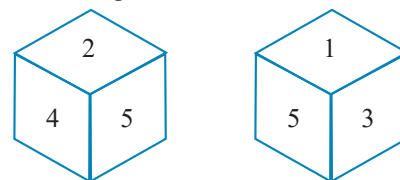
By taking the anticlockwise direction we get the following respective faces:

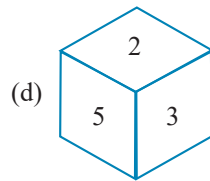
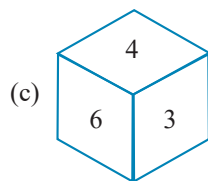
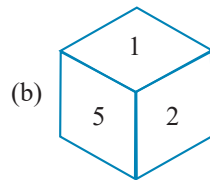
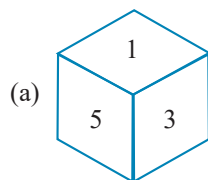
5	2	4
5	3	1

So, we can say that:

- 2 is opposite to 3;
- 4 is opposite to 1.

Example2. If the two positions of the dice are given then which of the following dice can not be formed?



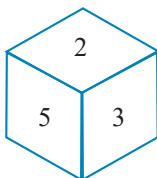


Sol. As we can see that,
The face which is common is = 5
By taking the anticlockwise direction we get the following respective faces:

5	2	4
5	3	1

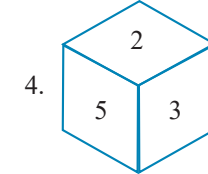
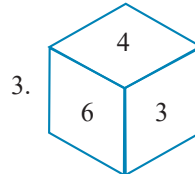
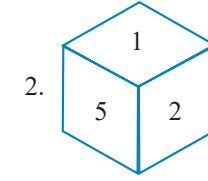
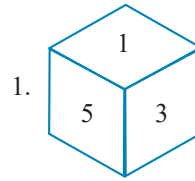
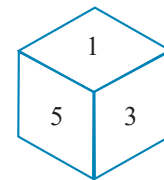
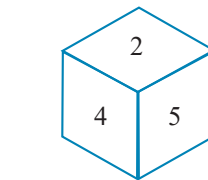
So, we can say that:

- 2 is opposite to 3.
- 4 is opposite to 1.
- 5 is opposite to 6.

So the dice  can not be formed because 2

and 3 are opposite to each other. Hence, This is not possible.

Example3. If the two positions of the dice are given then which combinations are possible.



(a) 1 & 4

(b) 2 & 4

(c) 1 & 2

(d) 3 & 4

Sol. As we can see that,

The face which is common is = 5

By taking the anticlockwise direction we get the following respective faces:

5	2	4
5	3	1

So, we can say that:

- 2 is opposite to 3.
- 4 is opposite to 1.
- 5 is opposite to 6.

According to this, 1 & 2 arrangements are possible.

Arithmetical Problem

Arithmetic problems in reasoning involve applying mathematical operations and concepts to solve numerical puzzles or challenges. These problems typically require logical thinking, numerical reasoning, and a solid understanding of arithmetic principles.

In reasoning, arithmetic problems can take various forms, such as number series, equations, number puzzles, or word problems with numerical components. They often involve manipulating numbers, identifying patterns, and applying mathematical rules to arrive at a solution.

Solving arithmetic problems in reasoning usually requires the following steps:

1. Breaking down the given information
2. Identifying relevant mathematical operations or patterns
3. Applying appropriate strategies to find the correct solution.

These problems help develop logical reasoning skills and enhance mathematical proficiency.

This involves the following types of questions:

1. Question based on general mathematical operations such as : BODMAS.

2. Problems on age.
3. Problems on mathematical concepts.
4. Problems on using the mathematical squares, cube to solve the reasoning problems.

We can understand the problem by following examples:

Example 1. The total age of Rahul, Swaraj, Sohan is 80 years. What was the total of their ages three years ago ?

Explanation: Required sum = $(80 - 3 \times 3)$ years = $(80 - 9)$ years = 71 years.

Example 2. Two train tickets from city P to Q and three tickets from city P to R cost Rs. 77 but three tickets from city P to Q and two tickets from city P to R cost Rs. 73. What are the fares for cities Q and R from P ?

Explanation: Let Rs. x be the fare of city Q from city P and Rs. y be the fare of city R from city P.

Then, $2x + 3y = 77$...(i) and

$3x + 2y = 73$...(ii)

Multiplying (i) by 3 and (ii) by 2 and subtracting, we get: $5y = 85$ or $y = 17$.

Putting $y = 17$ in (i), we get: $x = 13$.

Word Problem

There are two general categories of the word problems asked in exams:

1. Arrangement of Words In Logical Order
2. Word Formation

Types of questions:

1. When the words are given and asked to be arranged in the logical order:

In this type of question all the words are connected with some logic. By observing that logic we can arrange them in the proper order.

Example: Arrange the following in a logical order-

1. Birth
2. Old
3. Teenager
4. Child
5. Adult

Sol. According to the growing age after the birth given words can be arranged as follows:

1. Birth
4. Child
5. Adult
3. Teenager
2. Old

Hence, the correct order is: 14352

2. When the words are given and asked to arrange in order according to the dictionary:

In this type of question all the words are arranged according to the order they appear in the dictionary.

Example: Arrange the following in the order as they appear in the dictionary.

Astonished, Assassin, Ample, Amplification, Application.

Sol. According to the dictionary we can arrange the given words as follows:

- ➔ Ample
- ➔ Amplification
- ➔ Application
- ➔ Assassin
- ➔ Astonished

3. When the certain rules are given and the formation of the word is asked:

In this type of question all the some particular rules with jumbled words are given and by using all the rules we are asked to form a meaningful word.

Example: If all the alphabet are replaced by their next alphabet then what will be the letter that is 7th to the left of O.

ABCDEFGHIJKLMNP

Explanation: If we replace the letters with their next alphabet then the arrangement would be as follows:

BCDEFGHIJKLMNOPQ

So, the letter that is 7th to the left of O would be: I

4. When a word is given and the formation of meaningful words from that words is asked:

By using the letters present in that word we can find how many meaningful words can be formed.

Example: How many meaningful words can be formed by the given following word:

FISHY

Explanation: The word that is formed by the given word are

IF

FISH

Hence, 2 words can be formed.

Counting Figure

Counting figures in reasoning is a problem-solving task that involves determining the total number of figures or shapes present in a given arrangement or pattern. It tests an individual's ability to observe patterns, analyze geometric shapes, and apply logical reasoning skills.

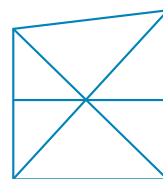
To solve counting figures problems, you can follow these general steps:

1. Carefully examine the given arrangement: Take a close look at the arrangement of figures and try to identify any patterns or repetitions. Pay attention to the size, orientation, and positioning of the figures.
2. Start with the simplest figures: Begin by counting the most straightforward and easily recognizable figures in the arrangement. These could be basic shapes like circles, squares, triangles, or rectangles that are not overlapping or intersecting with other figures.
3. Identify overlapping figures: Look for figures that overlap or intersect with one another. Count these figures separately by breaking them down into individual components or sections. It may be helpful to mentally trace the outline of each overlapping figure to ensure you count all its parts.
4. Look for hidden or embedded figures: Some figures may be partially or fully hidden within larger shapes or arrangements. Pay attention to negative space or shapes formed by the arrangement itself. These hidden figures need to be counted as well.
5. Be systematic and organized: It's essential to have a systematic approach while counting figures. You can mark each figure you count or keep a tally to avoid missing or double-counting any of them.
6. Practice visualizing and manipulating shapes: Developing spatial visualization skills can be beneficial in counting figures. Mentally rotating or repositioning shapes can help you identify additional figures that might be hidden or less obvious at first glance.
7. Check your answer: Once you have counted all the figures to the best of your ability, review your answer and compare it with any options provided or any specific requirements given in the problem. Make sure you haven't missed any figures or made any counting errors.

There can be questions regarding calculating triangle, square, rectangle, circles etc.

There are some examples of the counting figures:

Example 1. Find the total number of triangle in the given following figure:



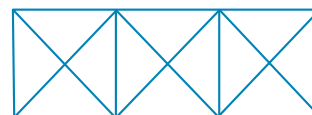
Sol. By counting the triangles made by 1 triangle = 6

By counting the triangle made by 2 triangle = 2

By counting the triangle made by 3 triangle = 4

Total no of triangle = $6 + 4 + 2 = 12$

Example 2. Find the total number of triangle in the given following figure:



Sol.

○ By counting the triangles made by 1 triangle; we get = 12

○ By counting the triangle made by 2 triangles; we get = 12

○ By counting the triangle made by 4 triangles; we get = 4

Hence, the total number of triangles are = $12 + 12 + 4 = 28$

Example 3. Find the total number of triangle in the given following figure:



Sol.

○ By counting the triangles made by 1 triangle; we get = 5

○ By counting the triangle made by 2 triangles; we get = 4

○ By counting the triangle made by 3 triangles; we get = 2

○ By counting the triangle made by all triangles; we get = 1

Hence, the total number of triangles are = 12.

Matrix

In this type of problem two matrices are arranged in a particular order with the allotment of the english alphabet. According to the pattern in the matrix, each letter in the word is assigned a number. That code of the letters is considered as the answer.

To understand this better there are some following examples are given:

Example 1: A word is mentioned by a group of numbers. letters as shown in Matrices can be represented by the alphabets in the matrices given below.

The no. of rows & columns in Matrix I are from 0- 4 & those in Matrix II are 5-9. A letter can be defined using the no. of row & then the no. column. e.g. 'A' can be defined by 00, 12, 23 etc. & 'P' by 58, 69, 75 etc. Find the code/group of numbers for the given word.

How will the word 'SPECIAL' can be represented?

Matrix 1:

	0	1	2	3	4
0	A	R	S	I	C
1	I	C	A	R	S
2	S	I	C	A	R
3	R	S	I	C	A
4	C	A	R	S	I

Matrix 2.

	5	6	7	8	9
5	O	E	L	P	T
6	T	O	E	L	P
7	P	T	O	E	L
8	L	P	T	O	E
9	E	L	P	T	O

- (a) 32,55,44,11, 55, 00, 95
- (b) 31, 86, 56, 11, 44, 00, 57
- (c) 67, 85, 49, 55, 39, 00,57
- (d) 31, 85,56,75,44,00,68

Sol. From the given options we can see that,

S can be coded as : 31

P can be coded as : 86

E can be coded as : 56

C can be coded as : 11

I can be coded as : 44

A can be coded as : 00

L can be coded as : 57

Hence, the code for SPECIAL would be : 31, 86, 56, 11, 44, 00, 57

PAPER CUTTING AND FOLDING

Paper cutting and folding is a type of reasoning task that involves visualizing and manipulating paper shapes through cutting and folding operations. It tests your ability to mentally transform and predict the outcomes of these operations.

Here's an example to illustrate paper cutting and folding in reasoning:

Please note that in practice, paper cutting and folding reasoning tasks can vary in complexity and involve different shapes, patterns, and folding operations.

Calendar and Clock

CALENDAR:

Calendar includes the following types of questions:

1. Day on a particular date.
2. Day on a date with year change.
3. Day on a particular date if the reference date is given.
4. Day repetition date.

By calculating the number of odd days we can solve the calendar problem.

- To calculate the number of days first we need to calculate the number of odd days.
- Then divide the number of odd days by 7.
- Remainders will be the code of the day.

No. of odd days in centuries:-

100 Years	5
200 Years	3
300 Years	1
400 Years	0

➔ **Code for weekdays:-**

Number of odd days	Day
0	Sunday
1	Monday
2	Tuesday
3	Wednesday
4	Thursday
5	Friday
6	Saturday

- ➔ Normal year contains 365 days.
- ➔ Leap year contains 366 days.
- ➔ (In 365 days we have 1 odd day and in 366 days we have 2 odd days.)

CLOCK:

Hour Hand and Minute Hand

A clock has two hands, the smaller one is called the hour hand or shorthand while the larger one is called minute hand or long hand.

Clock includes the following types of questions such as:

1. Angle between two hands of a clock.
2. Mirror image of the clock.
3. Water image of the clock.

To find the angle between the two hands of the clock the following formula is used: $\frac{11}{2} M - 30 H$

Example 1. If one day before the previous day was Monday then what will be the fourth day after today?

- (a) Monday (b) Wednesday
(c) Sunday (d) Friday

Sol. The logic followed here is:

- If one day before the previous day was Monday it means today is Wednesday.

If today is Wednesday then, Wednesday + 4 = Sunday

Hence,

“Sunday” is the correct answer.

Example 2. If 11th October 1994 was Tuesday then what was the day on 11th October 1998?

- (a) Sunday (b) Tuesday
(c) Thursday (d) Saturday

Sol. The logic followed here is:

- Normal year contains 365 days.
- Leap year contains 366 days.

So, in 365 days we have 1 odd day and in 366 days we have 2 odd days.

= 1994, 1995, 1997 and 1998 is a normal year.

= 1996 is a leap year.

= 11th October 1994 - Tuesday

= 11th October 1995 (Normal year) - Tuesday + 1 = Wednesday.

= 11th October 1996 (Leap year) - Wednesday + 2 =

Friday.

= 11th October 1997 (Normal year) - Friday + 1 = Saturday.

= 11th October 1998 (Normal year) - Saturday + 1 = Sunday

Therefore, Sunday falls on 11th October 1998.

Hence, the correct answer is “**Sunday**”.

Example 3. If it was Friday on 1st January 2021 then what was the day on 25th August 2021?

- (a) Wednesday (b) Saturday
(c) Sunday (d) Friday

Sol. As we know that,

2021 was not a leap year.

So, 236 (30 + 28 + 31 + 30 + 31 + 30 + 31 + 25) days have passed till 25th August.

The days of the week repeat itself after 7 days.

So, on dividing 236 by 7, we get the remainder 5.

Number of odd days = 5.

So, on 25th August, 2021 it will be Wednesday

Example 4. What day of the week was 17 September, 2012?

- (a) Saturday (b) Thursday
(c) Sunday (d) Monday

Sol. 17 September, 2012 = (2011 years + Period from 1/1/2012 to 17/9/2012)

No. of odd days in 400 years = 0

Therefore,

No. of odd days in 2000 years = 0

11 years = 9 ordinary years + 2 leap years (as leap year occurs every four years)

No. of odd days in 11 years = $9 \times 1 + 2 \times 2 = 13$

No. of odd days from 1 January 2012 to 17 September 2012
= (31 + 29 + 31 + 30 + 31 + 30 + 31 + 31 + 17)/7 = 261/7 = 2

Total no. of odd days = 13 + 2 = 15

$15/7 = 1$ remainder

Means, 17 sep 2012 was Monday

Example 5. If 1st January 2001 was Friday, then, what was the last day of April month of the same year?

- (a) Friday (b) Monday
(c) Saturday (d) Sunday

Sol. 2001 was a non- leap year.

If 1st January 2001 was Friday, then,

So, there are (30 + 28 + 31 + 30) = 119 days between 1st January and 30th April.

The days of week repeat itself after 7 days.

So, on dividing 119 by 7, we get remainder 0.

So, the total number of odd days will be 0.

So, the last day of April of the same year will be Friday

Example 6. What was the day of the week on 1 Jan 2011, if it was Monday on 10 April 2011?

- (a) Friday (b) Saturday
(c) Sunday (d) Monday

Sol. As we know that,

2010 and 2011 was non- leap year.

So, number of days between 10th April 2011 to 1st January 2010 is (99 + 365) = 464

The days of the week repeat itself after 7 days.

So, on dividing 464 by 7, we get remainder 2.

So, number of odd days = 2

10 April 2011 was Monday - number of odd days.

So, it was Saturday on 10th April 2011.

Example 7. If January 1st is a Sunday, what is the first day of the month of April, in a leap year?

- (a) Wednesday (b) Thursday
(c) Sunday (d) Monday

Sol. Leap year is given so February = 29 Days

1 January = Sunday

Days between 1 January and 1 April = 30 + 29 + 31 + 1 = 91

Odd Days = $91/7 = 0$

1 April = Sunday + 0 = Sunday

Sunday is the correct answer.

Example 8. If today is Saturday, then what will be the day after 255 days?

- (a) Friday (b) Tuesday
(c) Sunday (d) Monday

Sol. Given: Today is Saturday.

As we know, after every seven days, we get the same day.

Number of total days = 255.

To get the no of odd days :

= $255 \div 7 = 36$, Remainder = **3 = odd days.**

So, Saturday + 3 = Tuesday.

Hence, the correct answer is “**Tuesday**”.

Example 9. It was Monday on 2 May, 2022. What will be the day on May 2, 2026?

- (a) Saturday (b) Friday
(c) Sunday (d) Thursday

Sol. Number of odd days in normal year is 1 and number of odd days in leap year is 2.

There are 3 normal years (2023, 2025 and 2026) From May 2, 2022 to May 2, 2026 and 1 leap year 2024.

So, number of odd days will be

From May 2, 2022 to May 1, 2023: 1 odd days

From May 2, 2023 to May 1, 2024: 2 odd days

From May 2, 2024 to May 1, 2025: 1 odd days

From May 2, 2025 to May 1, 2026: 1 odd day

So, total number of odd days is 5.

So, on May 2, 2026, it will be Saturday (As Monday + 5 odd days = Saturday)

Saturday is the correct answer.

Example.10 What was the day of the week on 9th March 2008, if it was Monday on 1st January 2007?

- (a) Friday (b) Saturday
(c) Sunday (d) Monday

Sol. As we know that,
2007 was a non-leap year and 2008 was a leap year.
So, the number of odd days in 2007 = 1.
So, it was Tuesday on 1st January 2008.
Now 68, (30 + 29 + 9) days have been passed between 1st January 2008 to 9th March 2008.
The days of the week repeat itself after 7 days.
So, on dividing 68 by 7, we get the remainder 5.
So, the number of odd days = 5.
Total number of odd days = 5 + 1 = 6
1st January 2007 was Monday + Total number of odd days
So, it was Sunday on 9th March 2008.

Example 11. Find angles between Hour hand and Minute hand of 45 minutes?

- (a) 200° (b) 247.5°
(c) 235.5° (d) 185°

Sol.

- Hour Hand:- $1 \text{ Hour} = 30^\circ$
 $60 \text{ Minutes} = 30^\circ$
 $1 \text{ Minute} = \frac{1}{2}^\circ$
- Minute Hand:- $5 \text{ Minutes} = 30^\circ$
 $1 \text{ Minute} = 6^\circ$
- *(HH is hour hand and MH is minute hand)
- HH:- $1H = 30^\circ$
 $1M = \frac{1}{2}^\circ$
 $45M = 45 \times \frac{1}{2}^\circ$
 $= 22.5^\circ$
- MH:- $5M = 30^\circ$
 $1M = 6^\circ$
 $45M = 45 \times 6^\circ$
 $= 270^\circ$
- Angle between HH & MH = $270^\circ - 22.5^\circ$
 $= 247.5^\circ$
Hence, 247.5° is the correct answer.

Example 12. During 5:50, what will be the reflex angle between Hour and Minute needle?

- (a) 245° (b) 235°
(c) 125° (d) 230°

Sol.

- Hour Hand:- $1 \text{ Hour} = 30^\circ$
 $60 \text{ Minutes} = 30^\circ$
 $1 \text{ Minute} = \frac{1}{2}^\circ$
- Minute Hand:- $5 \text{ Minutes} = 30^\circ$
 $1 \text{ Minute} = 6^\circ$
- *(HH is hour hand and MH is minute hand)
*(Reflex angle is $>180^\circ$)
- HH:- $1H = 30^\circ$
 $5H = 30^\circ \times 5$
 $= 150^\circ$
 $5 \text{ to } 5:50 \text{ is } 50 \text{ minutes at } \frac{1}{2}^\circ$
 $50M \times \frac{1}{2}^\circ = 25^\circ$
Full angle of HH = 175°
- MH:- $1M = 6^\circ$
 $50M = 50 \times 6$
 $= 300^\circ$
- Angle between HH & MH = $300^\circ - 175^\circ = 235^\circ$
- Reflex angle = $>180^\circ$
But, $125^\circ > 180^\circ$

So,

Total angle = 360°

So reflex angle will be = $360^\circ - 125^\circ = 235^\circ$

Example 13. Find reflex angle between Hour hand and Minute hand needle at time 9:22 of the clock?

- (a) 312° (b) 211°
(c) 210° (d) 110°

Sol.

- MH:- $1M = 6^\circ$
- Hour Hand:- $1 \text{ Hour} = 30^\circ$
 $60 \text{ Minutes} = 30^\circ$
 $1 \text{ Minute} = \frac{1}{2}^\circ$
- Minute Hand:- $5 \text{ Minutes} = 30^\circ$
 $1 \text{ Minute} = 6^\circ$
- *(HH is hour hand and MH is minute hand)
*(Reflex angle is $>180^\circ$)
- HH:- $1H = 30^\circ$
 $9H = 30^\circ \times 9$
 $= 270^\circ$

Total travel of HH from 9 to 9:22 is 22 minutes at $\frac{1}{2}^\circ$

So, $22M \times \frac{1}{2}^\circ = 11^\circ$



$$\begin{aligned}\text{Full angle of HH} &= 270^\circ + 11^\circ \\ &= 281^\circ\end{aligned}$$

- MH:- $1M = 6^\circ$
 $22M = 22 \times 6$
 $= 132^\circ$
- Angle between HH & MH $= 281^\circ - 132^\circ$
 $= 149^\circ$
- Reflex angle is $> 180^\circ$
 But 149° is $< 180^\circ$
 So,
 $360^\circ - 149^\circ = 211^\circ$
 Hence, 211° is the correct answer.

Example 14. Find the angle in 2 minutes between Hour hand and Minute hand of a clock?

- (a) 20° (b) 11°
 (c) 90° (d) 110°

Sol.

- Hour Hand:- $1 \text{ Hour} = 30^\circ$
 $60 \text{ Minutes} = 30^\circ$
 $1 \text{ Minute} = \frac{1}{2}^\circ$
- Minute Hand:- $5 \text{ Minutes} = 30^\circ$
 $1 \text{ Minute} = 6^\circ$
- *(HH is hour hand and MH is minute hand)
- HH:- $1H = 30^\circ$
 $1M = \frac{1}{2}^\circ$
 $2M = 2M \times \frac{1}{2}^\circ$
 $= 1^\circ$
- MH:- $5M = 30^\circ$
 $1M = 6^\circ$
 $2M = 2M \times 6^\circ$
 $= 12^\circ$
- Angle between HH & MH $= 12^\circ - 1^\circ$
 $= 11^\circ$
 Hence,
- 11° is the correct answer.

Example 15. How many times will the hour hand and the minute hand in a clock make a 30-degree angle between 12:00 to 15:00?

- (a) 4 (b) 6
 (c) 5 (d) 7

Sol. Logically:

Between 12:00 to 13:00, it'll make a 30-degree angle 2 times.
 Between 13:00 to 14:00, it'll also make twice
 But between 14:00 to 15:00 it'll only be made once as the second time will be after 15:00.
 So, Answer = 5

Example 16. If a clock rings one time at 1:00, two times at 2:00, twelve times at 12:00 like this, then how many times will it ring in a day?

