34 Blood Relations

The questions from this section are generally easy to address, but they are framed in a challenging manner. The test takers are expected to address these questions attentively and draw a flowchart to arrive at the ultimate result when answering the questions in this part.

A blood relationship between two persons is described as a relationship formed by their birth or marriage or any other circumstance. Blood Relation questions require analysing data that demonstrate the blood relation between family members. A chain of relationships is provided to the candidates in the form of information, and on the basis of this information, the candidates are required to determine the relationship between two members of the chain.

Students should be familiar with various family hierarchical structures, which are normally three generations above and below the current generation. So, in a nutshell, Blood Relation involves questions aimed to identify a link between family members based on the facts provided in the question. For example, any relation through birth will be mother, father, son, daughter, and so on. Any marriage relationship will have a father-in-law, mother-in-law, sister-in-law, and so on.

Before proceeding with this chapter, here is a list of the common relationship terms you must know:

List of male relations [Males can be denoted by a (+) or a square]:

TERMS	RELATION
Mother's or father's son	Myself/Brother
Mother's or father's brother	Uncle
Mother's or father's brother	Uncle
Mother's or father's father	Grandfather
Daughter's husband	Son-in-law
Husband's wife's brother	Brother-in-law
Brother's son	Nephew
Uncle or aunt's son	Cousin
Sister's husband	Brother-in-law
Brother of wife	Brother-in-law
Brother of husband	Brother-in-law

List of female relations [Females can be denoted by a (-) or a circle]:

TERMS	RELATION
Mother's or father's daughter	Myself/Sister
Mother's or father's sister	Aunt
Mother's or father's mother	Grandmother
Son's wife	Daughter-in-law
Husband's wife's sister	Sister-in-law

Brother's daughter	Niece
Uncle or aunt's daughter	Cousin
Brother's wife	Sister-in-law
Sister of wife	Sister-in-law
Sister of husband	Sister-in-law

Grandfather's only daughter-in-law	Mother
Grandmother's only daughter-in-law	Mother
The only daughter of your father	Yourself
Wife of your father	Mother

Hierarchy of blood relationships:

Stage 1	Grandparents	Grandfather, grandmother
Stage 2	Parents and in-laws	Father, mother, father-in-law, mother-in-law, uncle, aunt
Stage 3	Siblings, spouse, and in-laws	Brother, sister, wife, husband, brother-in-law, sister-in-law
Stage 4	Children and in-laws	Son, daughter, niece, nephew, son-in-law, daughter-in-law
Stage 5	Grandchildren	Grandson, granddaughter

Maternal: Relations on the mother's side are called maternal relations or relatives. For example, mother's brother is called 'maternal uncle.'

Paternal: Relations on the father's side are called paternal relations or relatives. For example, father's father is called 'paternal grandfather.'

There are three kinds of questions that can be asked under blood relations:

1. Dialogue/Conversation Based: In these types of questions, one person describes his/her relationship with another person, which may or may not be related to the person with whom the conversation is being made.

Example:

Karan introduces Imran saying, "He is the husband of the granddaughter of the father of my father." How is Imran related to Karan?

A. brother-in-law
B. son-in-law
C. father
D. brother

Answer: Father's father—grandfather; grandfather's granddaughter—sister; sister's husband—brother-in-law. Therefore, Imran is Karan's brother-in-law. The right option is A.

2. Based on Puzzles: Blood relations based on puzzles contain a piece of brief information about multiple people being interrelated and sub-questions based on the same can be asked. It is easier to solve these questions by drawing a family tree. A family tree is a pictorial representation of genealogical data. Here are some points to note while drawing family trees for blood relations questions:

- Usually, the names of female members of the family are written inside a circle and the names of male members are written inside a square for differentiation.
- The family members are ranked in a hierarchical order, i.e., the older generations are at the top of the family tree and the latest generation members are at the bottom of the family tree. Refer to the earlier table 'hierarchy of blood relationships' on the first page.
- While most relationships in the family tree are connected by a normal arrow, you can differentiate relationships (for example, to denote a couple, by using an arrow, like this ⇄ or an equals to (=) sign).

SYMBOL	MEANING
+ or □	Male
– or ○	Female
→ or ←	Siblings (Brother or sister)
= or ⇆	Husband-wife
↑ or ↓	Generation gap

Example:

Six friends, namely P, Q, R, S, T, and U, are shopping in a shopping mall. P and T are brothers. U is the sister of T. R is the only son of P's uncle. Q and S are the daughters of the brother of R's father. R's father has only one brother.

1. What is the relation of R with U?
A. Brother B. Sister
C. Cousin D. Uncle

Answer: U is T's and hence P's sister. R is also the son of U's uncle and is, therefore, U's cousin. Hence, the answer is option C.

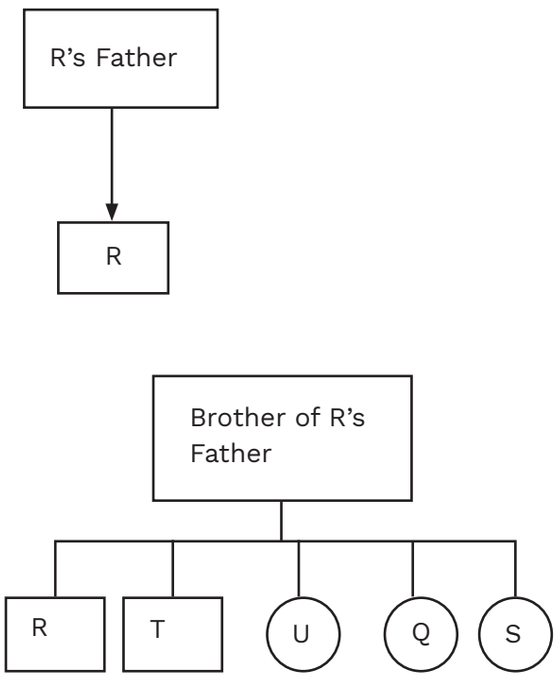
2. How many boys are in this group of friends?
A. 1 B. 2
C. 3 D. 4

Answer: P and T are brothers, so they both are males. U is the sister of T, hence female. R is the son, hence male. Q and S are daughters, so they both are female. There are a total of three boys, so the answer is option C.

3. What is the relation of S with P?
A. Uncle B. Cousin
C. Sister D. None of these

Answer: S's father is the brother of R's father and R's father is P's uncle. So, S's father is also P's father. Thus, S is P's sister, and the right option is C.

Given below is the family tree for this example:



3. **Coding-Decoding:** Under this type, the relationships are represented by certain codes or symbols like +, *, and =, which are to be decoded.

Example:
If P + Q means P is Q's mother; P # Q means P is the Q's brother; P @ Q means P is the Q's son and P * Q means P is the Q's daughter, which of the following means X is the niece of Y?

A. Y * X B. Y @ Z * X
C. X * Z # Y D. Z + Y # X

Answer: X is the niece of Y means X is the daughter of the brother (say Z) of Y, i.e., X * Z # Y. Hence, option C is the correct answer.

Important things to keep in mind while solving blood relations questions:

1. The gender of a person should never be inferred from their given name. For example, generally, Ram is the name of a boy but you are not expected to assume this on your own. In these types of questions, Ram can be the name of a girl as well.
2. If a particular statement says A is the son of B, the gender of B cannot be ascertained unless it is indicated in the question. B can be A's mother or father.
3. Make family trees using the information provided in the questions, since this will help you in answering the questions more quickly.
4. Visualising the scene and putting yourself in the shoes of one of the characters may help you in quickly resolving questions concerning blood relations.
5. The term 'only son' or 'only daughter' does not necessarily imply "only child." If the question states that A is B's only son, A could have one son and one daughter, or simply one son.

PRACTICE QUESTIONS

1. A lady, while referring to a person in an album, said, "His sister's father is the only son of my grandmother." How is the lady related to the person in the album?
   A. sister-in law B. mother
   C. daughter D. sister

2. Pointing out an officer, a lady said, "His wife is the only daughter of my father." How was that officer related to the lady?
   A. husband B. father
   C. brother D. none of the above

3. Waving to a woman, Kabir said, "She is the daughter of the woman who is the mother of the husband of my mother." Who is the woman to Kabir?
   A. sister B. mother
   C. aunt D. daughter

4. X is the son of Y while Y and W are sisters. L is the mother of W. If K is the son of L, find the correct statement?
   A. L is the brother of Y
   B. K is the cousin of X
   C. Y and K are sisters
   D. K is the maternal uncle of X

(Questions 5 to 9) Read the following information carefully and answer the questions.

There are six family members, namely A, B, C, D, E, and F, living at Sharma's residence. There is one teacher, one singer, one dancer, one painter, and two professors in the family. There are two couples. B is a teacher and E's father. F is C's grandfather and is a singer. D is the grandmother of E and is a painter. Both the grandchildren are professors.