- (a) 152 (b) 156
 (c) 148 (d) 150

Sol. If a clock rings like it was explained in the question, then, it'll ring $1+2+\dots+11+12$ times in 12 hours = 78 times
 So, it'll ring 78×2 times in 24 hours.
 Which is :156
 Hence, The correct answer is 156

Example 17. How many times will a clock make a 180-degree angle in a day?

- (a) 22 (b) 20
 (c) 18 (d) 24

Sol. In 24 hours, the minute hand completes a full rotation of the clock 24 times, but the hour hand only does so twice.

The differential rate of movement establishes the time at which the following 180-degree turn will occur.

The number 22 represents the difference between 24 and 2 rotations per day.

So, we can say that the answer will be 22 times.

Example 18. Calculate the smaller angle between the hour hand and the minute hand of a clock at 15:35.

- (a) 137.5 (b) 120.5
 (c) 257.5 (d) 102.5

Sol. We know that the angle between each number in a clock is 30 degrees.

So, We can calculate the angle between 3 and 7 is 120 degrees.

But in this case, when the minute hand reaches 7, the hour hand will also have some movement.

The movement will be $(35/60) \times 30 = 17.5$ degrees.

So, The answer will be $120 - 17.5$
 $= 102.5$ degrees.

Example 19. After midnight, when will the hour hand and the minute hand make a 0-degree angle next?

- (a) 1:05:65 (b) 1:05:00
 (c) 1:05:45 (d) 1:05:25

Sol. We can find that in 12 hours, 11 situations come where the angle between the minute and the hour hand becomes 0 degrees.

The total time period is 60×12 minutes.

So, To find the time duration between any two consecutive situation we have to calculate:

$(60 \times 12) / 11 = 65.45$ approximately.

So, the answer will be:

$= 12 \text{ am} + 65:45 \text{ minutes}$

$$= 1:05:45$$

Hence, 1:05:45 is the correct answer.

Example 20. Find the measure of the angle formed by the Hour and Minute needle when the time is 10 hours 10 minutes?

- (a) 160° (b) 245°
(c) 210° (d) 110°

Sol.

- Hour Hand:- $1 \text{ Hour} = 30^\circ$
 $60 \text{ Minutes} = 30^\circ$
 $1 \text{ Minute} = \frac{1}{2}^\circ$
- Minute Hand:- $5 \text{ Minutes} = 30^\circ$
 $1 \text{ Minute} = 6^\circ$
- *(HH is hour hand and MH is minute hand)
- HH:- $1H = 30^\circ$
 $1M = \frac{1}{2}^\circ$
 $10H = 10 \times 30^\circ$
 $= 300^\circ$
From 10 to 10:10 it travels for 10 minutes for $\frac{1}{2}^\circ$
 $10M \times \frac{1}{2} = 5^\circ$
Full angle made by HH = $300^\circ + 5^\circ = 305^\circ$

- MH:- $1M = 6^\circ$
 $10M = 10 \times 6^\circ$
 $= 60^\circ$

- Angle between both the hands of the clock is
 $HH - MH$
 $= 305^\circ - 60^\circ$
 $= 245^\circ$

Hence,

245° is the angle formed by HH & MH

Example 21. If the water image of the clock shows the time 05 hours 37 minutes as the time. What time will it be 29 minutes before the real time?

- (a) 12:36 (b) 12:24
(c) 11:49 (d) 07:58

Sol. The logic followed here is:

For water image: Subtract from "17:90"

Given: 05:37

$$= 17:90 - 05:37 = 12:53$$

But we have to subtract 29 minutes from the real time

$$= 12:53 - 29 \text{ Minutes} = 12:24$$

Hence, "**12:24**" is the correct answer

Sequences and Series

- The sum of the first n natural numbers

$$= 1 + 2 + 3 + \dots + n = \frac{n(n+1)}{2}$$
- The sum of the first n even natural numbers

$$= 2 + 4 + 6 + \dots + 2n = n(n+1)$$
- The sum of the first n odd natural numbers

$$= 1 + 3 + 5 + \dots + 2n - 1 = n^2$$
- The sum of squares of the first n natural numbers

$$= 1^2 + 2^2 + 3^2 + \dots + n^2 = \frac{n(n+1)(2n+1)}{6}$$
- The sum of squares of the first n even natural numbers

$$= 2^2 + 4^2 + 6^2 + \dots + (2n)^2 = \frac{2n(n+1)(2n+1)}{3}$$
- The sum of squares of the first n odd natural numbers

$$= 1^2 + 3^2 + 5^2 + \dots + (2n-1)^2 = \frac{n(2n-1)(2n+1)}{3}$$
- The sum of cubes of the first n natural numbers

$$= 1^3 + 2^3 + 3^3 + \dots + n^3 = \left[\frac{n(n+1)}{2} \right]^2$$
- The sum of cubes of the first n even natural numbers

$$= 2^3 + 4^3 + 6^3 + \dots + (2n)^3 = 2[n(n+1)]^2$$
- The sum of cubes of the first n odd natural numbers

$$= 1^3 + 3^3 + 5^3 + \dots + (2n-1)^3 = n^2(2n^2 - 1)$$
- Let a be the first term and d be the common difference of an Arithmetic Progression (AP). Then, the n th term of this AP is given by

$$T_n = a + (n-1)d$$
- Let a be the first term and d be the common difference of an Arithmetic Progression (AP). Then, the sum of the first n terms of this AP is given by

$$S_n = \frac{n}{2} [2a + (n-1)d]$$

Or

$$S_n = \frac{n}{2} [a + l], \text{ where } l \text{ is the last term of the given AP.}$$

- Let a be the first term and r be the common ratio of a Geometric Progression (GP). Then, the n th term of this GP is given by

$$T_n = ar^{n-1}$$

- Let a be the first term and r be the common ratio of a Geometric Progression (GP). Then, the sum of the first n terms of this GP is given by

$$S_n = \frac{a(r^n - 1)}{r - 1},$$

- Let a be the first term and r be the common ratio of a Geometric Progression (GP). If $|r| < 1$, then the sum of infinite terms of this GP is given by

$$S_\infty = \frac{a}{1-r}$$

- Arithmetic mean (AM) of two numbers a and $b = \frac{a+b}{2}$

- Arithmetic mean (AM) of n numbers

$$a_1, a_2, a_3, \dots, a_n = \frac{a_1 + a_2 + a_3 + \dots + a_n}{n}$$

- Geometric mean (GM) of two numbers a and $b = \sqrt{ab}$

- Geometric mean (GM) of n numbers

$$a_1, a_2, a_3, \dots, a_n = (a_1 \cdot a_2 \cdot a_3 \dots a_n)^{\frac{1}{n}}$$

- For n positive numbers, $AM \geq GM$

- For n negative numbers, $AM \leq GM$

- If the n th term of an AP is $T_n = 4n - 5$, then the 7th term of this AP is equal to

Sol. The n th term of the given AP is

$$T_n = 4n - 5 \quad \dots (1)$$

For 7th term put $n = 7$ in

$$T_7 = 4 \times 7 - 5 = 28 - 5 = 23$$

...(1)

$\therefore$ The 7th term of the given AP is 23

2. Find the 11th term of the AP

7, 15, 22, 29

Sol. The given AP is 7, 15, 22, 29, ...

First term, $a = 7$ Common difference, $d = 15 - 7 = 8$

$$n^{\text{th}} \text{ term } T_n = a + (n-1)d$$

$$\therefore 11^{\text{th}} \text{ term} = T_{11} = 7 + (11-1) \times 8$$

$$= 7 + 10 \times 8 = 7 + 80 = 87.$$

3. The sum of first 30 natural numbers is

Sol. The sum of first n natural number $= \frac{n(n+1)}{2}$

$\therefore$ The sum of first 30 natural number

$$= \frac{30(30+1)}{2}$$

$$= 15 \times 31 = 465$$

4. Which term of the AP 121, 117, 113, ... is 41

Sol. First term, $a = 121$ Common difference, $d = 117 - 121 = -4$

n^{th} term, $T_n = 41$

$$T_n = a + (n-1)d$$

$$\Rightarrow 41 = 121 + (n-1)(-4)$$

$$\Rightarrow 41 = 121 - 4n + 4$$

$$\Rightarrow 4n = 84 \Rightarrow n = 21$$

Thus, 21st term is 41

5. What is the sum of first 20 terms of the AP 5, 14, 23, ... ?

Sol. First term, $a = 5$ Common difference, $d = 14 - 5 = 9$
Number of term, $n = 20$

$$S_n = \frac{n}{2} [a + (n-1)d]$$

$$\therefore S_{20} = \frac{20}{2} [2 \times 5 + (20-1) \times 9]$$

$$= 10(10 + 171) = 10 \times 181 = 1810$$

Thus, the sum of first 20 terms of the AP is 1810

6. Find the sum $3^3 + 6^3 + 9^3 + \dots + 30^3$

Sol. $3^3 + 6^3 + 9^3 + \dots + 30^3$

$$= (3 \times 1)^3 + (3 \times 2)^3 + (3 \times 3)^3 + \dots + (3 \times 10)^3$$

$$= 3^3 [1^3 + 2^3 + 3^3 + \dots + 10^3]$$

$$= 27 \left[\frac{10(10+1)}{2} \right] 1^3 + 2^3 + 3^3 + \dots + 10^3$$

$$= \left\{ \frac{n(n+1)}{2} \right\}^2 = 27 \times 3025 = 81675$$

7. If the first term of an AP is $\frac{n^2-1}{2}$, its common difference is $(n+1)$, then the sum of its first n term is equal to

Sol. We have $a = \frac{n^2-1}{2}$ and $d = n+1$

$\therefore$ The sum of first n terms of the AP

$$S_n = \frac{n}{2} [2a + (n-1)d]$$

$$= \frac{n}{2} \left[2 \left(\frac{n^2-1}{2} \right) + (n-1)(n+1) \right]$$

$$= \frac{n}{2} [(n^2-1) + (n^2-1)]$$

$$= \frac{n}{2} [2(n^2-1)]$$

$$= n(n-1)(n+1)$$

8. If the 11th term of an AP is 43 and 21st term is 67, then the sum of its first 31 term is equal to

Sol. Let a and d be the first term and common difference respectively.

Then, n^{th} term, $T_n = a + (n-1)d$

$$T_{11} = 43 \Rightarrow a + 10d = 43$$

$$T_{21} = 67 \Rightarrow a + 20d = 67$$

Adding equations (1) and (2), we get

$$2a + 30d = 120$$

$\therefore$ The sum of its first 31 terms

$$= \frac{n}{2} [2a + (n-1)d] = \frac{31}{2} \times 120 = 31 \times 60 = 1860$$

9. Find the sum of the series

$$3, \frac{3}{2}, \frac{3}{4}, \frac{3}{8}, \dots$$

Sol. The given series is an infinite series with $a = 3$ and

$$r = \frac{\frac{3}{2}}{3} = \frac{1}{2}$$

$\therefore$ The sum of the given series

$$= \frac{a}{1-r} = \frac{3}{1-\frac{1}{2}} = 6$$

10. The common ratio of a GP is $\frac{1}{2}$. If the sum of its first 8 terms is $2^8 - 1$, then its first term is equal to

Sol. Let the first term of the GP be a .

$$S_n = \frac{a(1-r^n)}{1-r} \Rightarrow S_8 = \left[\frac{1 - \left(\frac{1}{2}\right)^8}{1 - \frac{1}{2}} \right]$$

$$\Rightarrow 2^8 - 1 = \left(\frac{2^8 - 1}{2} \right)$$

$$\Rightarrow 2^8 - 1 = a \left(\frac{2^8 - 1}{2^7} \right)$$

$$\Rightarrow a = 2^7 = 128.$$

11. The arithmetic mean and geometric mean of two number a and b are M and N respectively. The value of $a^3 + b^3$ is equal to

Sol. $AM(a, b) = M \Rightarrow \frac{a+b}{2} = M \Rightarrow a+b = 2M$

$$GM(a, b) = N \Rightarrow \sqrt{ab} = N \Rightarrow ab = N^2$$

$$\therefore a^3 + b^3 = (a+b)^3 - 3ab(a+b) = (2M)^3 - 3N^2(2M) \\ = 8M^3 - 6N^2M = 2M(4M^2 - 3N^2)$$

12. Thus, the minimum value of $a + 2b + 3c$ is 18.

If x, y and z are positive real number then the minimum

value of $\frac{x}{y} + \frac{y}{z} + \frac{z}{x}$ is equal to

Sol. We know that $AM \geq GM$

$$\therefore AM\left(\frac{x}{y}, \frac{y}{z}, \frac{z}{x}\right) \geq GM\left(\frac{x}{y}, \frac{y}{z}, \frac{z}{x}\right)$$

$$\frac{\frac{x}{y} + \frac{y}{z} + \frac{z}{x}}{3} \geq \left[\left(\frac{x}{y}\right) \left(\frac{y}{z}\right) \left(\frac{z}{x}\right) \right]^{\frac{1}{3}}$$

$$\Rightarrow \frac{x}{y} + \frac{y}{z} + \frac{z}{x} \geq 3(1)^{\frac{1}{3}} = 3$$

$$\frac{x}{y} + \frac{y}{z} + \frac{z}{x}$$

Thus, the minimum value of $y^z x^x$ is 3.

13. If a, b, c are three positive number such that $abc = 36$ find the minimum value of $a + 2b + 3c$

Sol. We know that $AM \geq GM$

$$\therefore AM(a, 2b, 3c) \geq GM(a, 2b, 3c) \Rightarrow \frac{a + 2b + 3c}{3}$$

$$\geq (a \cdot 2b \cdot 3c)^{\frac{1}{3}} \Rightarrow (6abc)^{\frac{1}{3}} = (6 \times 36)^{\frac{1}{3}}$$

$$\Rightarrow \frac{a + 2b + 3c}{3} \geq 6 \Rightarrow a + 2b + 3c \geq 18$$

Thus, the minimum value of $a + 2b + 3c$ is 18.

14. The geometric mean of 3 and 27 is equal to

Sol. The geometric mean of two numbers a and $b = \sqrt{ab}$.

$$\therefore \text{The geometric mean of 3 and } 27 = \sqrt{3 \times 27} \\ = \sqrt{81} = 9.$$

15. If the geometric mean of 5, x , and y is 5, then the value of xy is equal to

Sol. The geometric mean of $a, b, c = (abc)^{\frac{1}{3}}$

Now, the geometric mean of 5, $x, y = 5$

$$\therefore (5xy)^{\frac{1}{3}} = 5 \Rightarrow 5xy = 5^3 = 125 \Rightarrow xy = \frac{125}{5} = 25.$$

Sitting Arrangement

Seating Arrangement problems are regularly asked in the reasoning ability section of nearly all Government exams.

When a piece of information is presented related to a group of people and the manner in which they are seated, such an arrangement is referred to as a seating arrangement in reasoning ability. This could be a straight line, a circle, a rectangle, or any other arrangement of people or things.

Sitting arrangement includes the following types of questions such as:

1. Linear / row arrangement
2. Circular arrangement
3. Square arrangement
4. Miscellaneous (Triangular, hexagon, etc....)

Few points to remember:

- ➔ To prevent the confusion of left and right in circular and square/rectangular arrangements, assume that everyone is facing the centre unless otherwise specified.
- ➔ Understand all of the requirements and instructions given.
- ➔ Construct a general diagram based on the provided circumstance.
- ➔ Determine the location of a specific person or thing as stated in the question..

This can be understood by the following examples:

Direction(1-3): Study the following data carefully and answer the questions accordingly.

Example 1. Seven people are sitting around a circular table facing the center. Two people sit between H and G. U is a neighbor of G. One person sits between R and U. N is not a neighbor of H. G sits third to the right of K. W is not a neighbor of R.

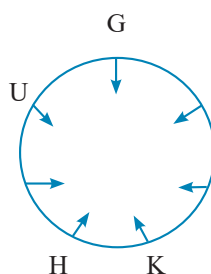
Example 1. Who among the following is an immediate neighbor of W?

- | | |
|-------|-------|
| (a) K | (b) H |
| (c) N | (d) G |

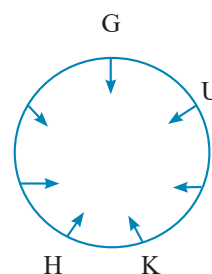
Sol. (B)

- (1) G sits third to the right of K.
- (2) Two people sit between H and G.
- (3) U is a neighbor of G.

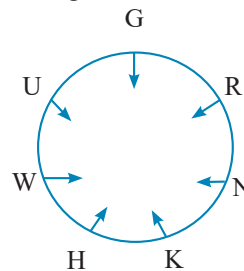
Case 1



Case 2



- (4) One person sits between R and U.
- (5) N is not a neighbor of H.
- (6) W is not a neighbor of R.



Directions(1-3): Study the following data carefully and answer the questions accordingly.

Seven people are sitting around a circular table facing the center. Two people sit between H and G. U is a neighbor of G. One person sits between R and U. N is not a neighbor of H. G sits third to the right of K. W is not a neighbor of R.

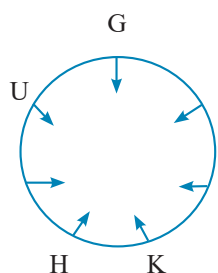
Example 2. Find the correct statement.

- (a) More than three people are sitting between N and U
- (b) R and H are not neighbors
- (c) K sits near W
- (d) R sits second to the right of U

Sol. (B)

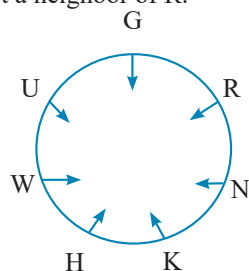
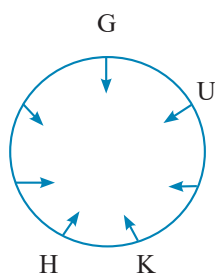
- (1) G sits third to the right of K.
- (2) Two people sit between H and G.
- (3) U is a neighbor of G.

Case 1



- (4) One person sits between R and U.
 (5) N is not a neighbor of H.
 (6) W is not a neighbor of R.

Case 2



Directions(1-3): Study the following data carefully and answer the questions accordingly.

Seven people are sitting around a circular table facing the center. Two people sit between H and G. U is a neighbor of G. One person sits between R and U. N is not a neighbor of H. G sits third to the right of K. W is not a neighbor of R.

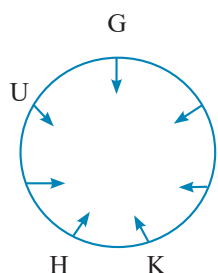
Example 3. Find the odd one.

- (a) H,K (b) U,W
 (c) G,R (d) U, N

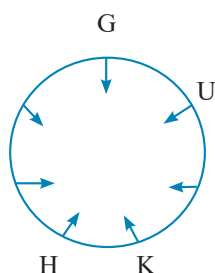
Sol. (D)

- (1) G sits third to the right of K.
 (2) Two people sit between H and G.
 (3) U is a neighbor of G.

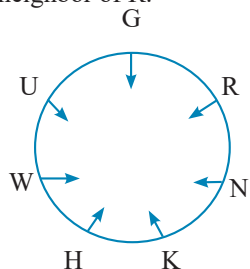
Case 1



Case 2



- (4) One person sits between R and U.
 (5) N is not a neighbor of H.
 (6) W is not a neighbor of R.



Directions(4-5): Study the following data carefully and answer the questions accordingly.

Eight people are sitting around a circular table facing outside. J sits opposite T. M is a neighbor of F but not a neighbor of J. M is not sitting immediate right of F. Q sits near P. L sits near J. Two people sits between F and L. V and P are not neighbors.

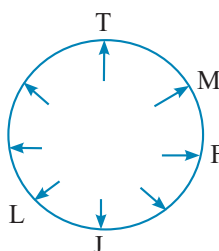
Example,4. Who among the following sits between M and V?

- (a) P (b) Q
 (c) J (d) F

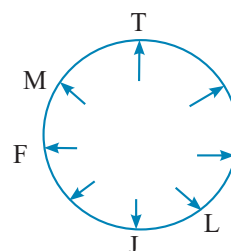
Sol (D)

- (1) J sits opposite T.
 (2) L sits near J.
 (3) Two people sits between F and L.
 (4) M is a neighbor of F but not a neighbor of J.

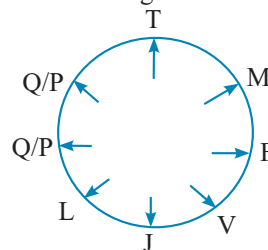
Case 1



Case 1



- (5) M is not sitting immediate right of F.
 (Here, case 2 will be eliminated)
 (6) Q sits near P.
 (7) V and P are not neighbors.



Directions(4-5): Study the following data carefully and answer the questions accordingly.

Eight people are sitting around a circular table facing outside. J sits opposite T. M is a neighbor of F but not a neighbor of J. M is not sitting immediate right of F. Q sits near P. L sits near J. Two people sits between F and L. V and P are not neighbors.

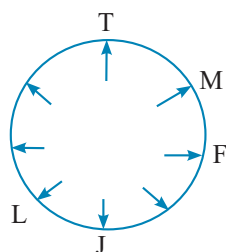
Example 5. Who among the following are the possible neighbors of L?

- (a) Q,J (b) Q,P
 (c) J,V (d) M,F

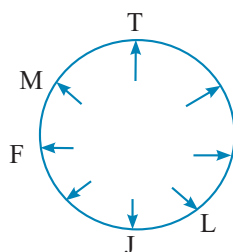
Sol. (A)

- (1) J sits opposite T.
 (2) L sits near J.
 (3) Two people sits between F and L.
 (4) M is a neighbor of F but not a neighbor of J.

Case 1



Case 1

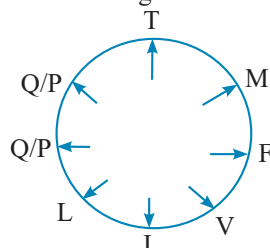


(5) M is not sitting immediate right of F.

(Here, case 2 will be eliminated)

(6) Q sits near P.

(7) V and P are not neighbors.



Directions(6-8): Study the following data carefully and answer the questions accordingly.

Example 6. Six people L, M, N, O, P and Q are sitting in a linear row facing north. Q sits at the right end of the row. There are only three people sitting between Q and M. There are only two people sitting between M and O. O sits near to P. N does not sit at the end of the row.

Which of the following sits second to the right of L ?

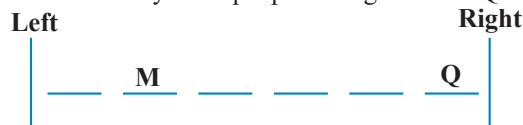
- (a) O (b) N
(c) M (d) Q

Sol. (B)

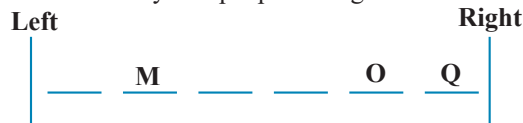
Q sits at the right end of the row.



There are only three people sitting between Q and M.



There are only two people sitting between M and O.