5. Who is the husband of A?
   A. C B. F
   C. B D. D
6. Who is the sister of E?
   A. C B. E
   C. B D. Information insufficient

7. Which of the following are two couples?
A. FD, BE B. FD, BA
C. ED, CF D. FD, CA

8. Which of the following groups is definitely of male members?
A. BF B. BFE
C. BFA D. FE

9. What is the profession of A?
A. teacher B. dancer
C. teacher or dancer D. professor

(Questions 10 to 13) Read the following information carefully and answer the questions.

There are 6 family members, namely P, Q, R, S, T, and U, in a family who are planning to go on a trip to Uttarakhand in October. T is R's brother. S is P's daughter. P and R are married to each other. U is Q's brother. Q is R's son, but R is not Q's mother.

10. How many of the members of the family are male?
A. 1 B. 3
C. 2 D. 4

11. Who is the mother of Q?
A. S B. U
C. T D. P

12. What is the number of children that P has
A. 1 B. 2
C. 3 D. 4

13. Who is the wife of T?
A. P B. U
C. Q D. Can't be determined

(Questions 14 to 20) Answer the questions based on the information given below.

X + Y means X is Y's father.
X – Y means X is Y's wife.
X × Y means X is Y's brother.
X ÷ Y means X is Y's daughter.

14. If A ÷ C + D + B, which of the following is correct?
A. A is B's mother
B. A is B's daughter
C. A is B's aunt
D. B is A's aunt

15. If A – C + B, which of the following statements is correct?
A. A is B's mother
B. B is A's daughter
C. A is B's aunt
D. A is B's sister

16. If A × C ÷ B, which of the following statements is correct?
A. A is B's uncle
B. A is B's father
C. A is B's brother
D. A is B's son

17. If A × C – B, which of the following is correct?
A. A is the brother-in-law of B
B. A is the brother of B
C. A is the uncle of B
D. A is the father of B

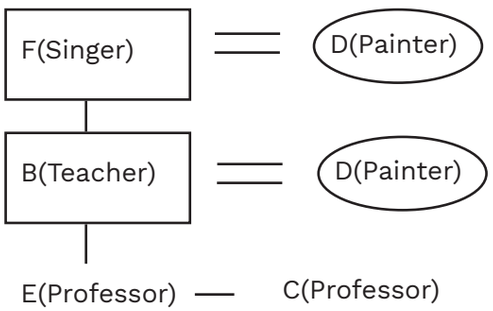
18. If A + C ÷ B, which of the following is correct?
A. A is B's brother
B. A is B's son
C. A is B's husband
D. A is B's father

19. If A ÷ C + B, which of the following is correct?
A. A is the father of B
B. A is the brother of B
C. A is the mother of B
D. A is the sister of B

20. If A – C × B, which of the following is correct?
A. A is the sister of B
B. B is the husband of A
C. A is the sister-in-law of B
D. B is the son of A

SOLUTIONS

1. **(D)** Only son of the lady's grandmother—lady's father. Person's sister's father—person's father. So, the lady is that person's sister.
2. **(A)** The only daughter of my father—myself. Therefore, the officer is the lady's husband.
3. **(C)** Mother's husband—father. Father's mother—grandmother. Grandmother's daughter—father's sister. Father's sister—aunt. Therefore, the woman is Kabir's aunt.
4. **(D)** Y and W are sisters. So, L is the mother of W means L is the mother of both Y and W. K is the son of L means L is the brother of Y. Thus, X is the son of Y means K is the maternal uncle of X.

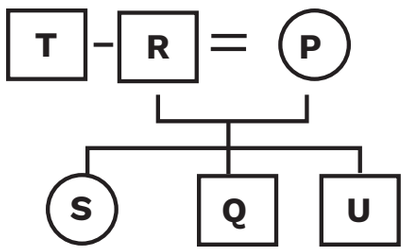


(Solutions 5-9):
The teacher B is the father of E. The painter D is the grandmother of E and hence the mother of B. Since there are only two couples, one being that of B, C's grandfather (i.e., F) must be married to D. Thus, C and E are both children of B and are the professors. So, A who is remaining is the wife of B and she alone can be the dancer. Thus, F must be the singer.

5. **(C)** B is the husband of A.
6. **(D)** C and E are children of the same parents, but their gender is not given. Therefore, the information is insufficient to conclude the relation between C and E.
7. **(B)** The two couples are B, A and F, D.
8. **(A)** The father B and the grandfather F are definitely male.
9. **(B)** A is the dancer.

(Solutions 10-13):
Q is R's son, but R is not the mother of Q means that R is the father of Q. P is married to R so P must be Q's mother. U is the brother of Q, so U is the son of P and R. S is the daughter of P means she is the daughter of P and R.

10. **(D)** P—mother, Q—son, R—husband, S—daughter, T—brother, U—son. Hence, there are 4 males.



11. **(D)** P is the mother of Q.
12. **(C)** P has 3 children—son Q, son U and daughter S.
13. **(D)** The wife of T cannot be determined from the data available.
14. **(C)** A ÷ C + D + B means A is the daughter of C, who is the father of D, who is the father of B, i.e., A is the sister of D, who is the father of B. Therefore, A is the aunt of B.
15. **(A)** A – C + B means A is the wife of C, who is B's father. Hence, A is the mother of B.
16. **(D)** A × C ÷ B means A is the brother of C, who is the daughter of B. Hence, A is the son of B.
17. **(A)** A × C – B means A is the brother of C who is the wife of B. Hence, A is the brother-in-law of B.
18. **(C)** A + C ÷ B means A is the father of C, who is the daughter of B. So, A and B are the father and mother of C, respectively. Hence, A is the husband of B.
19. **(D)** A ÷ C + B means A is the daughter of C who is the father of B. Hence, A is the sister of B.
20. **(C)** A – C × B means A is the wife of C who is the brother of B. Hence, A is the sister-in-law of B.

35 Coding–Decoding

Coding-decoding is a process of encrypting and decrypting any word, letter, set of patterns, sentences, or codes based on certain rules. In these types of questions, certain code values are assigned to a set of words or phrases and you have to find the original words and phrases.

When any letter/word/phrase is written in a way that hides the actual meaning of the particular word/phrase/sentence, then it is called coding. The process of finding the actual sentence from the hidden one is called decoding.
Some useful points to solve such questions are:

1. Forward order of letters

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

2. Reverse order of numbering

A	B	C	D	E	F	G	H	I	J	K	L	M
26	25	24	23	22	21	20	19	18	17	16	15	14
N	O	P	Q	R	S	T	U	V	W	X	Y	Z
13	12	11	10	9	8	7	6	5	4	3	2	1

3. Opposite letters

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
Z	Y	X	W	V	U	T	S	R	Q	P	O	N
26	25	24	23	22	21	20	19	18	17	16	15	14

To arrive quickly to the nearest possible position, use the concept of

E	J	O	T	Y
5	10	15	20	25

TYPES OF CODING–DECODING

1. Letter-to-letter coding

Here, the alphabets are coded using other letters in their place and are mostly opposites of each other. It can be from Table 2 like writing N in place of A or vice versa or it can be from Table 3 like Z in place of A or vice versa.

Illustration

In a certain language, BUNNY is written as YFMMB. What will be SHORT written in the same language?

A. HSLIG B. HGSIL
C. HLGIS D. HFLIS

Answer: A

It can be seen that in the sequence:
A B C D E F G H I J K L M
Z Y X W V U T S R Q P O N.
The word stated in the question and its code are opposite pairs like B is Y, U is F, and so on.

2. Letter-to-number coding

Here, numerical code values are assigned to a word or alphabetical code letters are assigned to the number.

Illustration

If BIRD is written as 2518923. What will BASKET be written as?

A. 2119115201
B. 2526816227
C. 2534516727
D. 4567782317

Answer: B

It can be seen that the number allotted is as per reverse order of placement, which means, Z is 1 and A is 26. It can be seen that in BIRD B is 25, I is 18, and so on as per their reverse order placement in alphabets.

3. Substitution coding

In this type of coding and decoding, words of different statements are coded with letters, symbols, and numbers using different operations. We need to find logic in the operations.

Illustration

If in a certain language, pen is paper, paper is plastic, plastic is black, black is bird. On what do we write according to this code language?

A. Pen B. Paper
C. Plastic D. Bird

Answer: **C**

We write on paper and in this language, paper is plastic. So, we write on plastic.

4. Conditional coding

Here, a few conditions will be provided and candidates need to answer based on the logic derived from the conditions.

Illustration

CODE	B	A	T
DIGIT	31	58	90

Conditions

- If the word starts with a consonant, then its digit is reversed in the code.

What will TAB be written as in this code?

A. 905831 B. 315890
C. 135890 D. 095831

Answer: D

Since it starts with T, a consonant, so the digit of T is reversed; others are written as per their digits.

5. Word coding

Here, a few statements consisting of the same words but in a different order will be coded as words, symbols, or letters. The same words are to be decoded with the common word as present in the code.

Illustration

If in a certain language 'ki ou ti' means 'I like singing', 'ti ji ka' means 'singing is good', 'ka ki ta' means 'I good person'. Then what is the code for 'good singing'?