O sits near to P.



N does not sit at the end of the row.



Directions(6-8): Study the following data carefully and answer the questions accordingly.

Example 7. Six people L, M, N, O, P and Q are sitting in a linear row facing north. Q sits at the right end of the row. There are only three people sitting between Q and M. There are only two people sitting between M and O. O sits near to P. N does not sit at the end of the row.

How many people are sitting between N and Q ?

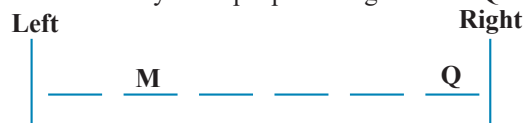
- (a) Two (b) Three
(c) One (d) No one

Sol. (A)

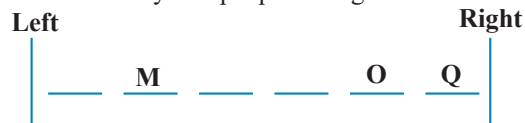
Q sits at the right end of the row.



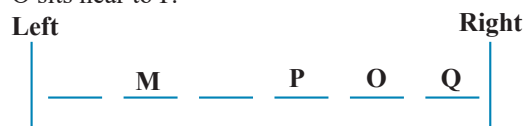
There are only three people sitting between Q and M.



There are only two people sitting between M and O.



O sits near to P.



N does not sit at the end of the row.



Directions (6-8): Study the following data carefully and answer the questions accordingly.

Six people L, M, N, O, P and Q are sitting in a linear row facing north. Q sits at the right end of the row. There are only three people sitting between Q and M. There are only two people sitting between M and O. O sits near to P. N does not sit at the end of the row.

Example 8. If N and L exchange their places, then who among the following sits on the immediate right of L ?

- (a) P (b) M
(c) Q (d) O

Sol. (A)

Q sits at the right end of the row.



There are only three people sitting between Q and M.



There are only two people sitting between M and O.



O sits near to P.



N does not sit at the end of the row.



Directions (9-10): Study the following data carefully and answer the questions accordingly.

Eight people sit in a two-parallel row. Four people in each row. In row-1 A, B, C and D seated and all face towards south. In row-2 L, M, N and O seated and all face towards north. People seated in row-1 face people seated in row-2. L sits second to the left of M. M faces C. There is only one person sitting between C and A. B does not sit at the end of the row. N sits second to the left of O. D faces O.

Example 9. How many people are sitting between N and M.

- (a) One (b) Two
(c) Three (d) No one

Sol. (D)

L sits second to the left of M.



M faces C.



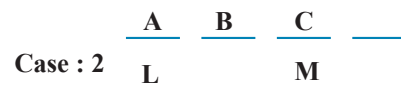
There is only one person sitting between C and A



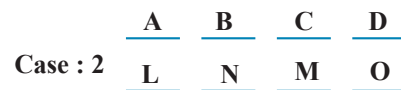
B does not sit at the end of the row



D faces O.



Case 1 is eliminated.



Directions (9-10): Study the following data carefully and answer the questions accordingly.

Eight people sit in a two-parallel row. Four people in each row. In row-1 A, B, C and D seated and all face towards south. In row-2 L, M, N and O seated and all face towards north. People seated in row-1 face people seated in row-2. L sits second to the left of M. M faces C. There is only one person sitting between C and A. B does not sit at the end of the row. N sits second to the left of O. D faces O.

Example 10. Which of the following statement(s) is/are definitely true?

- (a) Two people sitting between L and M.
(b) No one sits to the right of O
(c) N faces A.
(d) None of the above

Sol. (B)

L sits second to the left of M.



M faces C.

			C
Case : 1		L	M

			C
Case : 2	L		M

There is only one person sitting between C and A.

		A	C
Case : 1		L	M

	A		C
Case : 2	L		M

B does not sit at the end of the row.

		A	B	C
Case : 1		L		M

	A	B	C
Case : 2	L		M

N sits second to the left of O.

	D	A	B	C
Case : 1	N	L	O	M

	A	B	C	D
Case : 2	L	N	M	O

D faces O.

Case 1: is eliminated.

~~Case : 1~~	~~N~~	~~L~~	~~O~~	~~M~~
---------------------	--------------	--------------	--------------	--------------

	A	B	C	D
Case : 2	L	N	M	O

Directions(11-12): Study the following data carefully and answer the questions accordingly.

Eight people are sitting around a square table. Four of them are sitting at the corners facing outside and the remaining four are sitting at the sides of the table facing inside. R sits third to the right of N. Z is not a neighbor of M. W sits opposite K, who does not face outside. Z sits second to the left of X. Q is a neighbor of W and sits three places away from N.

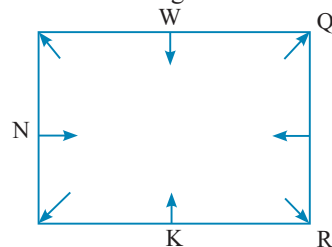
Example 11. Who among the following are the immediate neighbors?

- (a) Z, R (b) N, M
(c) W, R (d) N, Z

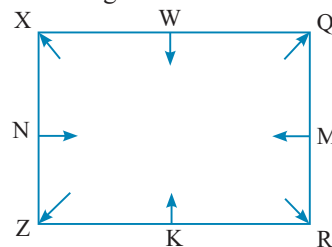
Sol. (D)

- W sits opposite K, who does not face outside.
- Q is a neighbor of W and sits three places away from N.

- R sits third to the right of N.



- Z sits second to the left of X.
- Z is not a neighbor of M.



Directions (11-12): Study the following data carefully and answer the questions accordingly.

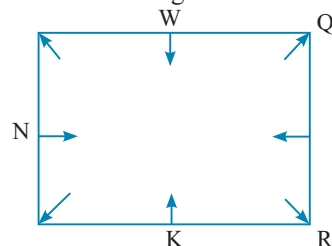
Eight people are sitting around a square table. Four of them are sitting at the corners facing outside and the remaining four are sitting at the sides of the table facing inside. R sits third to the right of N. Z is not a neighbor of M. W sits opposite K, who does not face outside. Z sits second to the left of X. Q is a neighbor of W and sits three places away from N.

Example 12. Who among the following sits second to the right of X?

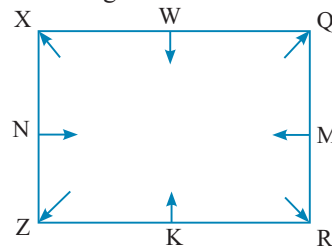
- (a) Z (b) M
(c) Q (d) R

Sol. (C)

- W sits opposite K, who does not face outside.
- Q is a neighbor of W and sits three places away from N.
- R sits third to the right of N.



- Z sits second to the left of X.
- Z is not a neighbor of M.



Blood Relations

Any relation by birth or by marriage in a family is called blood relation.

The relations by birth are as follows:

- ➔ MOTHER
- ➔ FATHER
- ➔ SON
- ➔ DAUGHTER
- ➔ GRANDFATHER
- ➔ GRANDMOTHER
- ➔ UNCLE
- ➔ AUNT
- ➔ COUSIN
- ➔ NEPHEW

The relations by marriage are as follows:

- ➔ WIFE
- ➔ HUSBAND
- ➔ DAUGHTER-IN-LAW
- ➔ SON-IN-LAW
- ➔ SISTER-IN-LAW
- ➔ BROTHER-IN-LAW
- ➔ MOTHER-IN-LAW
- ➔ FATHER-IN-LAW

Blood relation includes the following types such as:

1. Indicating / pointing relation
2. Coded blood relation
3. Puzzle form

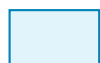
Things to be considered:

- ➔ Understand the given instructions.
- ➔ According to the instructions, draw a rough family tree diagram.
- ➔ In the family diagram different generations are shown in different alignment.

To distinguish between the male or female following symbols can be used.



Female



Male

or

+ for MALE

- for FEMALE

Similarly, To show the relationship between husband and wife or siblings the following symbols can be used.

===== Married

----- Sibling

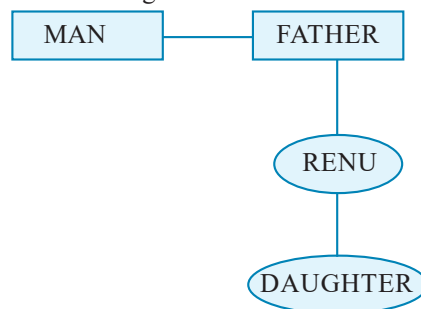
- ➔ The question should be carefully answered on the basis of “**Whose relationship with whom**”.
- ➔ In the question based on coded blood relation the code according to the relation should be written first.

Example 1. Pointing to a photograph, Renu said that, “His only brother is the father of my daughter’s mother”. How is the man in a photograph related to Renu?

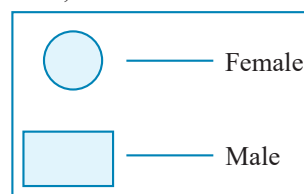
- (a) Niece
- (b) Uncle
- (c) Daughter
- (d) Father

Sol. Let’s draw the family tree for this question according to the

instructions given:



Here,



So it is clear that the man in the photograph is the uncle of Renu.

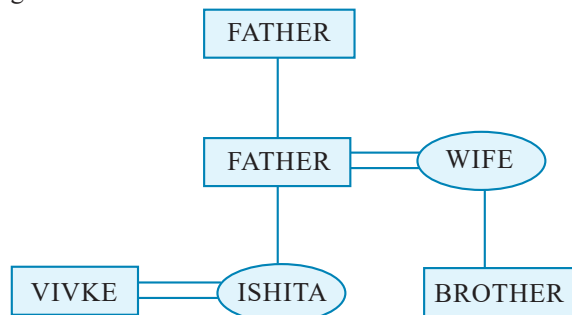
Hence,

Uncle will be the right answer.

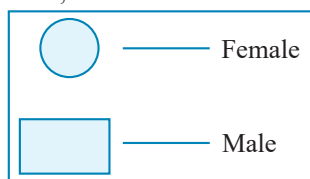
Example 2. Pointing to Ishita, Vivek said that, "She is the only sister of the son of the only daughter-in-law of my wife's paternal grandfather. How is Ishita related to Vivek?

- (a) Son-in-law (b) Wife
(c) Daughter (d) Son

Sol. Let's draw the family tree according to the instructions given :



Here,



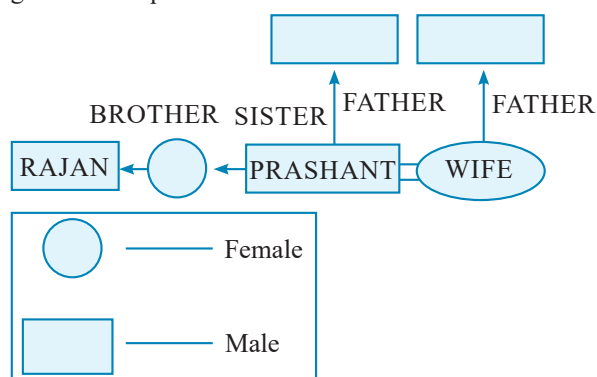
So it is clear that Ishita is the wife of Vivek.

Hence, Wife is the correct answer.

Example 3. Pointing to Rajan, Prashant said that, "He is the brother of only daughter of the father of my father-in-law's only daughter's husband. How can Rajan be related to Prashant?

- (a) Father (b) Brother
(c) Brother-in-law (d) Son

Sol. Let's draw the family tree according to the instructions given in the question:



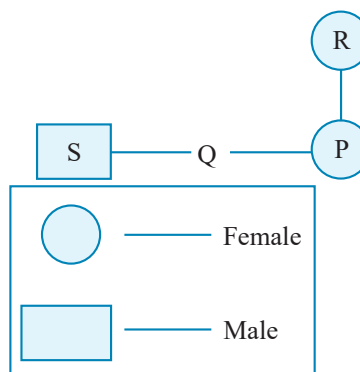
So, we can clearly see that Rajan is the brother of Prashant.

Hence, Brother is the correct answer.

Example 4. P is R's daughter. R is Q's mother. S is Q's brother. How is S related to P?

- (a) Father (b) Brother
(c) Cousin (d) Sister

Sol.



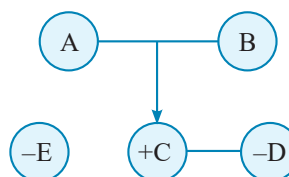
- + denotes male
- - denotes female
- denotes the relation of married couples.
- Blank space between two circles denotes the same generation.

Hence, S is the brother of P.

Example 5. A is married to B. C is A's son. D is married to C. E is daughter of B. How is E related to D?

- (a) Wife (b) Mother
(c) Sister-in-law (d) Brother-in-law

Sol.



- + denotes male
- - denotes female
- denotes the relation of married couples.
- Blank space between two circles denotes the same generation.

Hence,

E is Sister-in-law of D.

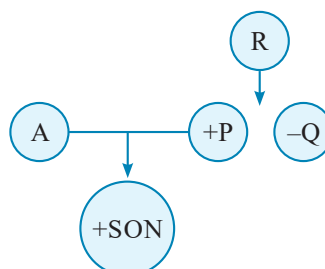
Example 6. If P is the brother of Q, how is Q related to R. To answer this, which statement is necessary?

Statement 1:- Son of P is the grandson of R.

Statement 2:- Q is the sister of P?

- (a) Only 1 (b) Only 2
(c) Either 1 or 2 (d) Both 1 & 2

Sol.



According to the given statements:

- + denotes male
- – denotes female
- — denotes the relation of married couples.
- Blank space between two circles denotes the same generation.

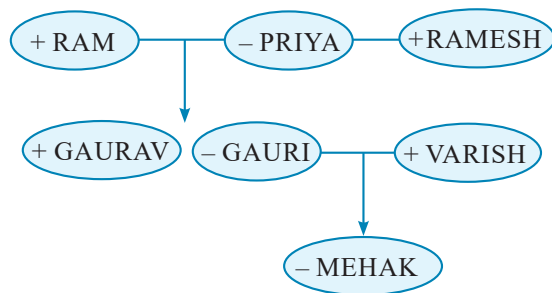
Hence

Both 1 & 2 statements are necessary to answer this.

Example 7. Varish and Gauri are married couples, who have a daughter Mehek, who is the granddaughter of Priya, who is the mother of Gaurav. Ram & Priya are married to each other and have two childrens. Ram is the husband of Priya & Brother-in-law of Ramesh who is a male member. How is Ramesh related to Gaurav?

- (a) Brother (b) Maternal Uncle
(c) Son (d) Paternal uncle

Sol.



- + denotes male
- – denotes female
- — denotes the relation of married couples.
- Blank space denotes the same generation.

Hence,

Ramesh is the maternal uncle of Gaurav.

Example 8. Read the following information carefully and answer the question given below.

A©B means A is the sister of B

A#B means A is the brother of B

A*B means A is the husband of B

A&B means A is the mother of B

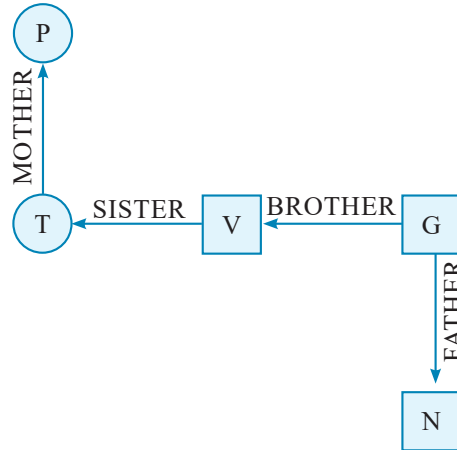
A\$B means A is the father of B.

If P&T©V#G\$N. Then which of the following is true?

- (a) G is the sister of T
(b) P is a grandmother of N
(c) P has two daughters
(d) T is the aunt of G

Sol. Given expression: P&T©V#G\$N

By Solving the given statement-



Example 9. Read the following information carefully and answer the question given below.

A©B means A is the sister of B

A#B means A is the brother of B

A*B means A is the husband of B

A&B means A is the mother of B

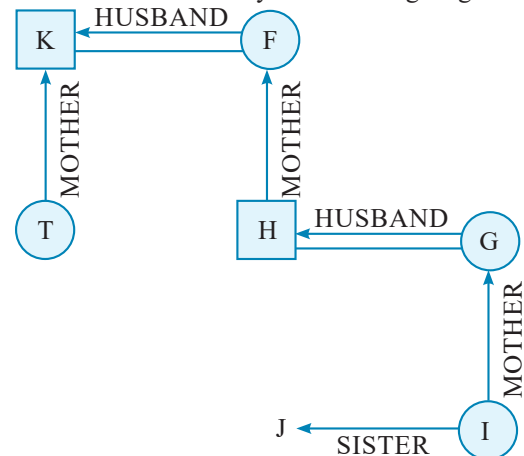
A\$B means A is the father of B.

If K*F&H*G&I©J, Then find the relationship of J with F.

- (a) Grandmother
(b) Can not be determined
(c) Granddaughter
(d) Grandson

Sol. Given expression: K*F&H*G&I©J

This can be understood by the following diagram.



Example 10. Read the following information carefully and answer the question given below.

A©B means A is the sister of B

A#B means A is the brother of B

A*B means A is the husband of B

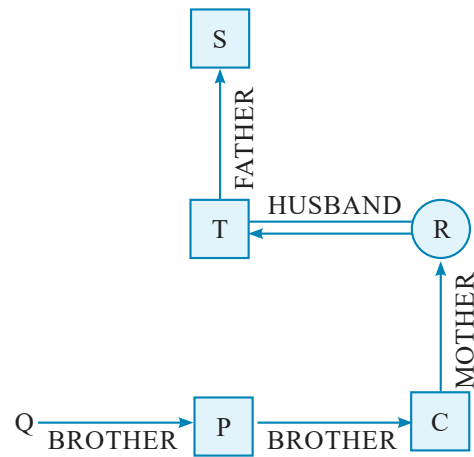
A&B means A is the mother of B

A\$B means A is the father of B.

If S\$T*R&C#P#Q, Then how is S related to Q?

- (a) Grandson
- (b) Paternal Grandfather
- (c) Granddaughter
- (d) Son

Sol. By drawing the family chart we can conclude the relationship between S and Q.



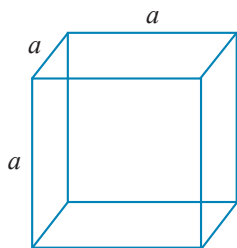
Cubes and cuboids

Some basic mathematical definitions of the cube and cuboid are given below:

- A cube is a 3D (three dimensional) solid having 6 faces, 8 vertices and 12 edges.
- All edges of a cube are equal and all the faces are square in shape.
- Each face being a square is called a cube.
- If each of the six faces is a rectangle, it is called cuboid.

Some important formulas related to cube and cuboid are given below:

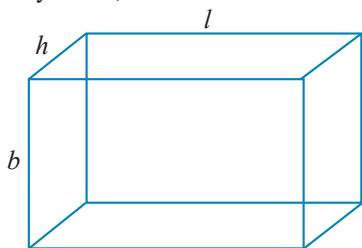
Cube: Let the edge of the cube be a . Then,



Volume of the cube $= a^3$

- Lateral surface area of the cube $= 4a^2$
- Total surface area of the cube $= 6a^2$
- Length of the longest diagonal of the cube $= \sqrt{3}a$

Cuboid: Let the length, breadth and height of a cuboid be l , b and h respectively. Then,



- i. Volume of the cuboid $= l \times b \times h$
- ii. Lateral surface area of the cuboid $= 2(l + b) \times h$
- iii. Total surface area of the cuboid $= 2(lb + bh + hl)$
- iv. Length of the longest diagonal of the cube $= \sqrt{l^2 + b^2 + h^2}$

While approaching this in reasoning; Cubes and Cuboids includes the following types of questions such as:

Question asked regarding the painted surface in the cube are as follows:

1. 1 side painted
2. 2 side painted
3. 3 side painted
4. No side painted

Some important formulas are given below:

If each side of the cube $= n$ = Side of the big cube / side of the smaller cube

Then,

- total number of small cube $= n^3$
- Number of vertex cubes (cubes with three colored side) $= 8$
- Number of middle cubes (cubes whose two sides are colored) $= 12(n-2)$
- Number of central cubes (cubes with two colored sides) $= 6(n-2)^2$
- Number of inner central cubes (cubes whose sides are not colored) $= (n-2)^3$

Example 1. All the surfaces of a cube are painted with the same color and it is cut in such a way that 125 small and equal cubes can be made, then how many such cubes will there be, whose only one surface is colored?

- (a) 54
- (b) 48
- (c) 42
- (d) 72

Sol. (a) Each side of the cube n = Side of the big cube / side of the smaller cube

total number of small cube $= n^3$

Number of vertex cubes (cubes with three colored side) $= 8$

Number of middle cubes (cubes whose two sides are colored) $= 12(n-2)$

Number of central cubes (cubes with two colored sides) $= 6(n-2)^2$

Number of inner central cubes (cubes whose sides are not colored) $= (n-2)^3$

Here $n = \sqrt[3]{\text{The number of all the small cubes}}$

$$= \sqrt[3]{125}$$

$$= 5$$

We know that only one surface of the central cube is colored so

$$\begin{aligned}\text{Central cube} &= 6(6n - 2)^2 \\ &= 6(5 - 2)^2 \\ &= 6 \times 9 \\ &= 54\end{aligned}$$

Thus, number of cubes having only one surface colored = 54

Example 2. All the surfaces of a cube are painted with the same color and it is cut in such a way that 64 small and equal cubes can be made, then how many such cubes will be there whose no surface is colored?

- (a) 10 (b) 24
(c) 48 (d) 8

Sol. (d) Each side of the cube $n = \text{Side of the big cube} / \text{side of the smaller cube}$ total number of small cube = n^3

Number of vertex cubes (cubes with three colored side) = 8

Number of middle cubes (cubes whose two sides are colored) = $12(n - 2)$

Number of central cubes (cubes with two colored sides) = $6(n - 2)^2$

Number of inner central cubes (cubes whose sides are not colored) = $6(n - 2)^3$

$$\begin{aligned}\text{Here } n &= \sqrt[3]{\text{The number of all the small cubes}} \\ &= \sqrt[3]{64} \\ &= 4\end{aligned}$$

We know that none of the surfaces of the inner central cube are colored, so

$$\begin{aligned}\text{Inner central cube} &= (n - 2)^3 \\ &= (4 - 2)^3 \\ &= 8 \\ &= 8\end{aligned}$$

Thus, the number of such cubes, none of whose surfaces are colored = 8

Example 3. All the faces of a cube are painted blue. Now it is cut in such a way that 216 small and equal cubes can be made, then how many such cubes will be there, whose two surfaces are Colored?