A. ti ka B. ti ji
C. ki ti D. ou ti

Answer: A

From 1st and 2nd statements, singing = ti
From 2nd and 3rd statements, good = ka

PRACTICE QUESTIONS

1. In a certain language, ENGLISH is written as FPJPNYO. What will SCIENCE be, if written in this language?
A. TEKGRFL B. TELGSFJ
C. TELISIL D. TELISIJ

2. In a certain language, TRIANGLE is written as SSHBMHKF. What will CREATIVE be written in the same language?
A. DQDBUHWF B. BSDBSKUG
C. BSDBSJUG D. BSDBSJUF

3. In a certain language, BEAUTY is written as YVZFGB. What will CONSIDER be written in the same language?
A. XMLHPWVS
B. XMLGOWVS
C. XLMHRWVI
D. XLMHSWVI

6. In a certain language, DRAGON is written as QENTBA. What will SQUARE be written in the same language?
A. HJFZIV B. FDHNER
C. HJFNER D. FCHNER

7. In a certain language, CAPITAL is written as MBUQBD. What is IMPORT written in the same language?
A. USPQNJ B. USPRNK
C. URPQNJ D. URPRNK

8. In a certain language, A is coded as 1, B is coded as 2, and so on. How will AROUND be written in this language?
A. 1171520144 B. 1181521134
C. 1181521144 D. 1181520144

9. If in a certain code, FUTURA is coded as 204091 and BUTTERY is coded as 5044798. What is BEAUTY, in the same language?
A. 571048 B. 571281
C. 581048 D. 581281

10. In a certain code, 1 is coded as Z, 4 is coded as S, 8 is coded as Q, 9 is coded as E, 5 is coded as V. What is 854891 according to the code?
A. QVSQZE B. QSVQZE
C. QVSQEZ D. QVQSEZ

11. In a certain code, CUTE is coded as 49. What will BOAT be coded as?
A. 37 B. 38
C. 39 D. 40

12. In a certain code, E is coded as 3, G is coded as 8, Y is coded as 7, N is coded as 5, R is coded as 1, A is coded as 6. What is ENERGY in the same code?
A. 363178 B. 358317
C. 353187 D. 353168

13. In a certain code, orange is called blue, blue is called green, green is called white, white is called black, black is called grey. What color is the grass?
A. Orange B. Blue
C. Green D. White

14. In a certain code, bus is called car, car is called taxi, taxi is called train, train is called airplane, and airplane is called brake. What is actually written in this language, if it is written as 'car brake'?
A. Bus airplane B. Taxi bus
C. Taxi airplane D. Bus taxi

15. In a certain code language, 'sim op tim' means 'apple is green', 'op ho tap' means 'green and black', and 'ho tim ko' means 'shirt is black'. Which of the following represents apple in that language?
A. sim B. op
C. tim D. tap

16. In a certain code 'nae po tam' means 'sky is blue', 'me tam sam' means 'she is cute', and 'ism po me' means 'she stares sky'. What is 'cute blue sky' in this language?
A. me po tam B. sam nae po
C. nae me tam D. tam op sam

17. In a certain code, '289' means 'read from book', '276' means 'tea from field' and '85' means 'wall book'. What is the code for 'field'?

A. 2
B. 7
C. 6
D. Cannot be determined

18. If in a certain code, '456' means 'she is pretty', '563' means 'she is cute', '689' means 'it is cold'. What will be the code for 'cute is pretty'?

A. 653 B. 564
C. 543 D. 643

19. If in the word EXISTENCE, each vowel is replaced by the 2nd next letter and each consonant is replaced by the previous letter and all the letters are arranged in alphabetical order, then which letter is 4th from the right?

A. K B. O
C. R D. M

20.

CODE	O	R	D	E	T
DIGITS	5	2	6	3	7

Conditions:
If the first and last digits are odd, both are written as X
If the first and last digits are even, both are written as Y
With the following conditions and code, what will 253672 be written as?

A. ROEDRR B. XOETRY
C. YOEDTR D. YOEDTY

SOLUTIONS

1. (C)

E	N	G	L	I	S	H
+1 F	+2 P	+3 J	+4 P	+5 N	+6 Y	+7 O
S	C	I	E	N	C	E
+1 T	+2 E	+3 L	+4 I	+5 S	+6 I	+7 L

2. (D) Subtract 1 from the first, third, fifth letters and so on and add 1 to the second, fourth, sixth, and so on.