- (a) 12 (b) 16
(c) 48 (d) 8

Sol. (c) Each side of the cube $n = \text{Side of the big cube} / \text{side of the smaller cube}$ total number of small cube = n^3

Number of vertex cubes (cubes with three colored side) = 8

Number of middle cubes (cubes whose two sides are colored) = $12(n - 2)$

Number of central cubes (cubes with two colored sides) = $6(n - 2)^2$

Number of inner central cubes (cubes whose sides

are not colored) = $(n - 2)^3$

$$\begin{aligned}\text{Here } n &= \sqrt[3]{\text{The number of all the small cubes}} \\ &= \sqrt[3]{216} \\ &= 6\end{aligned}$$

We know that the two faces of the central cube are colored so

$$\begin{aligned}\text{middle cube} &= 12(n - 2) \\ &= 12(6 - 2) \\ &= 48 \\ &= 48\end{aligned}$$

Thus, the number of such cubes, whose two surfaces are colored = 48

Example 4. A uniform color has been used to paint a cube. After this it is cut into 343 smaller cubes, then what will be the ratio of the number of such cubes whose none of the sides are colored and all the three sides are colored?

- (a) 2 : 5 (b) 15 : 2
(c) 5 : 6 (d) 125 : 8

Sol. (d) Each side of the cube $n = \text{Side of the big cube} / \text{side of the smaller cube}$ total number of small cube = n^3

Number of vertex cubes (cubes with three colored side) = 8

Number of middle cubes (cubes whose two sides are colored) = $12(n - 2)$

Number of central cubes (cubes with two colored sides) = $6(n - 2)^2$

Number of inner central cubes (cubes whose sides are not colored) = $(n - 2)^3$

$$\begin{aligned}n &= \sqrt[3]{\text{Number of small cubes}} \\ n &= \sqrt[3]{343} \\ n &= 7\end{aligned}$$

$$\begin{aligned}\text{We know that such a cube whose no edge is colored will be an inner central cube, so number of such cubes} &= (n - 2)^3 \\ &= (7 - 2)^3 \\ &= 5^3 \\ &= 125\end{aligned}$$

We know that such a cube whose all the three surfaces are colored will be vertex cube, so their number = 8

$$\begin{aligned}\text{According to the question, the ratio of a cube whose none of the sides is colored and whose all three sides are colored will be} &= 125 : 8\end{aligned}$$

Example 5. 10 cm All the faces of a solid cube of side x are painted black. It is cut into cubical blocks of side 2 cm, then what will be the ratio of the number of cubes whose one surface is black and two surfaces are black?

- (a) 1 : 2 (b) 2 : 3
(c) 3 : 4 (d) 3 : 2



Sol. (d) Each side of the cube $n = \text{Side of the big cube} / \text{side of the smaller cube}$ total number of small cube $= n^3$

Number of vertex cubes (cubes with three colored side) $= 8$

Number of middle cubes (cubes whose two sides are colored) $= 12(n - 2)$

Number of central cubes (cubes with two colored sides) $= 6(n - 2)^2$

Number of inner central cubes (cubes whose sides are not colored) $= (n - 2)^3$

$$n = \frac{10}{2}$$

$$n = 5$$

One surface is black, such that

$$\text{number of cubes} = 6(n - 2)^2$$

$$= 6(5 - 2)^2$$

$$= 6 \times 3^2$$

$$= 54$$

Two surfaces are black, such that number of cubes

$$= 12(n - 2)$$

$$= 12(5 - 2)$$

$$= 36$$

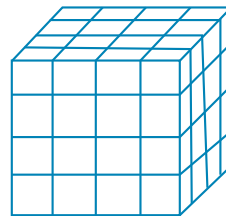
According to Question,

The ratio of the number of cubes with one surface black to the number of cubes with two surfaces black

$$= 54 : 36$$

$$= 3 : 2$$

Example 6. A big cube is made by arranging 64 cubes, then how many such cubes are there which are surrounded from all sides?



(a) 8

(b) 48

(c) 32

(d) 24

Sol. (a) Each side of the cube $n = \text{Side of the big cube} / \text{side of the smaller cube}$ total number of small cube $= n^3$

Number of vertex cubes (cubes with three colored side) $= 8$

Number of middle cubes (cubes whose two sides are colored) $= 12(n - 2)$

Number of central cubes (cubes with two colored sides) $= 6(n - 2)^2$

Number of inner central cubes (cubes whose sides are not colored) $= (n - 2)^3$

We know that

Number of cubes surrounded on all sides i.e. cubes whose surface is not visible, hence the number of cubes whose surface is not visible

$$n = \sqrt[3]{\text{number of small cubes}}$$

$$n = \sqrt[3]{64}$$

$$n = 4$$

$$\text{Number of cubes} = (n - 2)^3$$

$$= (4 - 2)^3$$

$$= 2^3$$

$$= 8$$

Hence, the number of cubes which are surrounded from all sides $= 8$

Data Sufficiency

Definition: The general approach to solve the questions of data sufficiency includes the process of checking a given set of information to see if the data is sufficient to answer the given question.

These are intended to evaluate ability to correlate each question given in order to come to a conclusion.

Data sufficiency includes the following type of question such as:

1. Sequence based.
2. Ranking based.
3. Blood relation based.
4. Puzzle based.
5. Coding-decoding based etc.....

These questions include either two or more than two statements. Based on which it is checked whether the question can be answered or not.

Some important points to consider while approaching the questions:

- ➔ Understand the given information properly.
- ➔ After checking the first statement and second statement the conclusion can be made

Let's understand questions by the following examples:

Example 1. Which statement is sufficient to answer the following question?

Who is the tallest among P, Q, R, S and T.

Statement 1:- P is taller than R. Q is shorter than P & R.

Statement 2:- T is taller than S who is taller than P.

- (a) Data in statement 1 is sufficient to answer.
- (b) Data in statement 2 is sufficient to answer.
- (c) Data in both statements 1 & 2 are sufficient to answer.
- (d) Data in both statements 1 & 2 are not sufficient to answer.

Sol. Statement 1:- P is taller than R. Q is shorter than P & R.
 $P > R$ $P & R > Q$

Statement 2:- T is taller than S who is taller than P.
 $T > S > P$

[*Here, $>$ means "taller than" & $<$ means "shorter than".]

After joining both the statements 1 & 2,

$T > S > P > R > Q$

So, T is the tallest among all.

Hence, data in both the statements 1 & 2 are sufficient to answer the question.

Example 2. Which statement is sufficient to answer the following question?

Who is the shortest among A, B, C, D & E?

Statement 1:- E is taller than C who is the shortest.

Statement 2:- A is taller than D & B.

- (a) Data in statement 1 is sufficient to answer.
- (b) Data in statement 2 is sufficient to answer.
- (c) Data in both statements 1 & 2 are sufficient to answer.
- (d) Data in both statements 1 & 2 are not sufficient to answer.

Sol. Statement 1:- E is taller than C who is the shortest.
 $E > C$

Statement 2:- A is taller than D & B.

$A > D \& B$

[*Here, $>$ means "taller than" & $<$ means "shorter than".]

After solving statement 1 we can conclude,

$E > C$ which means C is shorter than E and given that C is the shortest.

Hence, data in statement 1 is sufficient to answer the question.

Example 3. Which statement is sufficient to answer the following question?

Who is the heaviest among D, E, F, G & H?

Statement 1:- H is heavier than E.

Statement 2:- D is lighter than F.

- (a) Data in statement 1 is sufficient to answer.
- (b) Data in both statements 1 & 2 are not sufficient to answer.
- (c) Data in both statements 1 & 2 are sufficient to answer.
- (d) Data in statement 2 is sufficient to answer.

Sol. Statement 1:- H is heavier than E.

$$H > E$$

Statement 2:- D is lighter than F.

$$F > D$$

[*Here, > means “heavier than” & < means “lighter than”.]

No information is given about all the characters in the statements so, we can't find who is the heaviest among all

Hence, data in both the statements 1 & 2 are not sufficient to answer the question.

Example 4. Which statement is sufficient to answer the following question?

Who is the greater among L, M, N, O & P?

Statement 1:- P is greater than M.

Statement 2:- P is smaller than O who is the greatest.

- (a) Data in statement 1 is sufficient to answer.
- (b) Data in statement 2 is sufficient to answer
- (c) Data in both statements 1 & 2 are sufficient to answer.
- (d) Data in both the statements 1 & 2 are not sufficient to answer.

Sol. Statement 1:- P is greater than M.

$$P > M$$

Statement 2:- P is smaller than O who is the greatest.

$$O > P$$

[*Here, > means “greater than” & < means “smaller than”.]

Given in statement 2 that O is the greatest.

Hence, data in statement 2 is sufficient to answer the question.

Example 5. Which statement is sufficient to answer the following question?

If the first day of a month is Thursday, how many days were there in that month?

Statement 1 :- The fourth Sunday happened to be on 25th.

Statement 2 :- The last day of the month was the fifth Saturday of that month.

- (a) Data in statement 1 is sufficient to answer.
- (b) Data in statement 2 is sufficient to answer
- (c) Data in both statements 1 & 2 are sufficient to answer
- (d) Data in both statements 1 & 2 are not sufficient to answer.

Sol. Data in statement 2 is sufficient to answer.

Statement (1) Gives no additional information; it may be calculated from the statement itself.

Statement (2) Leads us to an answer. Thursday is the 1st day (given in the statement). So the first

Saturday will be the 3rd day. And 5th Saturday = $3 + 4 \times 7 = 31$ st day. Since this is the last day, There will be 31 days in the month.

Hence,

The correct answer is Data in statement 2 is sufficient to answer.

Example 6. Which statement is sufficient to answer the following question?

Among P, Q, R, S, T and V, who is the heaviest?

Statement 1:- P and S are heavier than Q, T and V.

Statement 2:- P is heavier than S but lighter than R.

- (a) Data in statement 1 is sufficient to answer
- (b) the data in statement 1 and 2 together are necessary to answer the question
- (c) the data in statement 1 and 2 together are not sufficient to answer the question
- (d) Data in statement 2 is sufficient to answer

Sol. if the data in statement 1 and 2 together are necessary to answer the question.

Statement 1: $P, S > Q, T, V$

Statement 2 : $R > P > S$

from statement 1 & 2,

R is the heaviest among them.

Hence the correct ans is :- the data in statement 1 and 2 together are necessary to answer the question.

Example 7. Which statement is sufficient to answer the following question?

Which codeword stands for ‘good’ in the coded

sentence ‘sin co bye’ which means ‘He is good.’

Statement 1 :- In the same code language ‘co mot det’ means ‘They are good’.

Statement 2:- In the same code language ‘sin mic bye’ means ‘He is honest’.

- (a) The data in statement 1 alone are sufficient to answer the question while the data in statement 2 alone are not sufficient to answer the question
- (b) The data either in statement 1 alone or in statement 2 alone are sufficient to answer the questions.
- (c) The data in statement 2 alone are sufficient to answer the question while the data in statement 1 alone are not sufficient to answer the question.
- (d) The data even in both statements 1 and 2 together are not sufficient to answer the questions.

Sol. The data either in statement 1 alone or in statement 2 alone are sufficient to answer the questions.

Given: ‘sin co bye’ means ‘He is good’

From 1: ‘co mot det’ means ‘They are good’

From 2: ‘sin mic bye’ means ‘He is Honest’

After a comparison between the given information and statement 1 we get 'co' is the code for 'good'.

Similarly,

After a comparison between the given information and statement 2 we get 'sin' and 'bye' as the codes for 'He' and 'is'.

Thus 'co' is the code for 'good'.

Hence the correct answer is :- The data either in statement 1 alone or in statement 2 alone are sufficient to answer the questions.

Example 8. Which statement is sufficient to answer the following question?

How far is Ranchi from Agra?

Statement 1 :- Agra is 899 km from Ranchi.

Statement 2 :- There is no air route linking Ranchi and Agra directly.

- (a) Data in statement 2 is sufficient to answer
- (b) Data in statement 1 is sufficient to answer
- (c) Data in both statements 1 & 2 are sufficient to answer
- (d) Data in both statements 1 & 2 are not sufficient to answer.

Sol. Data in statement 1 is sufficient to answer.

The distance from Ranchi to Agra is the same as the distance from Agra to Ranchi .

So Statement 1 answers the question completely.

Statement 2 has no relevance.

Hence the correct answer is :- Data in statement 1 is sufficient to answer.

Example 9. Which statement is sufficient to answer the following question?

How old am I ?

Statement 1 :- I was born before the earthquake.

Statement 2 :- My son was born in 1967.

- (a) Data in both statements 1 & 2 are sufficient to answer
- (b) Data in both statements 1 & 2 are not sufficient to answer.
- (c) Data in statement 2 is sufficient to answer
- (d) Data in statement 1 is sufficient to answer.

Sol. Data in both statements 1 & 2 are not sufficient to answer.

Neither of the statements answer the question.

Statement 1 :- furnishes us with virtually no data.

Statement 2 :- also gives my son 's age , not mine.

Hence the correct answer is :- Data in both statements 1 & 2 are not sufficient to answer.

Example 10. Which statement is sufficient to answer the following question?

Who is the third greater among L, M, N, O, P & Q?

Statement 1:- M is smaller than N & Q.

Statement 2:- L is greater than O.

- (a) Data in statement 1 is sufficient to answer
- (b) Data in statement 2 is sufficient to answer.
- (c) Data in both statements 1 & 2 are sufficient to answer.
- (d) Data in both the statements 1 & 2 are not sufficient to answer.

Sol. Statement 1:- M is smaller than N & Q.

$M < N \& Q$

Statement 2:- L is greater than O

$L > O$

[*Here, > means "greater than" & < means "smaller than".]

Both the given statements are not defining all the characters. So, it is difficult to find the positions of all.

Hence, data in both statements are not sufficient to answer the question.

Decision Making

Decision making is a process in which an output is derived by analyzing the given data. Where a set of rules is specified as selection criteria.

The process of approaching the questions involves the following steps:

1. The first step is to analyze and understand the given rules.
2. Then we need to identify that the given condition in the question can or can not satisfy the given condition.
3. According to that we choose the best suitable alternative to the question.

Decision making approach is totally based on the ability to analyze or evaluate the question. It involves the following types:

1. Passage based decision making
2. Eligibility test.

We can understand the approach to solve these problem by the following examples:

Example 1. Study the following information carefully and answer the questions given below.

The Following are the conditions for the requirement of a person as Manager in a company. The candidate must –

- (i) be a graduate in any discipline with at least 55% marks.
- (ii) be a post graduate in Management with specialization in Finance with at least 65% marks.
- (iii) have work experience of at least 4 years in the finance department.
- (iv) be at least 26 years and not more than 36 years as on 01-12-2016. In the case of candidate who fulfills all conditions except –
 - (a) at (ii) above, but has secured at least 60% marks in post graduate in Management with specialization in Finance and at least 70% marks in graduation, his case to be referred as DGM.
 - (b) at (iii) above, but has work experience of at least 2 years as Assistant Finance Manager, his case to be referred as GM.

In each question below, details of a candidate are provided followed by a question and 5 courses of action. The decision will be made only on the information provided.

Aman was born on 19th March 1986. He has been working in the finance department of an organization for the past 5 years. He has secured 67% marks in B.Com and 75% marks in his post-graduation. Which of the following will be a course of action if Aman applies?

- (a) Aman will be selected.
- (b) Data provided are inadequate to take the decision
- (c) Aman will not be selected.
- (d) Aman will be offered as DGM post

Sol. (b) All conditions specified for Aman can be selected as manager. But it is not known that he has done his post-graduation in which stream. So data is inadequate

Example 2. Study the following information carefully and answer the questions given below:

The Following are the conditions for the requirement of a person as Manager in a company. The candidate must –

- (i) be a graduate in any discipline with at least 55% marks.
- (ii) be a post graduate in Management with specialization in Finance with at least 65% marks.
- (iii) have work experience of at least 4 years in the finance department.
- (iv) be at least 26 years and not more than 36 years as on 01-12-2016. In the case of candidate who fulfills all conditions except –
 - (a) at (ii) above, but has secured at least 60% marks in post graduate in Management with specialization in Finance and at least 70% marks in graduation, his case to be referred as DGM.
 - (b) at (iii) above, but has work experience of at least 2 years as Assistant Finance Manager, his case to be referred as GM.

In each question below, details of a candidate are provided followed by a question and 5 courses of action. The decision will be made only on the information provided.

Vikram was born on 7th November 1987. He has been working for the past four years as Assistant Finance Manager in an organization. He has secured 70% marks in B.Sc and 70% marks in his post-graduation in Management with specialization in Finance. Which of the following will be a course of action if Vikram applies

- (a) He will be selected.
- (b) Data provided is inadequate to make the decision.
- (c) He will not be selecte (d)
- (d) He will be offered as DGM post

Sol. (a) First we have to check all the 4 conditions, these all follow so he will be selecte D. He is working as Assistant Manager will be taken into case only if point (ii) does not satisfy

Example 3. Study the following information carefully and answer the questions given below.

The Following are the conditions for the requirement of a person as Manager in a company. The candidate must –

- (i) be a graduate in any discipline with at least 55% marks.
- (ii) be a post graduate in Management with specialization in Finance with at least 65% marks.
- (iii) have work experience of at least 4 years in the finance department.
- (iv) be at least 26 years and not more than 36 years as on 01-12-2016. In the case of candidate who fulfills all conditions except –
 - (a) at (ii) above, but has secured at least 60% marks in post graduate in Management with specialization in Finance and at least 70% marks in graduation, his case to be referred as DGM.
 - (b) at (iii) above, but has work experience of at least 2 years as Assistant Finance Manager, his case to be referred as GM.

In each question below, details of a candidate are provided followed by a question and 5 courses of action. The decision will be made only on the information provided.

Koyal has been working in the finance department of an organization for the past 7 years after completing her post-graduation with 68% marks. She secured 52% in her graduation and was born on 12th January 1988. Which of the following will be a course of action if Koyal applies?

- (a) She will be selected.
- (b) Data provided is inadequate to make the decision.
- (c) She will not be selecte D.
- (d) She will be offered as DGM post

Sol. (c) She secured 52% in her graduation, but 55% is required.

Example 4. Study the following information carefully and answer the questions given below.

The Following are the conditions for the requirement of a person as Manager in a company. The candidate must –

- (i) be a graduate in any discipline with at least 55% marks.
- (ii) be a post graduate in Management with specialization in Finance with at least 65% marks.
- (iii) have work experience of at least 4 years in the finance department.

- (iv) be at least 26 years and not more than 36 years as on 01-12-2016. In the case of candidate who fulfills all conditions except –

- (a) at (ii) above, but has secured at least 60% marks in post graduate in Management with specialization in Finance and at least 70% marks in graduation, his case to be referred as DGM.
- (b) at (iii) above, but has work experience of at least 2 years as Assistant Finance Manager, his case to be referred as GM.

In each question below, details of a candidate are provided followed by a question and 5 courses of action. The decision will be made only on the information provided.

Sita was born on 26th July 1989. She has been working in the finance department of an organization. Which condition/s below will lead to her selecting as the DGM.

- (i) She secured 66% marks in post-graduation and 57% marks in graduation.
- (ii) She worked in the finance department for 5 years.
- (iii) She secured 63% marks in post-graduation and 74% marks in graduation.

- (a) Both (i) and (ii)
- (b) Only (iii)
- (c) Only (i)
- (d) Only (ii) and (iii)

Sol. (d) Sita was born on 26th July 1989- Satisfies (iv) point She worked in the finance department for 5 years- Satisfies (iii) point She secured 63% marks in post-graduation and 74% marks in graduation. – Satisfies DGM point

Example 5. Study the following information carefully and answer the questions given below.

The Following are the conditions for the requirement of a person as Manager in a company. The candidate must –

- (i) be a graduate in any discipline with at least 55% marks.
- (ii) be a post graduate in Management with specialization in Finance with at least 65% marks.
- (iii) have work experience of at least 4 years in the finance department.
- (iv) be at least 26 years and not more than 36 years as on 01-12-2016. In the case of candidate who fulfills all conditions except –
 - (a) at (ii) above, but has secured at least 60% marks in post graduate in Management with specialization in Finance and at least 70% marks in graduation, his case to be referred as DGM.
 - (b) at (iii) above, but has work experience of at least 2 years as Assistant Finance Manager, his case to be referred as GM.

In each question below, details of a candidate are provided followed by a question and 5 courses of action. The decision will be made only on the information provided.



Medha has been working as Assistant Finance Manager in an organization for the past 3 years. Which condition/s below will lead to her selecting as the GM. (i) She was born on 5th April 1992 (ii) She was born on 4th November 1990 (iii) She secured 69% marks in post-graduation and 74% marks in graduation.

- (a) Either (i) or (ii) and (iii)
- (b) Only (iii)
- (c) Both (ii) and (iii)
- (d) Both (i) and (iii)

Sol. (c) She was born on 5th April 1992 – makes her 24 in age

Example 6. Study the following information carefully and answer the questions given below:

The Following are the conditions for the requirement of an IT officer in an organization.. The candidate must –

- (i) be a BE/BTech in IT or Computer Science with at least 60% marks.
- (ii) be at least 20 years and not more than 26 years as on 01-11-2016.
- (iii) have secured at least 60% marks in written test
- (iv) have secured at least 40% marks in interview In the case of candidate who fulfills all conditions except –
 - (a) At (ii) above, but is a postgraduate, his case to be referred to as GM.
 - (b) at (iv) above, but has secured at least 35% marks in interview and at least 70% marks in written test, his case to be referred as VP.

In each question below, details of a candidate are provided followed by a question and 5 courses of action. The decision will be made only on the information provided.

Tushar was born on 19th March 1995. He has secured 65% marks in BE-IT. He has secured 62% marks in both written test and interview. Which of the following will be a course of action if Tushar applies?

- (a) Tushar will be selected.
- (b) Data provided is inadequate to make the decision.
- (c) Tushar will not be selected.
- (d) Tushar will be offered as GM post.

Sol. (a) All 4 conditions are followed. Tushar will be selected.

Example 7. Study the following information carefully and answer the questions given below:

The Following are the conditions for the requirement of an IT officer in an organization.. The candidate must –

- (i) be a BE/BTech in IT or Computer Science with at least 60% marks.
- (ii) be at least 20 years and not more than 26 years as on 01-11-2016.
- (iii) have secured at least 60% marks in written test

(iv) have secured at least 40% marks in interview In the case of candidate who fulfills all conditions except –

- (a) At (ii) above, but is a post graduate, his case to be referred as GM.
- (b) at (iv) above, but has secured at least 35% marks in interview and at least 70% marks in written test, his case to be referred as VP.

In each question below, details of a candidate are provided followed by a question and 5 courses of action. The decision will be made only on the information provided.

Akshit was born on 7th November 1989. He has secured 70% marks in B.Tech and 70% marks in his M.Tech. He has secured 65% marks in both written test and interview. Which of the following will be a course of action if Akshit applies?

- (a) He will be selected.
- (b) Data provided are inadequate to take the decision.
- (c) He will not be selected.
- (d) He will be offered as GM post.

Sol. (b) It is not given that he has done BTech and MTech in IT or Computers or any other stream.

Example 8. Study the following information carefully and answer the questions given below:

The Following are the conditions for the requirement of an IT officer in an organization.. The candidate must –

- (i) be a BE/BTech in IT or Computer Science with at least 60% marks.
- (ii) be at least 20 years and not more than 26 years as on 01-11-2016.
- (iii) have secured at least 60% marks in written test
- (iv) have secured at least 40% marks in interview In the case of candidate who fulfills all conditions except –
 - (a) At (ii) above, but is a postgraduate, his case to be referred to as GM.
 - (b) at (iv) above, but has secured at least 35% marks in interview and at least 70% marks in written test, his case to be referred as VP.