3. (C) Write the alphabets in the order as given in the table of reversing alphabets
A B C D E F G H I J K L M
Z Y X W V U T S R Q P O N.
We see that the letters are opposite to each other. For B there is Y, for E there is V, and so on.

6. (B) Write the letters in the normal sequence
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
We see the answer forms opposite pairs. For D it is Q, for R it is E, and so on.

7. (A) Reverse the word and then add 1 to each letter of the reversed word.

8. (C) As given in question A is 1, B is 2, and so each letter is coded as the number on which it falls in the alphabets.

9. (A) As given in the question
F U T U R A B E Y
2 0 4 0 9 1 5 7 8
So, Beauty can be written in the same code where B is 5, E is 7, and so on.

10. (C) 854891 is coded as QVSQEZ.

11. (B) C (3) + U (21) + T (20) + E (5) = 49. In the same way, B (2) + O (15) + A (1) + T (20) = 38.

12. (C) ENERGY can be written as 353187.

13. **(D)** We know grasses are green. As given, green is called white, so white is the color of grass.

14. **(A)** In this language, car means bus in the actual language and brake means airplane in the actual language.

15. **(A)** From the 1st and 3rd statements, is = tim
From the 1st and 2nd statements, green = op
From 1st statement and above, apple = sim

16. **(B)** From the 1st and 3rd statements, sky = po
From the 2nd statement, cute = sam
From the 1st statement blue = nae.

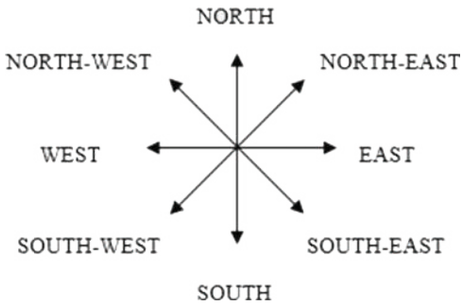
17. **(D)** We cannot find 'field' as we have no idea what 'tea' is and there is no other code with 'field'.

18. **(D)** From the 1st statement, pretty = 4
From the 1st, 2nd, and 3rd statements, is = 6
From the 2nd statement, cute = 3

19. **(D)** EXISTENCE, replacing all the letters we get GWKRSGMBG. Arranging the letters, we get BGGGKMRSW. Therefore, M is the 4th letter from the right.

20. **(D)** Since both first and last digits are even, it is written as Y and others are compared with the table.

36 Directions



Directions help us to trace a path from one place to another. Distance is a measurement of the position of one thing with respect to another thing or a reference point. The shortest distance between two different points is known as displacement. There are mainly 4 directions: north, south, east, and west. There are some other directions which fall between the 4 main directions, namely north-east, north-west, south-east and south-west.

The problems based on direction and distance will be regarding the movement of a person or an object from a starting point to an endpoint. The questions will provide the directions and magnitude on the basis of which the questions need to be solved.

The questions will be asked on the following basis:

1. Turns and rotations

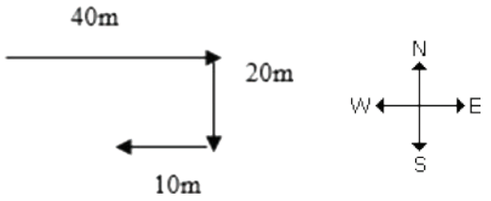
In this type of question, you will be provided with rotations like clockwise or anticlockwise or left or right and you need to find the final direction you will be facing. A right turn is clockwise and a left turn is anticlockwise.

Example

Ram walks 40 m towards east and then takes a right turn and walks 20 m and then turns right again and walks 10 m. Which direction is he facing now?

A. North B. South
C. East D. West

Answer: D



Distance and displacement

Here, you need to find the distance between the start point and endpoint. The shortest distance between start and endpoints is known as displacement. The shortest distance from a particular point after travelling distance x metres in the horizontal direction and y metres in the vertical direction is $(x^2 + y^2)^{1/2}$.

Illustration

Atul starts cycling from home towards his school. On the way to his school, he takes three left turns. He takes each one of the left turns after cycling 40 m straight, 50 m straight, and 60 m, respectively, and then 80 m straight. What is the minimum distance from his house to school?

A. $10\ (13)^{1/2}$ m B. $5\ (13)^{1/2}$ m
C. 10 m D. 50 m

Answer: A

His path can be seen as 80 - 50 = 30 m, 60 - 40 = 20 m.

Minimum distance = $[(30)^2 + (20)^2]^{1/2} = 10\ (13)^{1/2}$ m.