In each question below, details of a candidate are provided followed by a question and 5 courses of action. The decision will be made only on the information provided.

Ayushi has secured 78% marks in written tests and 38% marks in interviews. She secured 62% in B.tech-IT and was born on 12th January 1991. Which of the following will be a course of action if Ayushi applies?

- (a) Data provided are inadequate to take the decision.
- (b) She will not be selected.
- (c) She will be offered as GM post.
- (d) She will be offered as VP post.

Sol. (d) She has secured 38% in interview which is less than required 40%, but is greater than 35% and in written test, she secured greater than 70%, so VP

Example 9. Study the following information carefully and answer the questions given below:

The Following are the conditions for the requirement of an IT officer in an organization.. The candidate must –

- (i) be a BE/BTech in IT or Computer Science with at least 60% marks.
- (ii) be at least 20 years and not more than 26 years as on 01-11-2016.
- (iii) have secured at least 60% marks in written test
- (iv) have secured at least 40% marks in interview In the case of candidate who fulfills all conditions except –
 - (a) At (ii) above, but is a postgraduate, his case to be referred to as GM.
 - (b) at (iv) above, but has secured at least 35% marks in interview and at least 70% marks in written test, his case to be referred as VP.

In each question below, details of a candidate are provided followed by a question and 5 courses of action. The decision will be made only on the information provided.

Mohini was born on 26th July 1991. She did her graduation and post-graduation in the Computer department. Which condition/s below will lead to her selecting as the GM.

- (i) She secured 68% in graduation and 65% both in written test and interview.
 - (ii) She secured 65% in BE.
 - (iii) She secured 63% marks in the written test and 74% marks in the interview.
- (a) Both (i) and (ii)
 - (b) Only (iii)
 - (c) Only (i)
 - (d) Both (ii) and (iii)

Sol. (d) In question it is not given that she did her graduation in which field. So (ii) is important and then (iii) In (i), it is not given then she graduated in BE/B.tech.

Example 10. Study the following information carefully and answer the questions given below:

The Following are the conditions for the requirement of an IT officer in an organization.. The candidate must –

- (i) be a BE/BTech in IT or Computer Science with at least 60% marks.
- (ii) be at least 20 years and not more than 26 years as on 01-11-2016.
- (iii) have secured at least 60% marks in written test
- (iv) have secured at least 40% marks in interview In the case of candidate who fulfills all conditions except –
 - (a) At (ii) above, but is a postgraduate, his case to be referred to as GM.
 - (b) at (iv) above, but has secured at least 35% marks in interview and at least 70% marks in written test, his case to be referred as VP.

In each question below, details of a candidate are provided followed by a question and 5 courses of action. The decision will be made only on the information provided.

Gauri completed her BTech in IT in the year 2012. Which condition/s below will lead to her selecting as the IT officer?

- (a) Both (ii) and (iii)
- (b) Both (i) and (ii)
- (c) All (i) , (ii) and (iii)
- (d) None of these

Sol. (d) None of the conditions gives her marks in B.tech.

Direction and Distance

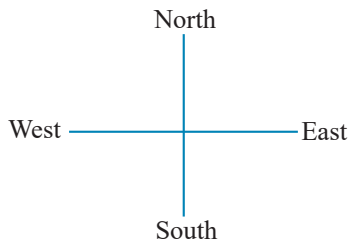
As the name suggests, In this topic the questions are based on the puzzle related to the Direction and distance.

It includes the following type of question such as:

1. Final direction.
2. Initial direction.
3. Total distance covered.
4. Minimum distance between the initial and final point.

The process of solving such questions the following points should be taken into consideration:

- ➔ For convenience the directions should be taken as shown below.



- ➔ According to the given condition the direction diagram should be drawn.
- ➔ Left turn = anti-clockwise direction with respect to the person.
- ➔ Right turn = clockwise direction with respect to the person.
- ➔ Minimum distance between two points is always a straight line.
- ➔ To calculate direct distance we use the pythagorean theorem; which is as follows:
- ➔ In a right angled triangle.

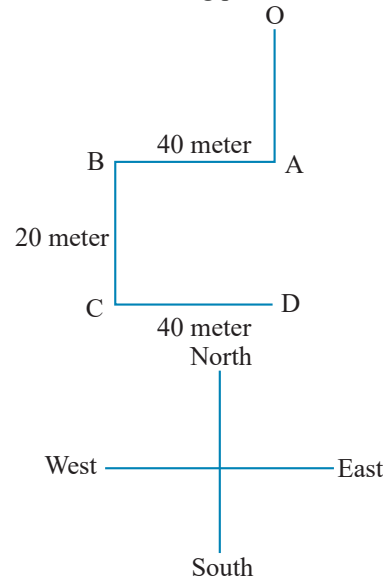
$$\text{Hypotenuse}^2 = \text{Perpendicular}^2 + \text{Base}^2$$

Let's understand this by following examples:

Example 1. Rahul starts walking in south direction and after walking 30m takes a right turn and walks 40m from there he takes a left turn and walks 20m and finally again takes a left turn and walks 40m. Then how far and in which direction is he from the starting location?

- | | |
|---------------------|---------------|
| (a) 50 meters north | (b) 50m south |
| (c) 50m east | (d) 50m west |

Sol. Let O be the starting position of Rahul.



(30 + distance between A and D)

$$30 + 20 = 50 \text{ meters}$$

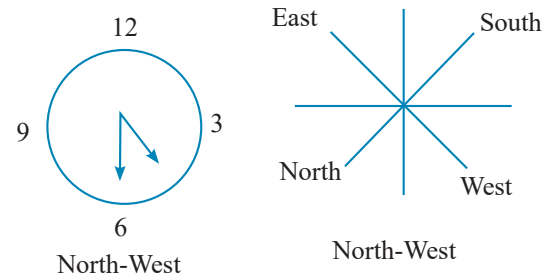
Hence,

Rahul is 50 meters away from the starting point and in the south direction.

Example 2. It is 4:30 in a clock, if the minute hand is in the north-west direction, then in which direction will the hour hand be?

- | | |
|-----------|-----------|
| (a) South | (b) West |
| (c) East | (d) North |

Sol.



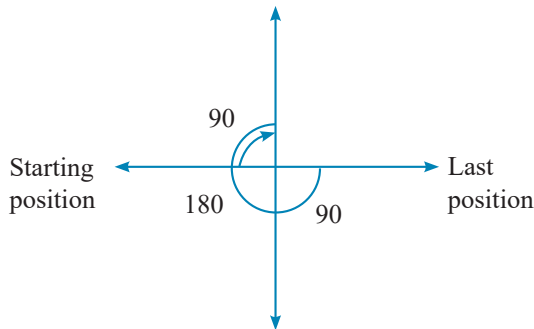
Hence,

the hour hand is in the west direction.

Example 3. A man is facing west he turns 90 degree clockwise then 180 degree anticlockwise and 90 degree anticlockwise in which direction is he facing now?

- (a) South (b) East
(c) North (d) West

Sol.

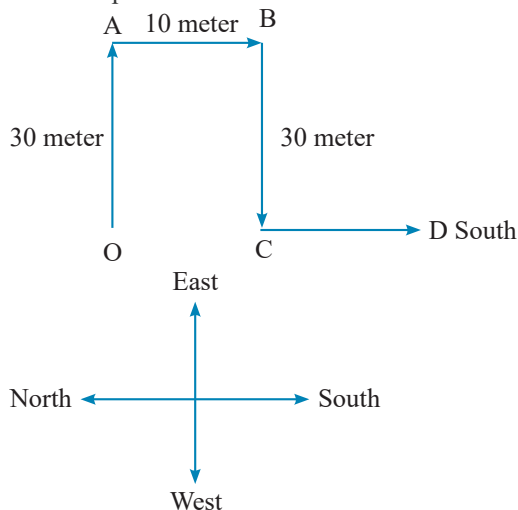


Hence,
now that man's face is towards the east.

Example 4. Suresh leaves his house and walks straight for 30 metres, then takes a right turn and walks 10 metres. Then takes a right turn and walks 30 meters and finally takes a left turn and starts walking. If he is now moving in the south direction, then in which direction did he start initially?

- (a) West (b) East
(c) South (d) North

Sol. Let the initial position of Suresh be O.



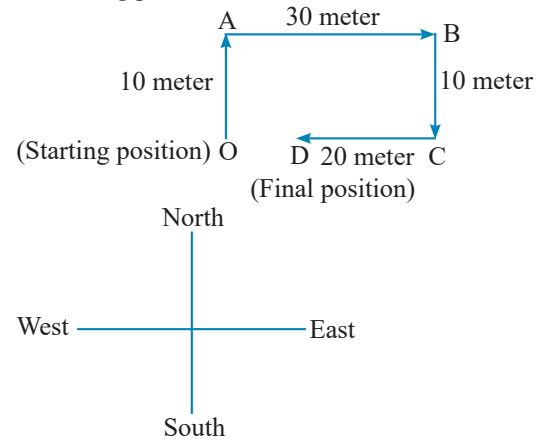
So,

It is clear from the picture that Suresh's final direction is south, then his initial direction will be east.

Example 5. Rahim from his starting point goes 10 meters to the north and from there turns right and goes 30 meters, then again turns right and goes 10 meters and finally again turns right and goes 20 meters, then the starting point, In which direction from the last position?

- (a) East (b) West
(c) North (d) South

Sol. Let the starting position of Rahim be O.

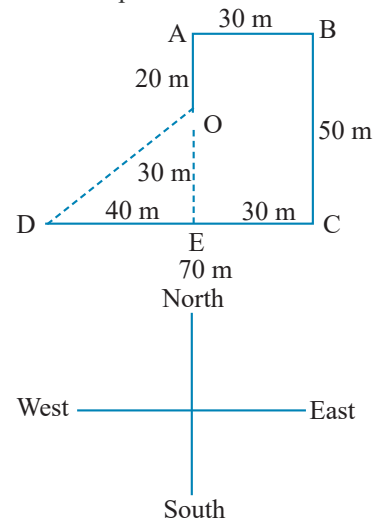


So it is clear from the picture that the starting point is in the west direction from the final point.

Example 6. I start walking in my opposite direction facing south and after walking 20m I turn right and walk 30m, then again turn right and walk 50m and finally again turn right and walk 70m. How far am I from my starting point?

- (a) 30m (b) 50m
(c) 40m (d) 210m

Sol. Let the initial position be O.



$$CD = 70 \text{ m}$$

$$ED = 40 \text{ m}$$

$$OE = 30 \text{ m}$$

$$OD = \sqrt{(DE)^2 + (OE)^2}$$

$$OD = \sqrt{40^2 + 30^2}$$

$$OD = \sqrt{1600 + 900}$$

$$OD = \sqrt{2500}$$

$$OD = 50 \text{ m}$$

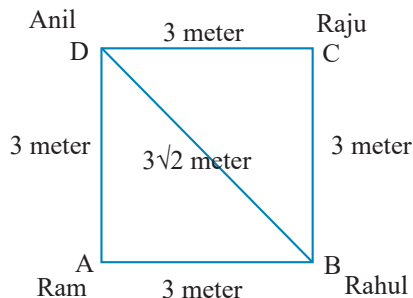
So,

I am 50 meters away from my starting point.

Example 7. A, B, C, D is a square whose four edges belong to Ram, Rahul, Raju and Anil respectively. Ram has to walk 3 meters to reach Rahul. How long will Rahul have to walk to return to his starting point passing through Raju and Anil?

- (a) 12 meters (b) $6 + 3\sqrt{2}$ Meters
(c) $6 + 3\sqrt{3}$ Meters (d) 9 meters

Sol.



BCD is a right angled triangle.

Therefore,

$$BD = \sqrt{(BC)^2 + (CD)^2} \quad (\text{Pythagoras theorem})$$

$$BD = \sqrt{3^2 + 3^2}$$

$$BD = \sqrt{9 + 9}$$

$$BD = \sqrt{18}$$

$$BD = 3\sqrt{2}$$

Distance between Anil to Raju = $3\sqrt{2}$

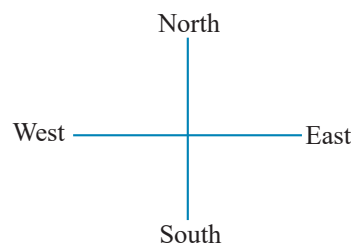
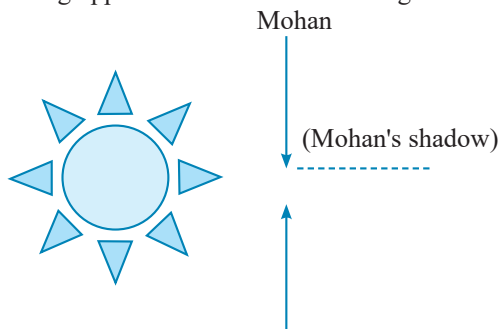
The distance covered by Rahul to reach Anil via Raju is $(3 + 3) = 6$ m

Therefore, the total time taken by Rahul to come back to the starting point passing through Raju and Anil is $(6 + 3\sqrt{2})$ meters distance will have to be walked.

Example - 8. One evening, just before sunset, Ram and Mohan were standing opposite each other and talking. If Mohan's shadow falls to the right of Ram, then in which direction is Mohan's face?

- (a) West (b) North
(c) East (d) South

Sol. One evening, just before sunset, Ram and Mohan were standing opposite each other and talking.

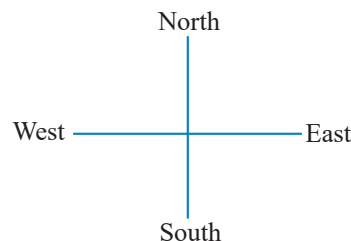
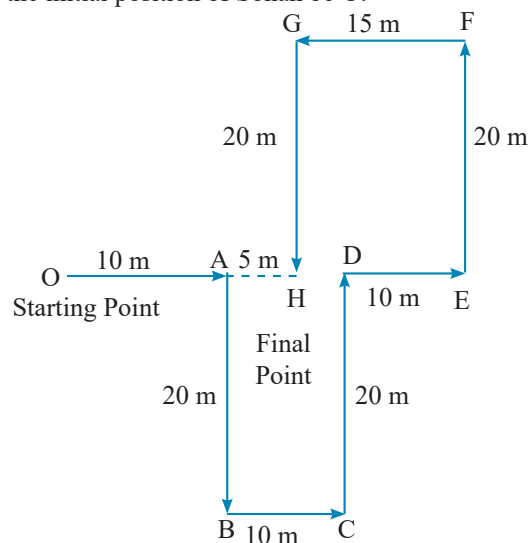


Hence, it is clear from the picture that Ram's face is in the north direction because at the time of sunset the sun will be in the west and the shadow will always be in the east. Mohan's face will be in the south direction.

Example 9. Sohan walks 10 m towards East from his house, then from there he walks 20 m to his right, then turns to his left and walks 10 m, again turns left and walks 20 m, again turns right and walks 10 m. Then turns left and goes 20 metres, again turns left and goes 15 meters and finally turns left again and goes 20 metres, then tell in which direction and how far is the final place from the starting point?

- (a) 20m West (b) 15 m east
(c) 15m west (d) 10m East

Sol. Let the initial position of Sohan be O.



Distance of Sohan from starting point to final point,

$$(10 + 5) = 15$$

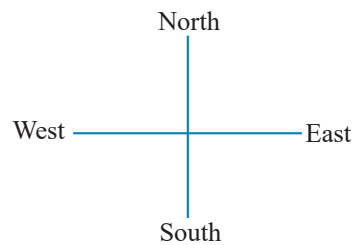
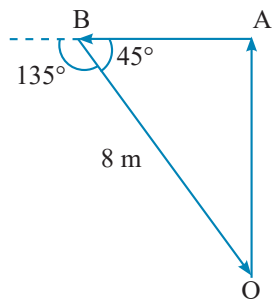
Hence,

It is clear from the figure that the starting point is 15 meters away from the final point and is in the east direction.

Example 10. A person walks some distance in the north direction from his place from where he turns left and again walks some distance. Now he turns 135 degree left from the direction of walking and walks 8 meters to reach the starting point. Find the distance traveled by him in the north direction?

- (a) Cannot be determined (b) $4\sqrt{2}$ m
(c) $3\sqrt{2}$ m (d) 4 m

Sol.



here $OA = AB$

$$\text{hence } \tan 45 = \frac{OA}{AB}$$

$$\text{or, } 1 = \frac{OA}{AB}$$

$$OA = AB = X \text{ m}$$

$$X^2 + X^2 = 8^2$$

$$X^2 + X^2 = 64$$

$$2X^2 = 64$$

$$X = 32$$

$$OA = 4\sqrt{2} \text{ m}$$

Hence, initially the person has covered a distance of $4\sqrt{2}$ meters in the north direction.

Figures and Mirror Images

FIGURES

Figures includes the following type of question such as:

1. **Embedded figure:** In the embedded figure we need to find out the figure in which the question figure is hidden. (It should be kept in mind if the rotation of the figure is allowed or not)
2. **Figure completion:** In the questions related to figure completion the figure would be divided into four parts and one of them would be missing. To find the missing part we need to check the symmetry of the figure and accordingly a suitable figure would be the correct alternative.
3. **Figure series:** In the questions related to figure series there would be a series of the figures based on the particular logic or pattern. After identifying the pattern the suitable alternative can be found.
4. **odd one out/Classification of figure:** In the classification of figures four distinctive alternatives would be given. In which three are alike in some manner as they follow the same pattern or similar logic but the one that does not follow the pattern would be the correct answer.
5. **Paper cutting and folding:**

MIRROR IMAGE

Mirror image includes the following types:

1. Alphabet image
2. Figure image
3. Combination of Alphabet and figure both.

Things to be considered.

- The mirror image of some alphabet remains same, which are as follows:

A, H, I, M, O, T, U, V, W, X, Y

Mirror image of the rest of the alphabets changes.

- In the mirror image the left side of the figure becomes the right side of the image and the right side of the image becomes the left side of the image.

Let's understand this by the following examples:

Example-1. If a mirror is placed on the line MN, then which of the answer figures is the right image of the given figure?

Question figure:

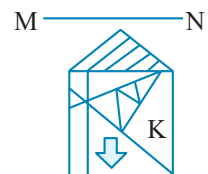


- (a) 2 3 H I f S Z (b) 2 E H I f S Z
(c) 2 3 H I f S Z (d) 2 E H I L L S Z

Sol. (d) The correct mirror image of the given figure is:
2 E H I L L S Z

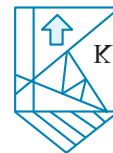
Example 2. If a mirror is placed on the line MN, then which of the answer figures is the right image of the given figure?

Question figure:



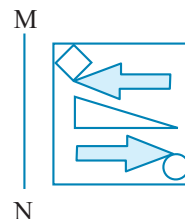
- (a) (b)
(c) (d)

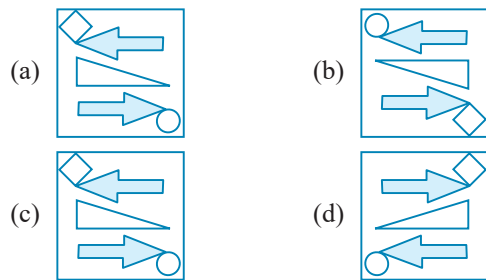
Sol. (c) The correct mirror image of the given figure is:



Example 3. If a mirror is placed on the line MN, then which of the answer figures is the right image of the given figure?

Question figure:



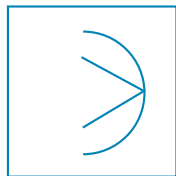


Sol. (d) The correct mirror image of the given figure is:

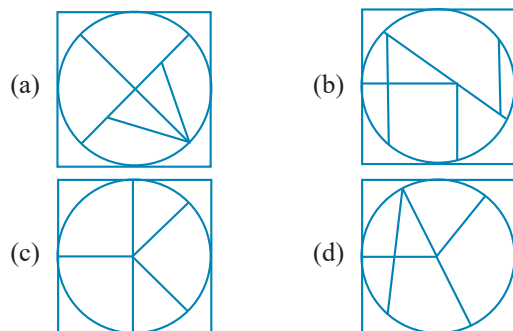


Example 4. From the given figures, select the one in which the question figure is hidden/embedded. (Rotation is allowed)

Question Figure:



Answer Figure



Sol. (a) The question figure is embedded/hidden in the following figure.



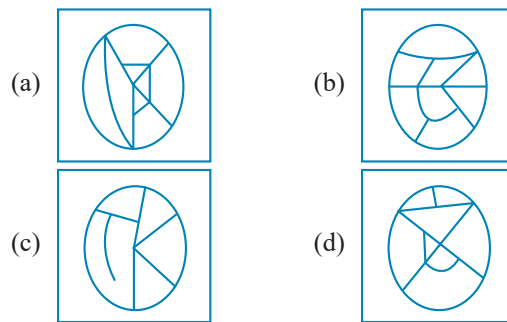
Hence, this is the correct answer.

Example 5. From the given figures, select the one in which the question figure is hidden/embedded.

Question Figure:



Answer Figure:



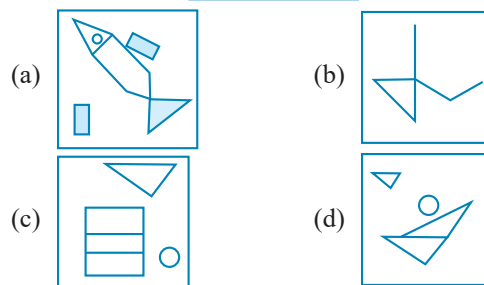
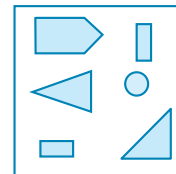
Sol. (b) The question figure is embedded/hidden in the following figure.



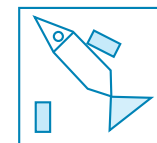
Hence, this is the correct answer.

Example 6. From the given figures, select the one in which the question figure is hidden/embedded.

Question Figure:

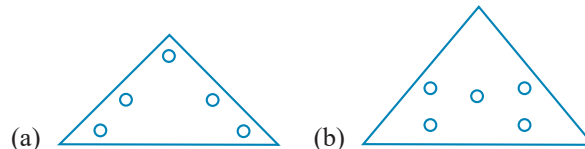
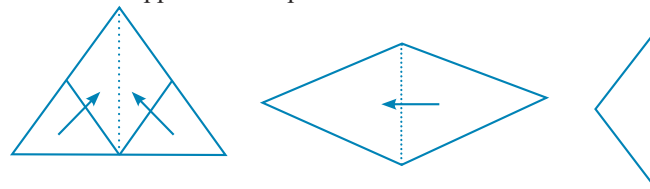


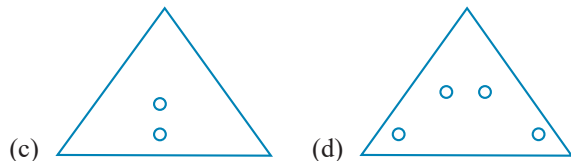
Sol. (a) The question figure is embedded/hidden in the following figure.