2. Shadow based

Shadows are formed with respect to the position of the Sun. In this type of question, you will be asked either the direction of the shadow or the direction of the Sun. Some important points to be remembered are:

- At the time of sunrise if a man stands facing the east, his shadow is in the west, i.e., behind him. At the time of sunset, the shadow of an object is always towards the east.

- If a man is facing north, at the time of sunrise his shadow will be towards his left and at the time of sunset, it will be towards the right.
- At noon, there will be no shadow.

Illustration

In the evening, Seeta is standing in her garden and facing west, in which direction will her shadow fall?

A. North B. South
C. East D. West

Answer: C

During sunset, shadows are always formed in the east no matter what direction you face.

3. Direction puzzle

Here, the persons are seated in rows and then scattered or shuffled in different directions. For a person facing north, right is east and left is west. The opposite is true for the south.

Illustration

Ram, Shyam, and Seeta are standing in a line one after another facing north. Ram takes two steps forward, Seeta turns right and walks two steps. Shyam turns 180 degrees. What are the directions the three are facing respectively?

A. North, South, East
B. South, North, East
C. South, North, West
D. North, South, West

Answer: A

Ram was facing north and just moved two steps forward so he is still facing north. Shyam turned 180 degrees, and so from the north, he turned to south and Seeta turned right from the north which is east.

PRACTICE QUESTIONS

1. Mr. X starts walking from his house to his office. He walks 5 km north, then takes a right turn and walks 10 km, he takes a left turn and walks 2 km to reach the office. Which direction is he currently facing with respect to the start point?

A. North B. North-east
C. East D. South-east

2. In the evening a man is walking from a park to his house. He walks 5 m towards the west then takes a turn, then walks 3 m towards the south and then takes a left turn, and walks 5 m. Which direction is he facing?

A. North B. South
C. East D. West

3. The door of Arun's house faces east. He walked 200 m from the door, turned right and walked 100 m, then turned left and walked 100 m to reach his office. In which direction is he with respect to the door?

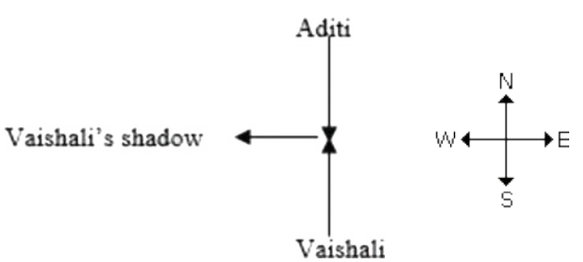
A. North B. North-west
C. West D. North-east

4. Chintu walks southwards and then turns 45 degrees right and then takes a left turn. In which direction is he walking now?

A. South-west B. North-west
C. North-east D. South-east

5. One morning, Aditi and Vaishali were talking to each other face to face at a crossing. If Vaishali's shadow was exactly to the right of Aditi, which direction was Aditi facing?

A. East B. West
C. North D. South



6. Adil is in the east of Shyam, who is in the north of Zio. If Pankaj is in the south of Zio, then in which direction of Adil is Pankaj?

A. North B. South
C. South-east D. South-west

7. If north-east becomes north-west, north becomes west and so on, what will south become?

A. South-west B. South-east
C. East D. North-east

8. If south-east becomes north, north-east becomes west and so on, which direction will be the new south?

A. North B. North-west
C. West D. East

9. Ram put his timepiece on the table in such a way that at 6 A.M., the hour hand points to north. In which direction will the minute hand point at 10.15 A.M.?

A. South-east B. South
C. North D. West

10. One evening before sunset, Rina and Hetal were talking to each other face to face. If Hetal's shadow was exactly to the right of Hetal, which direction was Rina facing?

A. North B. South
C. East D. Data inadequate

11. A person rode southward, then turned right and rode 1 km and again turned right and rode 2 km. He found himself 1 km west of his starting point. How far did he ride southward initially?

A. 1 km B. 2 km
C. 3 km D. 4 km

12. Karan is 30 m south-west of Lina. If Mala is 30 m south-east of Lina, then Mala is in which direction of Karan?

A. East B. West
C. North-east D. South

13. Shina goes 4 km east, then turns right and goes 5 km. Then turns left and goes 4 km and then turns left and goes 5 km. At what distance is Shina from the starting point?

A. 5 km B. 6 km
C. 7 km D. 8 km

14. The length and breadth of a room are 3 m and 4 m, respectively. A cat runs along all four walls and finally along a diagonal order to catch a rat. How much total distance is covered by the cat?

A. 16 m B. 18 m
C. 19 m D. 17 m

15. One morning, Gita started to walk towards the sun. After covering some distance, she turned to the right, then again to the right, and after covering some distance she again turns to the right. Now in which direction is her shadow facing?