Hence, this is the correct answer.

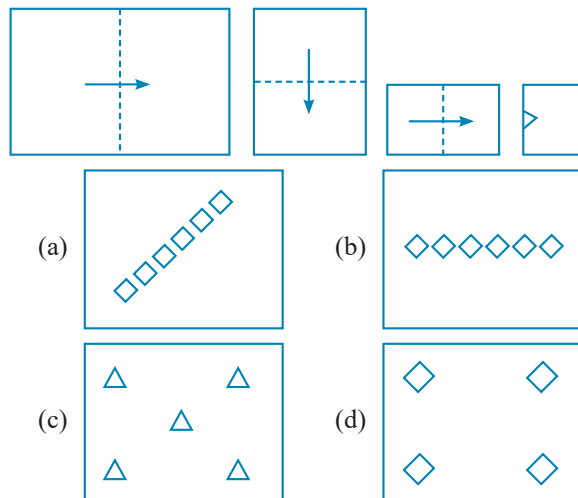
Example 7. A piece of paper is folded and cut as shown below in the question figures. From the given answer figures, indicate how it will appear when opened.



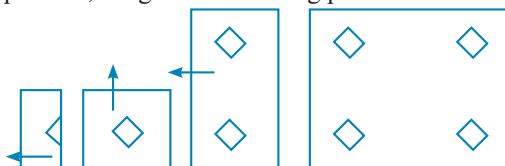


Sol. (d) After cutting and unfolding the paper as shown in the question, we get the following pattern:

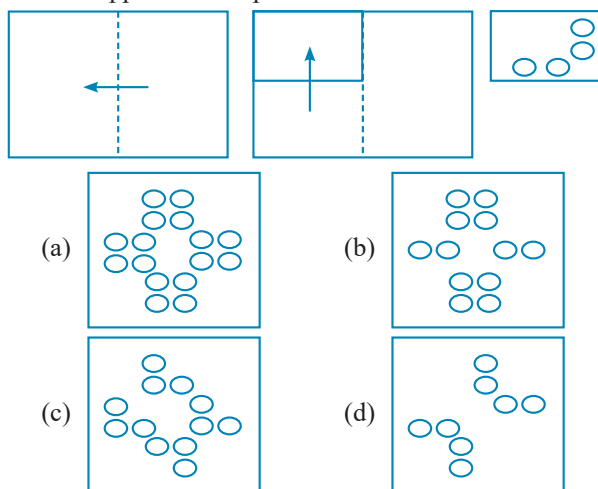
Example 8. A piece of paper is folded and cut as shown below in the question figures. From the given answer figures, indicate how it will appear when opened.



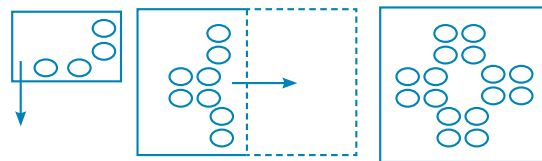
Sol. (d) After cutting and unfolding the paper as shown in the question, we get the following pattern:



Example 9. A piece of paper is folded and cut as shown below in the question figures. From the given answer figures, indicate how it will appear when opened.

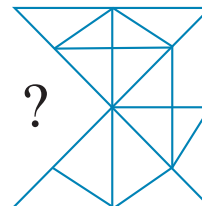


Sol. (a) After cutting and unfolding the paper as shown in the question, we get the following pattern:

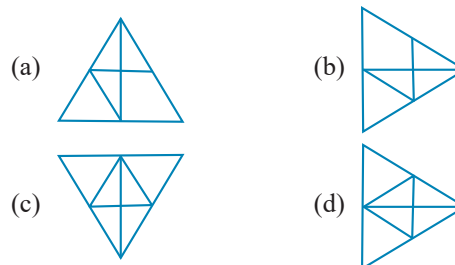


Example 10. Which answer figure will complete the pattern in the following question figure?

Question Figure :



Answer Figure:



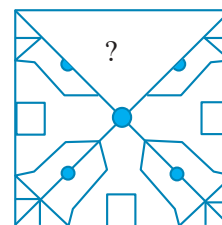
Sol. (b) To complete the given figure, the answer figure should follow the pattern of the given figure.

We see that the following figure completes the pattern.

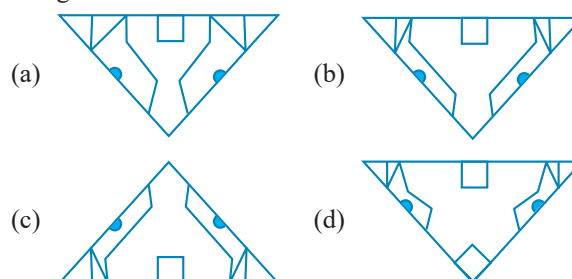


Example 11. Which answer figure will complete the pattern in the following question figure?

Question Figure

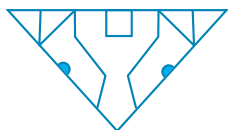


Answer Figure:



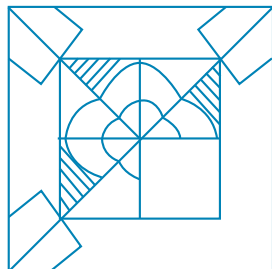
Sol. (a) To complete the given figure, the answer figure should follow the pattern of the given figure.

We see that the following figure completes the pattern.

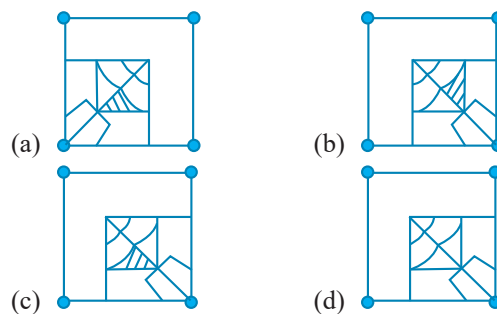


Example 12. Which answer figure will complete the pattern in the following question figure?

Question Figure



Answer Figure



Sol. To complete the given figure, the answer figure should follow the pattern of the given figure.

We see that the following figure completes the pattern.



Puzzles

Puzzle can be considered as a set of rules or conditions according to which the given question can be answered. The concept of puzzle is entirely based on the logical analysis or evaluation of the information or data given in the question.

There are following types of the question based on puzzle:

- ➔ When one condition is given:
 1. Box based puzzle
 2. Floor based puzzle
 3. Day based, etc....
- ➔ When one or more variables are given:
 4. Floor -flat puzzle
 5. Person - colour puzzle etc.....

Things to be considered:

- ➔ Read the information in the question carefully.
- ➔ Make a general diagram based on the instructions.
- ➔ Based on the diagram, the question can be answered.

Let's understand this by some of the following examples:

Directions(1-3): Study the following data carefully and answer the questions accordingly.

Six people A, B, C, D, E and F live in a six storey building, but not necessarily in the same order. The lowermost floor is numbered 1 and topmost floor is numbered 6. E lives on an odd numbered floor, but not on the lowest floor. There is a two floor gap between E and A. There is only one floor between A and D. The number of floors above D is the same as the number of floors below C. F does not live on the topmost floor.

Example 1. F lives on which of the following floors?

- (a) 4th (b) 2nd
(c) 6th (d) 1st

Sol. (d) E lives on an odd numbered floor, but not on the lowest floor.

	Case : 1	Case : 2
6		E
5		
4		
3	E	
2		
1		

There is a two floor gap between E and A.

	Case : 1	Case : 2
6	A	
5		E
4		
3	E	
2		A
1		

There is only one floor between A and D.

	Case : 1	Case : 2
6	A	
5		E
4	D	D
3	E	
2		A
1		

The number of floors above D is the same as the number of floors below C.

Case 1: is eliminated.

	~~Case : 1~~	Case : 2
6	A	
5		E
4	D	D
3	E	C
2		A
1		

F does not live on the topmost floor.

	~~Case : 1~~	Case : 2
6	A	B
5		E
4	D	D
3	E	C
2		A
1		F

Directions: Study the following data carefully and answer the questions accordingly.

Six people A, B, C, D, E and F live in a six storey building, but not necessarily in the same order. The lowermost floor is numbered 1 and topmost floor is numbered 6. E lives on an odd numbered floor, but not on the lowest floor. There is a two floor gap between E and A. There is only one floor between A and D. The number of floors above D is the same as the number of floors below C. F does not live on the topmost floor.

Example - 2. How many floors are there between C and E?

- (a) Two (b) Three
(c) One (d) Four

Sol. (c) E lives on an odd numbered floor, but not on the lowest floor.

	Case : 1	Case : 2
6		E
5		
4		
3	E	
2		
1		

There is a two floor gap between E and A.

	Case : 1	Case : 2
6	A	
5		E
4		
3	E	
2		A
1		

There is only one floor between A and D.

	Case : 1	Case : 2
6	A	
5		E
4	D	D
3	E	
2		A
1		

The number of floors above D is the same as the number of floors below C.

Case 1: is eliminated.

	~~Case : 1~~	Case : 2
6	A	
5		E
4	D	D
3	E	C
2		A
1		

F does not live on the topmost floor.

	~~Case : 1~~	Case : 2
6	A	B
5		E
4	D	D
3	E	C
2		A
1		F

Directions(1-3): Study the following data carefully and answer the questions accordingly.

Six people A, B, C, D, E and F live in a six storey building, but not necessarily in the same order. The lowermost floor is numbered 1 and topmost floor is numbered 6. E lives on an odd numbered floor, but not on the lowest floor. There is a two floor gap between E and A. There is only one floor between A and D. The number of floors above D is the same as the number of floors below C. F does not live on the topmost floor.

Example 3. Which of the following statements is/are true?

- (a) C lives on fourth floor
(b) Two people lives between E and B
(c) E lives just below B
(d) B lives four floor above F

Sol. (c) E lives on an odd numbered floor, but not on the lowest floor.

	Case : 1	Case : 2
6		E
5		
4		
3	E	
2		
1		

There is a two floor gap between E and A.

	Case : 1	Case : 2
6	A	
5		E
4		
3	E	
2		A
1		

There is only one floor between A and D.

	Case : 1	Case : 2
6	A	
5		E
4	D	D
3	E	
2		A
1		

The number of floors above D is the same as the number of floors below C.

Case 1: is eliminated.

	~~Case : 1~~	Case : 2
6	A	
5		E
4	D	D
3	E	C
2		A
1		

F does not live on the topmost floor.

	~~Case : 1~~	Case : 2
6	A	B
5		E
4	D	D
3	E	C
2		A
1		F

Directions(4-5): Study the following data carefully and answer the questions accordingly.

Eight people P, Q, R, S, A, B, C and D were born in different months January, March, April, May, July, September, October and December but not necessarily in the same order. A was born at-least two months before D. S was born in the month which has 30 days. R was born just after S. There are three people born between R and C. There is only one person born between C and B, who is not born in the January. There are at-least three people born between B and Q. The number of people born before Q is the same number of people born after P.

Example 4. If all the people are arranged in an alphabetical order from January, then how many persons remain unchanged in their position?

- (a) One
- (b) None
- (c) Three
- (d) Four

Sol (b) S was born in the month which has 30 days.

	Case : 1	Case : 2
January 31		
March 31		
April 30	S	
May 31		
July 31		
September 30		S
October 31		
December 31		

R was born just after S.

	Case : 1	Case : 2
January 31		
March 31		
April 30	S	
May 31	R	
July 31		
September 30		S
October 31		R
December 31		

There are three people born between R and C.

	Case : 1	Case : 2
January 31		
March 31		
April 30	S	C
May 31	R	
July 31		
September 30		S
October 31		R
December 31	C	

There is only one person born between C and B, who is not born in the January.

	Case : 1	Case : 2
January 31		
March 31		
April 30	S	C
May 31	R	
July 31		B
September 30	B	S
October 31		R
December 31	C	

There are at-least three people born between B and Q.

	Case : 1	Case : 2
January 31	Q1	Q
March 31	Q2	
April 30	S	C
May 31	R	
July 31		B
September 30	B	S
October 31		R
December 31	C	

The number of people born before Q is the same number of people born after P.

	Case : 1	Case : 2
January 31		Q
March 31	Q	
April 30	S	C
May 31	R	
July 31		B
September 30	B	S
October 31	P	R
December 31	C	P

A was born at-least two months before D.

Case 2: is eliminated.

	Case : 1	~~Case : 2~~
January 31	A	Q
March 31	Q	
April 30	S	C
May 31	R	
July 31	D	B
September 30	B	S
October 31	P	R
December 31	C	P

Directions(4-5): Study the following data carefully and answer the questions accordingly.

Eight people P, Q, R, S, A, B, C and D were born in different months January, March, April, May, July, September, October and December but not necessarily in the same order. A was born at-least two months before D. S was born in the month which has 30 days. R was born just after S. There are three people born between R and C. There is only one person born between C and B, who is not born in the January. There are at-least three people born between B and Q. The number of people born before Q is the same number of people born after P.

Example 5. How many people are born between P and B ?

- (a) Two (b) Three
(c) Four (d) None

Sol (d) S was born in the month which has 30 days.

	Case : 1	Case : 2
January 31		
March 31		
April 30	S	
May 31		
July 31		
September 30		S
October 31		
December 31		

R was born just after S.

	Case : 1	Case : 2
January 31		
March 31		
April 30	S	C
May 31	R	
July 31		
September 30		S
October 31		R
December 31		

There are three people born between R and C.

	Case : 1	Case : 2
January 31		
March 31		
April 30	S	C
May 31	R	
July 31		
September 30		S
October 31		R
December 31	C	

There is only one person born between C and B, who is not born in the January.

	Case : 1	Case : 2
January 31		
March 31		
April 30	S	C
May 31	R	
July 31		B
September 30	B	S
October 31		R
December 31	C	

There are at-least three people born between B and Q.

	Case : 1	Case : 2
January 31	Q1	Q
March 31	Q2	
April 30	S	C
May 31	R	
July 31		B
September 30	B	S
October 31		R
December 31	C	

The number of people born before Q is the same number of people born after P.

	Case : 1	Case : 2
January 31		Q
March 31	Q	
April 30	S	C
May 31	R	
July 31		B
September 30	B	S
October 31	P	R
December 31	C	P

A was born at-least two months before D.

Case 2: is eliminated.

	Case : 1	~~Case : 2~~
January 31	A	Q
March 31	Q	
April 30	S	C
May 31	R	
July 31	D	B
September 30	B	S
October 31	P	R
December 31	C	P

Direction(6-7): Study the following data carefully and answer the questions accordingly.

Seven persons – A, B, C, D, E, F and G have their day off on different days of the week starting from Sunday and ending on Saturday. F has an off day neither Sunday nor Friday. E has an off day on Thursday. There is only one day off between E and B. A has an off day just before E. There is only one day off between A and C, whose day off is not Friday. There are only two days off between F and D.

Example 6. Four of the following five are alike in a certain way based on their positions in the above arrangement and so form a group. Which of the following does not belong to the group ?

- (a) Sunday - G
- (b) Thursday - E
- (c) Friday - D
- (d) Tuesday - B

Sol. (d) E has an off day on Thursday.

Sunday	
Monday	
Tuesday	
Wednesday	
Thursday	E
Friday	
Saturday	

There is only one day off between E and B.

	Case : 1	Case : 2
Sunday		
Monday		
Tuesday	B	
Wednesday		
Thursday	E	E
Friday		
Saturday		B

A has an off day just before E.

	Case : 1	Case : 2
Sunday		
Monday		
Tuesday	B	
Wednesday	A	A
Thursday	E	E
Friday		
Saturday		B

There is only one day off between A and C, whose day off is not Friday.

	Case : 1	Case : 2
Sunday		
Monday	C	C
Tuesday	B	
Wednesday	A	A
Thursday	E	E
Friday		
Saturday		B

There are only two days off between F and D.

Case 1: is eliminated.

F has an off day neither Sunday nor Friday.

	~~Case : 1~~	Case : 2
Sunday		G
Monday	C	C
Tuesday	B	F
Wednesday	A	A
Thursday	E	E
Friday		D
Saturday		B

Directions(6-7): Study the following data carefully and answer the questions accordingly.

Seven persons – A, B, C, D, E, F and G have their day off on different days of the week starting from Sunday and ending on Saturday. F has an off day neither Sunday nor Friday. E has an off day on Thursday. There is only one day off between E and (b) A has an off day just before E. There is only one day off between A and C, whose day off is not Friday. There are only two days off between F and D.

Example 7. Which of the following has an off day on Sunday ?

- (a) B (b) G
(c) F (d) D

Sol (b) 'E has an off on Thursday' with 'G has an off on Sunday'

Sunday	
Monday	
Tuesday	
Wednesday	
Thursday	E
Friday	
Saturday	

There is only one day off between E and B.

	Case : 1	Case : 2
Sunday		
Monday		
Tuesday	B	
Wednesday		
Thursday	E	E
Friday		
Saturday		B

A has an off day just before E.

	Case : 1	Case : 2
Sunday		
Monday		
Tuesday	B	
Wednesday	A	A
Thursday	E	E
Friday		
Saturday		B

There is only one day off between A and C, whose day off is not Friday.

	Case : 1	Case : 2
Sunday		
Monday	C	C
Tuesday	B	
Wednesday	A	A
Thursday	E	E
Friday		
Saturday		B

There are only two days off between F and D.

Case 1: is eliminated.

F has an off day neither Sunday nor Friday.

	Case : 1	Case : 2
Sunday		
Monday	C	C
Tuesday	B	
Wednesday	A	A
Thursday	E	E
Friday		
Saturday		B

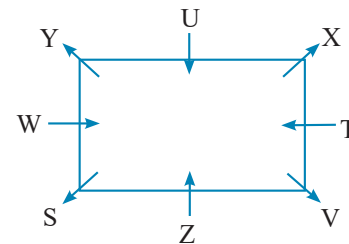
Example 8. Directions: Study the following data carefully and answer the questions accordingly.

Eight persons-S, T, U, V, W, X, Y and Z are sitting on a rectangular table such that four persons are sitting in the corners of the table and facing away from the centre while four persons are sitting in the middle of the sides and facing towards the centre. U faces the one who sits third to the right of X. Two persons sit between X and W who faces T. V sits second to the left of S. Y sits two places away from S. Neither Z nor Y sits on the smaller sides of the table.

Four of the five among the following are similar in such a way to form a group, which one of the following doesn't belong to that group?

- (a) X (b) Y
(c) S (d) W

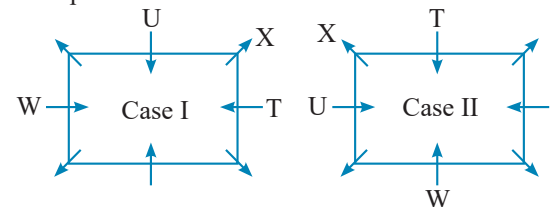
Sol. (d) **Final Answer:**



Logic is used here, All the persons are sitting in the corner of the table except in option D

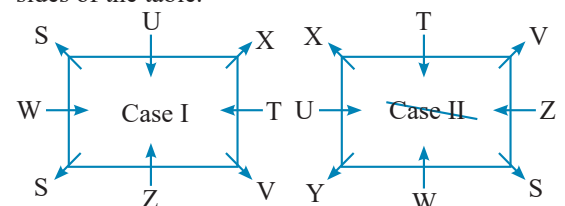
We have,

U faces the one who sits third to the right of X.
Two persons sit between X and W who faces T.



Again we have,

V sits second to the left of S. Y sits two places away from S. Neither Z nor Y sits on the smaller sides of the table.



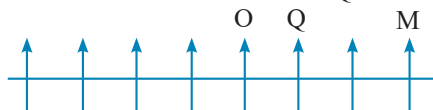
Example 9. Directions: Eight People – K, L, M, N, O, P, Q and R are seated in a straight line facing north but not necessarily in the same order.

- (i) Q sits third from the right end of the line
- (ii) Three people sit between M and N, who do not sit at the extreme end.
- (iii) O sits to the immediate left of Q.
- (iv) Only one person sits between M and Q
- (v) L is not an immediate neighbor of N and M.
- (vi) K sits in between L and N but is second to the right of P

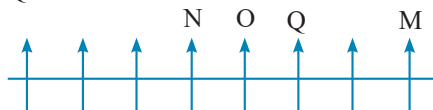
Who amongst the following sits exactly between P and K?

- (a) N
- (b) Q
- (c) R
- (d) L

Sol. (d) Q sits third from the right end of the line.
Only one person sits between M and Q.
O sits to the immediate left of Q.

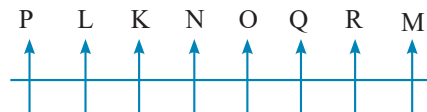


Three people sit between M and N, who do not sit at the extreme end. O sits to the immediate left of Q.



L is not an immediate neighbor of N and M.

K sits in between L and N but is second to the right of P.



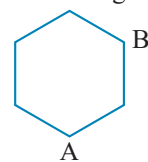
L sits between P and K.

Example 10. Directions: Six friends A, B, C, D, E and F are sitting around the hexagonal table each at one corner and are facing the center of the hexagonal table. B sits second to the right of A. C is a neighbour of D and F. E is second to the left of D.

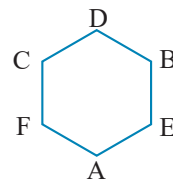
Which one is sitting opposite to D?

- (a) F
- (b) E
- (c) D
- (d) A

Sol. (d) B sits second to the right of A.



C is a neighbor of D and F.
E is second to the left of D.



A is sitting opposite of D.

Coding-Decoding

Coding can be defined as a part of logical reasoning which is used to encrypt words, numbers in specific patterns or codes using particular logics and rules.

Decoding is the process that is used to decode the patterns into original forms after identifying the rules and logics used in the encryption.

TYPES OF CODING-DECODING:

1. Letter based Coding-Decoding
2. Number Coding-Decoding
3. Substitution Coding-Decoding
4. Mixed Letter Coding-Decoding
5. Mixed Number Coding-Decoding

Few important points to be considered:

- While decoding we should know the place value of the alphabets. The best trick to solve Alphabetical Series questions is to correlate the English alphabet to the numbers, as shown below.

A B C D E F G H I J K L M

1 2 3 4 5 6 7 8 9 10 11 12 13
N O P Q R S T U V W X Y Z

14 15 16 17 18 19 20 21 22 23 24 25 26

- Sum of the place value of the alphabet and its opposite alphabet is always equal to 27.

Let's understand this by the following examples:

Example 1. In a certain code, '2579' means 'the weather is good', '5471' means 'weather is hot' and '427' means 'stain is good'. What stands for 'weather' in the same code language?

- (a) 4 (b) 5
(c) 7 (d) 2

Sol. As we can see,

The common word in the first two statements is: 'weather' and 'is'.

number code for these words are = 5 & 7

And the common word in first and last statement is 'is' and 'good' = '2 and 7'

So,

In these two conditions 'is' is common.

Now,

code word for the word 'weather' will be : 5

Example 2. In a certain code, '2580' means 'my life is good', '5481' means 'life is very hard' and '4297' means 'my paper was hard'. What stands for 'good' in the same code language?

- (a) 2 (b) 0
(c) 5 (d) 9

Sol. As we can see,

The common word in the first two statements is: 'life' and 'is'.

number code for these words are = 5 & 8

And the common word in first and last statement is 'my' = 2

So, there is only one word left in first statement = good

And only one number is left in first statement = 0

Hence, the code for word 'good' will be = 0

Example 3. In a certain code, 'TEATIME' is written as '5N9G1V20', how is 'SNACKS' written in that same code?

- (a) 20Q3Z14H (b) 19P3Z14H
(c) 19P4A14H (d) 19P3Z15H

Sol. As we can see that,

The given word TEATIME :: 5N9G1V20 follows the following pattern.

- Alternate words replaced by the opposite letters.
- Rest exchange their positional value given as follows:

opposite letters of M = N
of T = G
of E = V
T E A T I M E
20 20 01 20 09 13 05
5 20

and T E A T I M E
20 20 01 20 09 13 05
N 9 G 1 V

Similarly,
19 14 1 3 11 19
S N A C K S
19 P 3 Z 14 H

'SNACKS' will be written as '19P3Z14H'.

Example 4. In a certain code, 'SOCKET' is written as 'H15X11V20', how is 'ELECTRICAL' written in that same code?

- (a) W12V03G18R03Z12
- (b) V12V03G18R03Z12
- (c) V12V030718R032612
- (d) V122203G18R03Z12

Sol. As we know that, opposite letters of the english alphabets are as follows:

ss
A B C D E F G H I J K L M
1 2 3 4 5 6 7 8 9 10 11 12 13
26 25 24 23 22 21 20 19 18 17 16 15 14
Z Y X W V U T S R Q P O N

Opposite letters of the word 'SOCKET' is :
'HLXPVG';

In the given word SOCKET each alternate word is replaced by their opposite word.

Rest of the words are replaced by their place value.

Hence,

SOCKET = H15X11V20

Similarly,

ELECTRICAL will be written as ::

V12V03G18R03Z12

Example 5. In a certain code, 'MEANING' is written as 'GVZMRMM', how is 'QUESTION' written in that same code?

- (a) NFBHGLRQ
- (b) NFBHGRLQ
- (c) VFNHGRLQ
- (d) NFBHVRLQ

Sol. As we know that, opposite letters of the english alphabets are as follows:

A B C D E F G H I J K L M
1 2 3 4 5 6 7 8 9 10 11 12 13
26 25 24 23 22 21 20 19 18 17 16 15 14
Z Y X W V U T S R Q P O N

The given word 'MEANING' : GVZMRMM follows the following pattern :

M E A N I N G
G V Z M R M M
and M E A N I N G
G V Z M R M M

Similarly,

'QUESTION' will follow the same pattern:

Q U E S T I O N
N F V H G R L Q

Hence, 'QUESTION' will be written as 'NFBH-GRLQ'.

Example 6. In a certain code, 'MEDICAL' is written as 'NEWIXAO', how is 'DIAGNOSE' written in that same code?

- (a) WIZGMEOH
- (b) WIAGMOHE
- (c) ZIWGMOHE
- (d) WIMGZOHE

Sol. As we know that, opposite letters of the english alphabets are as follows:

A B C D E F G H I J K L M
1 2 3 4 5 6 7 8 9 10 11 12 13
26 25 24 23 22 21 20 19 18 17 16 15 14
Z Y X W V U T S R Q P O N

The given word 'MEDICAL': 'NEWIXAO' follows the following pattern:

M E D I C A L
N E W I X A O
M E D I C A L
N E W I X A O

Except vowels every letter is replaced by their opposite letter.

Similarly,

D I A G N O S E
W I A G M O H E

'DIAGNOSE' will be written as : 'WIAGMOHE'.

Example 7. In a certain code, 'JOURNEY' is written as '34241218264404', how is 'WALKING' written in that same code?

- (a) 02583032362460
- (b) 08523032362640
- (c) 1052603236280
- (d) 08305232632640

Sol.

As we know that, opposite letters of the english alphabets are as follows:

A	B	C	D	E	F	G	H	I	J	K	L	M
1	2	3	4	5	6	7	8	9	10	11	12	13
26	25	24	23	22	21	20	19	18	17	16	15	14
Z	Y	X	W	V	U	T	S	R	Q	P	O	N

And sum of the place values of opposite letters is always = 27

The given word 'JOURNEY' :

J	O	U	R	N	E	Y
10	15	21	18	14	15	25

Place value of the letters opposite letters place value :

10	15	21	18	14	05	25
17	12	06	09	13	22	02
17	12	06	09	13	22	02
34	24	12	18	26	44	04

Then double the place value

Hence we get : 34241218264404

Similarly,

'WALKING' will follow the same pattern :

W	A	L	K	I	N	G
23	01	12	11	09	14	07

23	01	12	11	09	14	07
----	----	----	----	----	----	----

04	26	15	16	18	13	20
----	----	----	----	----	----	----

04	26	15	16	18	13	20
----	----	----	----	----	----	----

08	52	30	32	36	26	40
----	----	----	----	----	----	----

Hence we get :

So, 'WALKING' will be written as : 08523032362640

Example 8. In a certain code, 'EDITING' is written as 'T13R20R23V', how is 'SUMMARY' written in that same code?

- (a) Z09Z13N06I (b) B09Z13N06H
(c) B0913ZN06H (d) A09Z13NH06

Sol.

As we know that,

E	D	I	T	I	N	G
05	04	09	20	09	14	07

Place value of the given word:

EDITING follows the following pattern :

E	D	I	T	I	N	G
05	04	09	20	09	14	07

G	N	I	T	I	D	E
G	N	I	T	I	D	E
T	M	R	T	R	W	V

and T 13 R 20 R 23 V

Here, we can see that the middle term does not change its position value.

Except the middle term all the letters are replaced by their opposite letters after reversing the order.

Similarly,

The word SUMMARY:

By reversing the order of the word we get : YRAMMUS

Y	R	A	M	M	U	S
B	I	Z	M	N	F	H
B	09	Z	13	N	06	H

Hence,

YRAMMUS is coded as B09Z13N06H.

Example 9. In the first line capital letters are given along with their coded language in the second line of the chart. Identify the correct code for the word 'TANGENT'.

A	C	E	G	H	I	O	N	P	R	T	F	B	D	M
4	=	÷	×	-	(	\$	[	]	≠	5	#		>	<

- (a) 54[x÷[4 (b) 54[x÷[5
(c) 44[x÷[5 (d) 45[x÷[4

Sol.

According to the given chart,

T is coded as 5

A is coded as 4

N is coded as [

G is coded as x

E is coded as ÷

N is coded as [

T is coded as 5

TANGENT is coded as : 54[x÷[5

Example 10. In a certain code, 'MOTHERHOOD' is written as 'NOGHVRSOLD', how is 'HOMETOWN' written in that same code?

- (a) SONEOGDN
(b) SONEGODN
(c) SOENGODN
(d) OSNEGODN



Sol.

As we know that the opposite letters of the alphabets are given as follows :

A	B	C	D	E	F	G	H	I	J	K	L	M
1	2	3	4	5	6	7	8	9	10	11	12	13
26	25	24	23	22	21	20	19	18	17	16	15	14
Z	Y	X	W	V	U	T	S	R	Q	P	O	N

In the given word 'MOTHERHOOD' :: 'NOGH-VRSOLD' follows the following pattern:

M	O	T	H	E	R	H	O	O	D
N	O	G	H	V	R	S	O	L	D

Alternate letters are replaced by their opposite letters and rest alphabets do not change.

Similarly,

H	O	M	E	T	O	W	N
S	O	N	E	G	O	D	N

Hence, HOMETOWN is coded as SONEGODN

Pattern Series and Sequences

A string of alphabets, numbers, figures, alphaneu either in a single file or in combination, comprise a sequence in the alphabet series section. These types of questions are grouped together according to a set pattern.

The type of the question related to the series and sequence pattern can be as follows:

- ➔ Number series
- ➔ Alphabet series
- ➔ Alphanumeric series
- ➔ Figure series
- ➔ Word series

Some common and important patterns are as follows:

1. Arithmetic progression
2. Geometric progression
3. Common 2nd difference
4. Difference of prime numbers, etc.....

Let's understand this by the following examples:

Example 1. A series is given, with one word missing. Choose the correct alternative from the given ones that will complete the series.

Queen, Aqua, Pique, Torque, Antique, ?

- (a) Squad
- (b) Quadrilateral
- (c) Prerequisite
- (d) Queue

Sol. Here, in this question we have to find the next word using the pattern followed.

Logic: The position of 'Q' is moving to the next place in the subsequent term.

The correct pattern followed here is:

- Queen - Q placed in the first place.
- Aqua - Q placed in second place.
- Pique - Q placed in third place.
- Torque - Q placed in fourth place.
- Antique - Q placed in fifth place.
- Prerequisite - Q placed in sixth place.

Hence, the correct answer is Prerequisite.

Example 2. A series is given, with one word missing. Choose the correct alternative from the given ones that will complete the series.

yes, rain, alive, subtle, ?

- (a) Airport
- (b) Smoke
- (c) Inch
- (d) fabulous

Sol. Here, we have to find the correct word that can replace the question mark(?).

Logic followed here is: In each word the number of letters is increasing as 3, 4, 5, 6, and 7.

Given:

yes - Number of letters is 3

rain - Number of letters is 4

alive - Number of letters is 5

subtle - Number of letters is 6

Now, we According to the pattern the next word would be 7 letters.

Let's check each option one by one.

- airport - The number of letters is 7. (Correct)
- smoke - The number of letters is 5. (Incorrect)
- inch - The number of letters is 4. (Incorrect)
- fabulous - The number of letters is 8. (Incorrect)

Hence, the correct answer is airport.

Example 3. A series is given, with one term missing. Choose the correct alternative from the given ones that will complete the series

XIIIII, IXIIII, IIXIII, IIIXII, IIIIXI, ?

- (a) IIIIXII
- (b) IIIIXI
- (c) IIIIX
- (d) XIIIX

Sol. Here, in this question we have to find the missing word in the series

XIIIII, IXIIII, IIXIII, IIIXII, IIIIXI, ?

The logic is:

The position of 'X' in each term is shifted one place to the right alternatively and with a total of letters is constant (i.e. 6 letters).

Ex. XIIIII (first place), IXIIII (second place), IIXIII (third place), IIIXII (fourth place), IIIIXI (fifth place)

In the next word X should be at sixth place.

- IIIIXII → 'X' will be fifth place with a total of 7 letters.
- IIIIXI → 'X' will be sixth place with a total of 7 letters.
- IIIIX → 'X' will be sixth place with a total of 6 letters.
- XIIIX → 'X' will be first and sixth place with a total of 6 letters.

Thus, in the next term, 'X' will be at sixth place and among the options, next term is IIIIX (sixth place).

Hence, IIIIX is the correct answer.

Example 4. Select the letter-cluster that can replace the question mark (?) in the following series.

SAT, VEW, YIZ, ?, EUF

- (a) BOC
- (b) BUK
- (c) FIC
- (d) COD

Sol. In this type of question, we have been given a series, in this series we have to find the next term or wrong term of this series by finding the relation.

The logic is:

Adding 3 to the first letter and third letter of the first term gives the first and third letter of the second term.

The middle letter in all terms has a series of vowels.

The pattern is as follow:

(Vowels)

S (19)	A	T (20)
↓ +3	↓	↓ +3
S (22)	E	W (23)
↓ +3	↓	↓ +3
Y (25)	I	Z (26)
↓ +3	↓	↓ +3
B (2)	O	C (3)
↓ +3	↓	↓ +3
E (5)	U	F (6)

So, BOC will complete the series as above.

Hence, BOC is the correct answer.

Example 5. Select the set of letters that when sequentially placed in the blanks of the given letter series will complete the series.

F_hg_fh_gf_hg_fh_g

- (a) f, g, h, f, g, h
- (b) h, f, g, h, f, g
- (c) g, f, g, f, h, f
- (d) g, h, f, g, h, f

Sol. Here, we have to choose the correct letter series that will complete the series.

Let's check the logic used is in all option-

1. f, g, h, f, g, f : ffh/ggf/hhg/ffh/ggf/hfg → does not follow any pattern.
2. h, f, g, h, f, h : fhg/gff/hgg/fhh/gff/hf → does not follow any pattern.
3. g, f, g, f, h, f : fgh/gff/hgg/ffh/ghf/hfg → does not follow any pattern.
4. g, h, f, g, h, f : fgh/ghf/hfg/fgh/ghf/hfg → follows a pattern fgh/ghf/hfg' repeats a cyclic pattern.

Hence, g, h, f, g, h, f' is the correct answer.

Example 6. Select the missing number in the given matrix.

3	4	2	14
6	5	4	44
5	2	7	?

- (a) 5
- (b) 8
- (c) 70
- (d) 49

Sol. In the given box .

There are 16 sub - boxes .

The values in the boxes are put with some logic .

We have to identify the logic and find the missing number using that logic .

Logic: (horizontally) (First number + Second number) * Third number = fourth number

- $(3 + 4) * 2 = 7 * 2 = 14$
- $(6 + 5) * 4 = 11 * 4 = 44$
- $(5 + 2) * 7 = 7 * 7 = 49$

So , the missing number is 49.

Hence , "49" is the correct answer.

Example 7. In the following question, select the number which can be placed at the sign of question mark (?) from the given alternatives.

2	31	1
	5	

2	145	6
	3	

1	?	7
	5	

- (a) 91
- (b) 70
- (c) 80
- (d) 71

Sol. As we can see, we are given some number pairs in the figure.

In the given completed pairs:-

Center number = Product of outer four numbers + 1 i.e, $(2 \times 3 \times 1 \times 5) + 1$

- $(2 \times 3 \times 5 \times 1) + 1 = 31$
- $(2 \times 4 \times 6 \times 3) + 1 = 145$
- Therefore, $(2 \times 7 \times 1 \times 5) + 1 = 71$

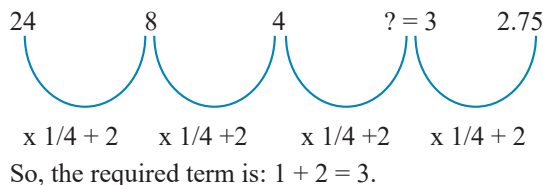
Hence, 71 is the correct answer.

Example 8. In each of the following questions a number series is given with one of the middle of the term missing. Choose the correct alternative that will continue the same pattern and replace the question Mark (?) in the given series.

24, 8, 4, ?, 2.75

- (a) 4 (b) 3
(c) 7 (d) 6

Sol. As we can see that the correct pattern of the series is the as follows:



So, the required term is: $1 + 2 = 3$.

Hence, 3 is the correct answer.

Example 9. Find the missing number in the following series?

15, 17, 37, 115, ?, 2331

- (a) 125 (b) 465
(c) 1820 (d) 1900

Sol. As we can see that the series follows the following pattern :-

$$17 = 15 \times 1 + 2$$

$$37 = 17 \times 2 + 3$$

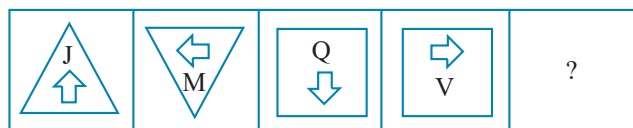
$$115 = 37 \times 3 + 4$$

$$\text{Similarly, the required term is: } 465 = 115 \times 4 + 5$$

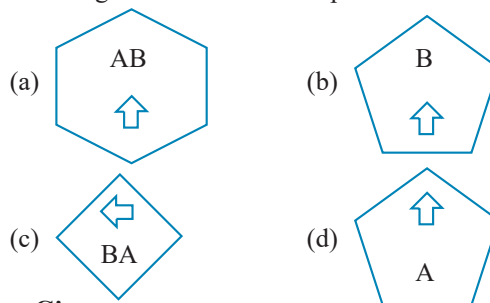
$$2331 = 465 \times 5 + 6$$

Hence, the correct option is 465.

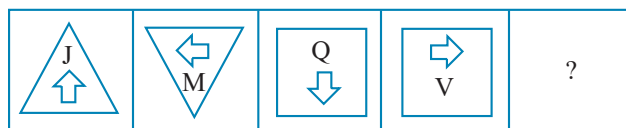
Example10. Select the figure that can replace the question mark (?) in the following series.



Sol. Here, in this question we have to find the correct image series that can complete this series.



Given:-

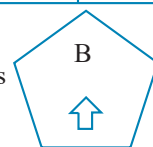


Logic followed here is:-

- **Step 1:** Addition of +3, +4, +5, and +6 in letters. So, the next alphabet is $V + 6 = B$
- **Step 2:** Arrow rotates 90-degree with anticlockwise direction in the next figure and shifts upward and downward in the next figure. So in the final figure the arrow shifted downward.
- **Step 3:** The number of sides increases by +1 after two figures. So, the next figure is the Pentagon.



Hence, the correct answer is



Statement, Assumptions and Conclusion

Statement is an information or a fact related to any general subject and assumption is the hidden or unsaid part of the statement which a person assumes before stating some fact or statement.

When we analyse assumptions, we find that when one says or writes something, he does not put everything into words and leaves some part unsaid or unwritten. He does so because he takes this unsaid part for granted.

In other words, he thinks this unsaid part will be understood without saying and there is no need to put this (unsaid part) into words.

Few important points to consider:

- ➔ It should be directly related to the statement.
- ➔ It should not be ambiguous.
- ➔ It should not be superfluous.
- ➔ It should not be merely repetition of the statement.
- ➔ It should not include words like 'all', 'every', 'each', 'only', etc.
- ➔ It should not be the conclusion derived from the statement.
- ➔ It may contain terms relating to any possibility, such as may be, possibly and so on.

Let's understand this by some of the following examples:

Example 1. In the question a statement is given, followed by two arguments, I and II. You have to consider the statement to be true even if it seems to be at variance from commonly known facts. You have to decide which of the given arguments, if, is a strong argument.

Statement: Should one year of army training be compulsory for all Indian citizens?

Argument I: No, the costs of training will be prohibitive and one year of labor will be lost.

Argument II: Yes, army training helps make better citizens.

Option1. if only argument *I* is strong

Option2. if only argument *II* is strong.

Option3. if both *I* and *II* are strong.

Option4. if neither *I* nor *II* is strong.

Sol. Here, we have to find which of the following arguments is strong using the statement given in the question.

Statement: Should one year of army training be compulsory for all Indian citizens?

- **Argument I:** No, the costs of training will be prohibitive and one year of labor will be lost - Yes, it is a strong argument because due to the training there will be a loss of labor for one year.
- **Argument II:** Yes, army training helps make better citizens - It is not necessary army training helps to make a better citizen. So it is not a strong argument.

So, only argument I is strong according to the statement.

Example 2. In the question a statement is given, followed by two arguments, I and II. You have to consider the statement to be true even if it seems to be at variance from commonly known facts. You have to decide which of the given arguments, if any, is a strong argument.

Statement : Should sale of alcohol near highways be banned?

Argument I : No, people should have freedom to decide as it is their fundamental right.

Argument II : Yes, 90 % of road accidents involve drivers who are under the influence of alcohol.

Option1. if only argument I is strong.

Option2. if only argument II is strong.

Option3. if both I and II are strong.

Option4. if neither I nor II is strong.

Sol. **In the question:**

Two arguments for a statement are given .

We have to check whether these arguments are strong .

For an argument to be strong , it should directly answer the problem .

Given statement:- Should sale of alcohol near highways be banned?

- The given statement can be strongly supported by argument I. Argument I is strong because the Constitution of India has given fundamental right of freedom to people of India to decide from where to buy goods they need. So banning the sale of alcohol near highways would be against it..

- The given statement can also be strongly supported by argument II. Argument II is strong because it is a fact that 90 % of road accidents involve drivers who are under influence of alcohol

So, both the given arguments (I and II) are strong.

Example -3. In the question below, there is a statement followed by two assumptions numbered I and II. An assumption is something supposed or taken for granted. You have to consider the statement and the following assumptions and decide which of the assumptions is implicit in the statement.

Statement: Obesity is a growing problem among young people in the country X. Last year, 40.9% of year six children (age 10-11) were measured as overweight or obese. Research shows that childhood obesity increases the likelihood of living with obesity as an adult.

Assumptions:

- I. Children of country X indulge more in junk food rather than the healthier alternatives.
- II. Only old people are taking their health seriously in country X.
 - (a) Only I is implicit
 - (b) Only II is implicit
 - (c) Both I and II are implicit
 - (d) Neither I nor II is implicit

Sol. (a)

I. Implicit - The percentage mentioned in the passage highlights the negligence of the children of country X towards the healthy lifestyle. Consuming junk food and avoiding the healthier food options is one of the important factors in causing obesity, so it is certainly right assumption.

II. Not-Implicit - No assumption can be made about the older generation with the given information in the passage. Therefore, only I is implicit.

Hence, option (a) is correct.

Example -4. In the question below, there is a statement followed by two assumptions numbered I and II. An assumption is something supposed or taken for granted. You have to consider the statement and the following assumptions and decide which of the assumptions is implicit in the statement.

Statement: Fast-fashion retailer H&M was using a scorecard system to inform customers about the environmental soundness of each product, but a report by *Quartz* claims that more than half of the scorecards portrayed products as being better for the environment than they actually were.

Assumptions:

- I. Quartz has a personal agenda with H&M in exposing H&M's transgressions.
- II. The fast-fashion industry has begun to make changes to its model in response to a perceived emerging customer focus on environmental and sustainability concerns.

- (a) Only I is implicit
- (b) Only II is implicit
- (c) Neither I nor II is implicit
- (d) Either I or II is implicit

Sol. (b)

I. Not-Implicit: Based on the context of the given statement, it is unreasonable to assume that Quartz has any personal agenda / vendetta against H&M. It appears that Quartz is a watchdog group assessing the methodology of H&M's scorecard. So, assumption I does not follow.

II. Implicit: The part of the statement "Fast-fashion retailer H&M was using a..." indicates that H&M was using the scorecard in the past, but it is highly probable that it has stopped using it now because of the report by Quartz. So, it is reasonable to go with assumption II.

Hence, option (b) is correct.

Example -5. In the question below, there is a statement followed by two assumptions numbered I and II. An assumption is something supposed or taken for granted. You have to consider the statement and the following assumptions and decide which of the assumptions is implicit in the statement.

Statement: Exxon Mobil Corp. announced on Tuesday an "ambition" to reach net-zero greenhouse gas emissions in its operations in the next three decades but fell short of making any commitments to offset or reduce the massive amounts of Earth-warming emissions from the fossil fuels that account for the company's profits.

Assumptions:

- I. As the vast majority of greenhouse gas emissions from the oil and gas industry stem from the consumption of its products, ExxonMobil's emissions reduction pledge misses the mark and is too little, too late.
- II. Exxon Mobil Corp. is going great lengths to help society reach a lower emissions future.
 - (a) Only I is implicit
 - (b) Only II is implicit
 - (c) Neither I nor II is implicit
 - (d) Either I or II is implicit

Sol. (a)

I. Implicit: The use of 'but' as conjunction in the given statement tells us that the efforts of Exxon Mobile Corp. in reaching net-zero greenhouse gas emissions is contrasted with the fact that the corporation has made no commitments to reduce emissions from fossil fuels. In a way, it is reasonable to assume that the corporation is failing to confront the very issues pertaining to greenhouse gas emissions. Hence, the assumption I follows.

II. Not-Implicit: For the same reason, Assumption II does not make sense because the corporation is



being criticized in the statement for not making the best efforts and commitments to reduce emissions from fossil fuels. Hence, assumption II does not follow.

Hence, option (a) is correct.

Example - 6. In the question below, there is a statement followed by two assumptions numbered I and II. An assumption is something supposed or taken for granted. You have to consider the statement and the following assumptions and decide which of the assumptions is implicit in the statement.

Statement: Edelman is one of the most powerful and controversial public relations and advertising firms in the world, and its work with the fossil fuel industry has been under scrutiny for years.

Assumptions:

- I. Edelman is scrambling to bolster its reputation.
- II. Edelman is the only advertising firm that no longer represents coal companies or other companies that denied that climate change was real or that human activity was contributing to it.
 - (a) Only II is implicit
 - (b) Only I is implicit
 - (c) Neither I nor II is implicit
 - (d) Either I or II is implicit

Sol. (b)

I. Implicit: The use of the word “controversial” indicates a negative connotation regarding Edelman. So, the firm is under scrutiny or careful observation to verify its accountability. Hence, it is safe to assume that Edelman is struggling to maintain / strengthen its reputation because it has been under scrutiny for years. Assumption I follow.

II. Not-Implicit: Since the statement specifically talks about the controversial aspect of the firm on working with fossil fuel industry, it is not reasonable to assume that it is the only advertising firm that does not represent coal or other companies denying that climate change was real. Assumption II does not follow.

Hence, option (b) is correct.

Example - 7. In the question given below there is a statement followed by three assumptions numbered I, II and III. An assumption is something supposed or taken for granted. You have to consider the statement and the following assumptions and decide which of the assumptions is implicit in the statement.

Statement: Although adults know that young children are inclined to ask a lot of questions, we tend to believe that they are too immature and unsophisticated to reflect seriously on complex topics. We assume that they don't really understand the philosophical dimensions of the larger questions they pose.

Assumptions:

- I. Children are dependent on adults which means that they are in a subordinate position, with their ideas and perspectives given little weight.
- II. Being a child should not mean being treated as a mediocre thinker.
- III. For children, philosophy is a profoundly imaginative and playful endeavour.
 - (a) Either I or III is implicit
 - (b) Only I and II are implicit
 - (c) Only I is implicit
 - (d) None of I, II and III is implicit

Sol. (c)

I. Implicit: The passage states how adults tend to see children (and their thoughts) as immature and not serious. (I) can be assumed that as children are heavily dependent on adults in many aspects, their thoughts and viewpoints are often not taken seriously by the adults surrounding them.

II. & III Not-Implicit: (II) and (III) are not assumptions but rather can be considered as an extension to the passage.

Hence, (c) is the correct answer.

Example - 8. In the question below, there is a statement followed by two assumptions numbered I and II. An assumption is something supposed or taken for granted. You have to consider the statement and the following assumptions and decide which of the assumptions is implicit in the statement.

Statement: Even after giving discounts, the problem for e-commerce's exponential growth is increased exposure to returns fraud, i.e., wardrobing. Consumers are committing online shoplifting by purposely returning the non-defective item, having used it at no cost. Honest customers buying something they thought was new would be outraged to realize another customer had already worn the item.

Assumptions:

- I. Parties, family photos, outfit-of-the-day social media posts, interviews and special occasion events are everyday occasions driving wardrobing returns fraud.
- II. Most people cannot afford the apparels and other items sold online and hence indulge in wardrobing.
 - (a) Neither I nor II is implicit
 - (b) Only II is implicit
 - (c) Either I or II is implicit
 - (d) Both I and II are implicit

Sol. (a)

I. Not-Implicit: (I) cannot be assumed implicitly as being the reason for people committing returns fraud from online stores. Social/peer pressure of being fashionable, trendy and not wanting to repeat clothes when one steps out of the house (or even inside the house while posting photos/videos, etc.) may prompt one to do so.

- II. Not-Implicit:** (II) cannot be assumed as the passage states that e-commerce gives discounts to its customers which would make them affordable for most people.

Hence, (a) is the correct answer.

Example - 9. In the question given below there is a statement followed by three assumptions numbered I, II and III. An assumption is something supposed or taken for granted. You have to consider the statement and the following assumptions and decide which of the assumptions is implicit in the statement.

Statement: BG State was recently announced as one of two forensic anthropology subcontractors with RTI International on the management of the National Missing and Unidentified Persons System. Their head, M. Ross, has been a longtime leader in the field of forensic anthropology, working extensively with law enforcement and on international efforts to identify victims of war crimes and political killings.

Assumptions:

- I.** BG state is the first forensic lab to work with the National Missing and Unidentified Persons System.
- II.** Prior to the two forensic anthropology subcontractors, most victims of war crimes and political killings could not be identified.
- III.** This is the first instance involving a private forensic lab to help the government in crime cases.
 - (a) Either I or III is implicit
 - (b) Only I and II are implicit
 - (c) Only I is implicit
 - (d) None of I, II and III is implicit

Sol. (d) **I, II & III Not-Implicit:** The passage states about the pact between the RTI International and the forensic lab, i.e., BG state and the professional works of its leader. From the passage, it cannot be

assumed if this is the first pact between a lab and the RTI International/government or if previous cases have remained unsolved. None of I, II and III can be assumed.

Hence, (d) is the correct answer.

Example - 10. In the question below, there is a statement followed by two assumptions numbered I and II. An assumption is something supposed or taken for granted. You have to consider the statement and the following assumptions and decide which of the assumptions is implicit in the statement.

Statement: Our natural inclination toward sleeping at certain times of the night (or day) is called our chronotype, and it's more than a simple preference. According to sleep scientists, chronotypes are at least partly genetic, so changing yours is going to be an uphill battle.

Assumptions:

- I.** Our behaviour patterns and instincts design the chronotypes that affect our sleep cycles.
- II.** The study of sleep scientists was partly based on genetics that influences our sleep timings.
 - (a) Only I is implicit
 - (b) Only II is implicit
 - (c) Either I or II is implicit
 - (d) Neither I nor II is implicit

Sol. (a)

I. Implicit: According to the passage, chronotypes are the timings of our sleep. It also states that chronotypes are partly genetic and changing is a difficult task. So, it is possible to change our sleep cycles by altering our behaviours and tendencies. So, statement I is implicit.

II. Not-Implicit: The passage doesn't mention the study of scientists. So, statement II is not implicit.

Hence, option (a) is the correct answer.

Syllogism

Syllogisms are a common example of logical reasoning.

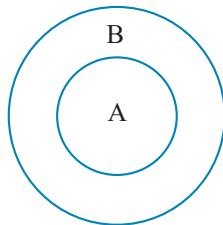
A conclusion is drawn from two or three provided propositions or statements using a syllogism. Deductive reasoning is used rather than inductive reasoning. Even if the provided statements differ from established facts, we have to accept them as true.

To put it differently, a syllogism is a type of logical argument that relies on deductive reasoning to draw a conclusion based on two assertions or presumptions. A syllogism first occurs when two true premises logically suggest a conclusion, or the primary point that the argument is trying to prove.

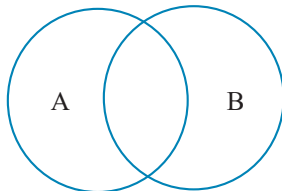
In simple words, Syllogisms are a logical argument of statements using deductive reasoning to arrive at a conclusion.

There are some types of syllogism as follows:

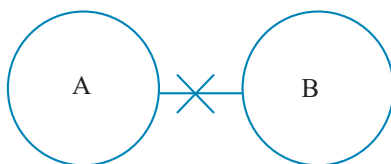
- All A are B
- If the condition is given that All A are B. It can be drawn as shown below:



- Some A are B
- If the condition is given that Some A are B. It can be drawn as shown below:

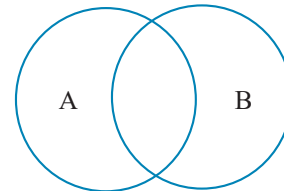


- No A are B
- If the condition is No A is B. It can be drawn as shown below:



- Some A are not B

- If the condition is Some A are not B. It can be drawn as shown below:



Few implications of syllogism are as follows:

- Any "All" and "All" sentence implies an "All" conclusion.
- Any "All" and "No" sentence implies a "No" conclusion.
- Any "All" and "Some" sentences implies a "No" conclusion.
- Any "Some" and "All" sentence implies a "Some" conclusion.
- Any "Some" and "No" sentence implies a "Some not" conclusion.
- Any "Some" and "Some" sentence implies a "No" conclusion.

Let's understand this by some of the following examples:

Example-1 Statements are given followed by conclusions. You have to consider the statements to be true even if they seem to be at variance from commonly known facts. You have to decide which of the given conclusions, if any, follow from the given statements.

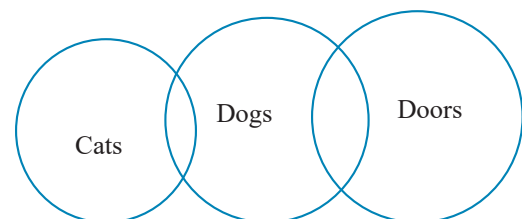
Statements:

- (I) Some doors are dogs.
- (II) Some dogs are cats.

Conclusions:

- (I) Some doors are cats.
- (II) Some cats are doors
- (a) Either (1) or (2) follows
- (b) Neither (1) nor (2) follows
- (c) Only (1) conclusion follows
- (d) Only (2) conclusion follows

Sol.



Statement 1: False, because no door is cat

Statement 2: False, because no cat is door

Hence, Neither (1) nor (2) follows.

Example 2. Statements are given followed by conclusions. You have to consider the statements to be true even if they seem to be at variance from commonly known facts. You have to decide which of the given conclusions, if any, follow from the given statements.

Statements:

(I) All the pumpkins are papaya.

(II) All the papayas are tomatoes.

Conclusions:

(I) All the pumpkins are tomatoes.

(II) Some tomatoes are pumpkins.

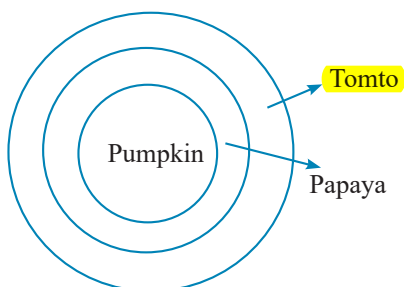
(a) Neither (1) nor (2) follows

(b) Both (1) or (2) follows

(c) Only (1) conclusion follows

(d) Only (2) conclusion follows

Sol.



Statement 1: True because all the pumpkins are tomato

Statement 2: True because some tomato are pumpkins

Hence, Both (1) or (2) follows.

Example-3. Statements are given followed by conclusions. You have to consider the statements to be true even if they seem to be at variance from commonly known facts. You have to decide which of the given conclusions, if any, follow from the given statements.

Statements:

(I) Some cows are crows.

(II) Some crows are eggs.

Conclusions:

(I) Some cows are eggs.

(II) All crows are eggs.

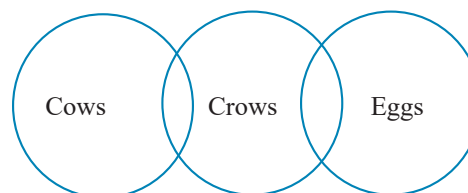
(a) Either (1) or (2) follows

(b) Neither (1) nor (2) follows

(c) Only (1) conclusion follows

(d) Only (2) conclusion follows

Sol.



Statement 1: False because no cow is egg for certain.

Statement 2: False because some crows are eggs.

Hence, Neither (1) nor (2) follows.

Example 4. Statements are given followed by conclusions. You have to consider the statements to be true even if they seem to be at variance from commonly known facts. You have to decide which of the given conclusions, if any, follow from the given statements.

Statements:

(I) All cards are books.

(II) All books are stationary.

Conclusions:

(I) Some cards are not stationary.

(II) Some stationary are cards.

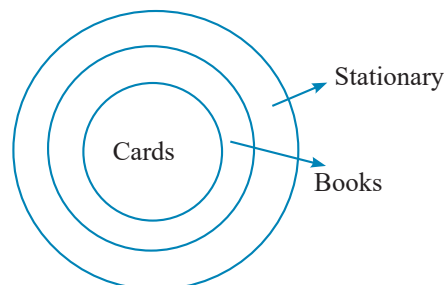
(a) Only (1) conclusion follows

(b) Only (2) conclusion follows

(c) Either (1) or (2) follows

(d) Neither (1) nor (2) follows

Sol.



Statement 1: False, Some cards are stationary

Statement 2: True, Some stationary are cards

Hence, Only (2) conclusion follows

Example 5. Statements are given followed by conclusions. You have to consider the statements to be true even if they seem to be at variance from commonly known facts. You have to decide which of the given conclusions, if any, follow from the given statements.

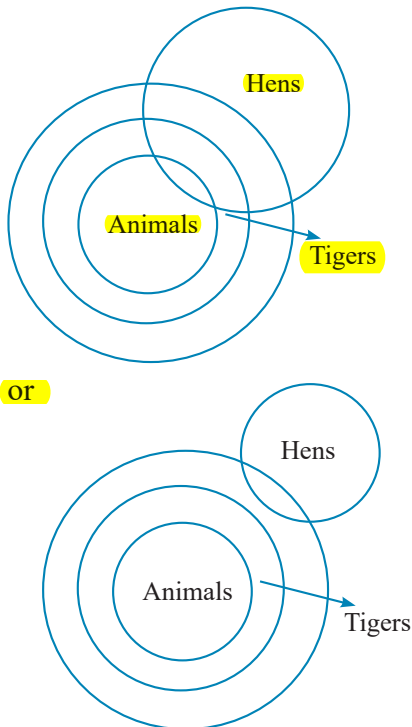
Statement:

All animals are tigers.

Some tigers are hens.

Conclusion:

- (I) Some hens are animals
 (II) No hens are animals
 (a) Neither (1) nor (2) follows
 (b) Either (1) or (2) follows
 (c) Only (1) conclusion follows
 (d) Only (2) conclusion follows

Sol.**or**

Statement 1: True if some hens are animals as shown in diagram 1.

Statement 2: True if No hens are animals as shown in diagram 2.

From both the cases only one is possible

Hence, Either (1) or (2) follows.

Example 6. Statements are given followed by conclusions. You have to consider the statements to be true even if they seem to be at variance from commonly known facts. You have to decide which of the given conclusions, if any, follow from the given statements.

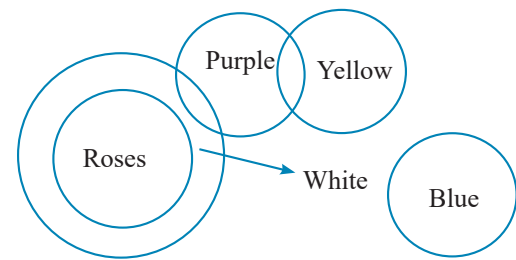
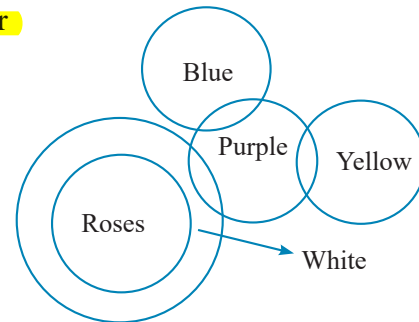
Statements:

- (I) All roses are white.
 (II) Some white are purple.
 (III) Some purple are yellow.
 (IV) No yellow is blue.

Conclusions:

- (I) No blue is purple.
 (II) Some purple are rose.
 (III) Some blue are rose.
 (IV) Some blue are purple.

- (a) None follows
 (b) Only either I or IV follows
 (c) All follow
 (d) Only III & IV follow

Sol.**or**

Statement 1: True, because no blue is purple it is a probability

Statement 2: False, because no purple is rose

Statement 3: False, because no blue is rose

Statement 4: True, because some blue are purple

From statement I and IV only one condition is possible.

Hence, Only either I or IV follows

Example 7. Statements are given followed by conclusions. You have to consider the statements to be true even if they seem to be at variance from commonly known facts. You have to decide which of the given conclusions, if any, follow from the given statements.

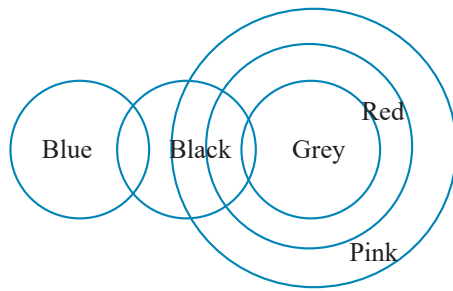
Statements:

- (I) Some blue are black.
 (II) Some black are grey.
 (III) All grey are red.
 (IV) All red are pink.

Conclusions:

- (I) Some red are black
 (II) Some pink are black
 (III) Some pink are grey
 (IV) Some red are blue
 (a) Only I & II follow
 (b) Only I, II and III follow
 (c) Only II & III follow
 (d) All follow

Sol.



Statement 1: True, because Some red are black.
Statement 2: True, because Some pink are black.
Statement 3: True, because Some pink are grey.
Statement 4: False, because no red is blue.
Hence, Only I, II and III follow.

Example-8 Statements are given followed by conclusions. You have to consider the statements to be true even if they seem to be at variance from commonly known facts. You have to decide which of the given conclusions, if any, follow from the given statements.

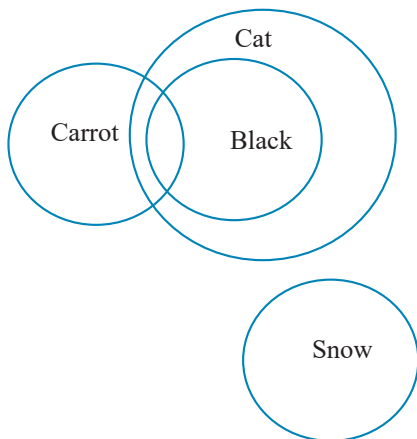
Statement:

- (I) Some carrots are Black.
- (II) All Black are cats.
- (III) No cat is snow.

Conclusion:

- (I) No carrots are cats.
- (II) Some carrots are cats.
- (III) No Black is Snow.
 - (a) Only II follows
 - (b) Only II & III follow
 - (c) Only I follows
 - (d) None follows

Sol.



Statement 1: False, because some carrot are cat.
Statement 2: True, because Some carrot are cat

Statement 3: True, because No Black is Snow

Hence, Only II & III follow

Example 9. Statements are given followed by conclusions. You have to consider the statements to be true even if they seem to be at variance from commonly known facts. You have to decide which of the given conclusions, if any, follow from the given statements.

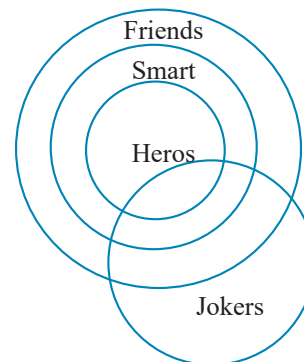
Statements:

- (I) All heros are Smart
- (II) All Smart are friends
- (III) Some heroes are jokers

Conclusion:

- (I) Some Jokers are heroes
- (II) Some Smart are jokers
- (III) Some friends are Smart
 - (a) Only I, II follow
 - (b) All I, II, III follows
 - (c) Only I, III follows
 - (d) Only II, III follow

Sol.



Statement 1: True, because Some Jokers are heroes.
Statement 2: True, because Some Smart are jokers
Statement 3: True, because Some friends are Smart
Hence, All I, II, III follows

Example 10. Some statements are given followed by conclusions. You have to consider the statements to be true even if they seem to be at variance from commonly known facts. You have to decide which of the given conclusions, if any, follow from the given statements.

Statements:

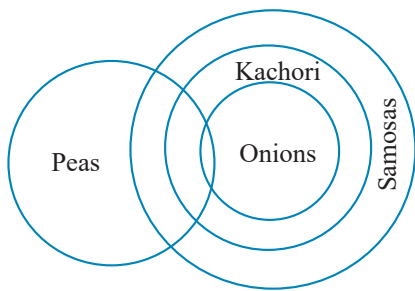
- (I) Some Peas are onions
- (II) All onions are kachori
- (III) All kachori are samosas

Conclusion:

- (I) Some Peas are kachori
- (II) Some kachori are Peas
- (III) All onions are samosas

- (a) Only I, III follow
- (b) All follow.
- (c) Only I, II follows
- (d) None of these

Sol.



Statement 1: True, because Some Peas are kachori
Statement 2: True, because Some kachori are Peas
Statement 3: True, because All onions are samosas
Hence, All follow

Critical thinking

Critical thinking is an essential component of reasoning that involves analyzing, evaluating, and interpreting information to make reasoned judgments or decisions. It is a cognitive skill that allows individuals to think logically, consider multiple perspectives, and arrive at well-reasoned conclusions. When solving problems using critical thinking, the following steps can be helpful:

The following topics are involved in the critical thinking:

1. Cause and effect
 2. Statement and Assumptions
 3. Statement and Arguments
 4. Statement and Courses of Action
 5. Statement and Conclusion
1. Understand the problem: Begin by clearly understanding the problem or situation at hand. Identify the key elements, facts, and any assumptions that may be present. Define the goal or desired outcome.
 2. Gather information: Collect relevant information and data related to the problem. Use reliable sources and ensure that the information is accurate and comprehensive. Consider different viewpoints and perspectives.
 3. Analyze the information: Carefully examine and evaluate the information gathered. Look for patterns, connections, and relationships. Identify any biases or inconsistencies that may be present.
 4. Identify assumptions: Recognize any assumptions that underlie the information or reasoning involved. Determine if these assumptions are valid or if there are alternative assumptions that could be considered.

5. Evaluate arguments and evidence: Assess the strength and validity of arguments and evidence presented. Look for logical fallacies, unsupported claims, or weak reasoning. Consider counter arguments or opposing viewpoints.
6. Apply reasoning strategies: Utilize logical reasoning strategies such as deduction, induction, and abduction to analyze the information and draw conclusions. Make logical connections and use evidence to support your reasoning.
7. Consider alternative solutions: Generate multiple possible solutions or approaches to the problem. Evaluate each option critically, considering their advantages, disadvantages, and potential consequences.
8. Make a decision or judgment: Based on the analysis and evaluation, make a well-informed decision or judgment. Clearly articulate the reasoning behind your decision, including the evidence and logical connections.
9. Reflect on the process: After reaching a conclusion or decision, reflect on the entire reasoning process. Assess the strengths and weaknesses of your reasoning, identify areas for improvement, and consider alternative perspectives or solutions.

By following these steps, individuals can enhance their critical thinking skills and improve their ability to solve problems and make reasoned judgments. Critical thinking promotes logical analysis, sound reasoning, and the ability to make informed decisions based on evidence and logical connections.