A. To her right
B. To her left
C. Behind her
D. In front of her

16. P started from his house towards west. After walking a distance of 20 m, he turned to the right and walked 5 m. He then again turned to the right and walked 15 m. After this, he is to turn right at 135° and to cover 30 m. In which direction is he going?

A. West B. South
C. South-west D. South-east

17. If A × B means A is to the south of B; A + B means A is to the north of B; A % B means A is to the east of B; A - B means A is to the west of B; then in P % Q + R - S, S is in which direction with respect to P?

A. North-east B. North
C. South D. South-west

18. One morning after sunrise, Sanika was standing facing a pole. The shadow of the pole fell exactly to her right. To which direction was she facing?

A. East B. West
C. North D. South

19. Kiyu started from his house, walked 10 km north, then 4 km west, and then 13 km south. How far is he from his house?

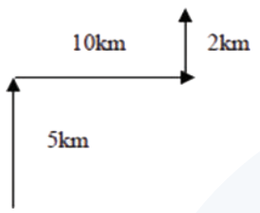
A. 5 km B. 6 km
C. 10 km D. 4 km

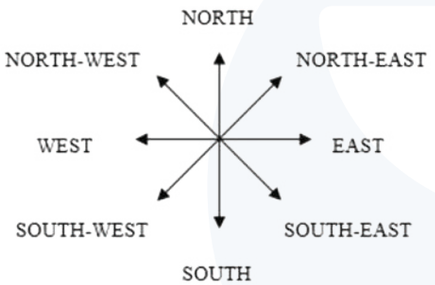
20. Anita faces north and covers 24 km, turns west and covers 12 km, then turns south and covers 6 km, and turns west again and covers 12 km. How far is she from the starting point and in which direction?

A. 20 km north-east
B. 20 km north-west
C. 30 km north-east
D. 30 km north-west

SOLUTIONS

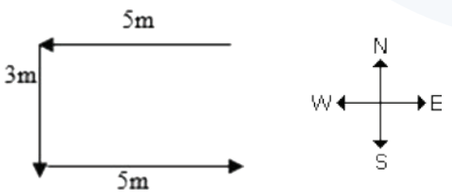
1. (B)





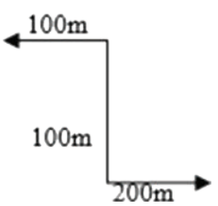
Option B is correct. Mr. X is in north-east direction with respect to the start point.

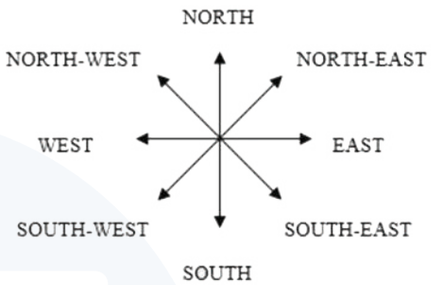
2. (C)



Option C is correct. The man is facing east.

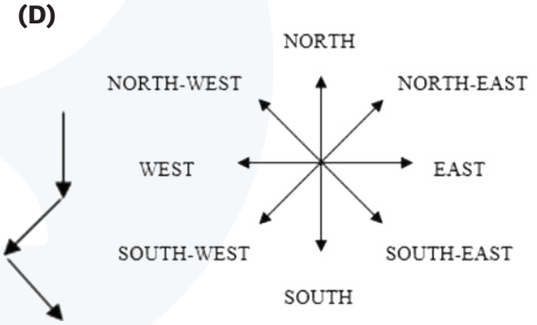
3. (B)





Option B is correct. Arun is in north-west direction with respect to the door.

4. (D)

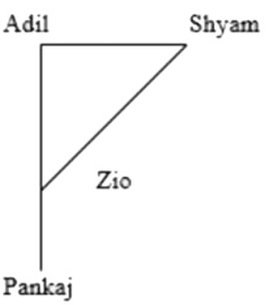


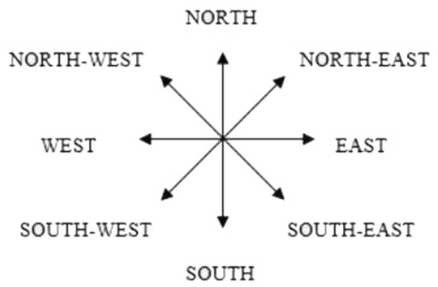
Hence, the direction is south-east. The correct answer is option D.

5. (D)

Aditi is facing south. Therefore, the correct answer is option D.

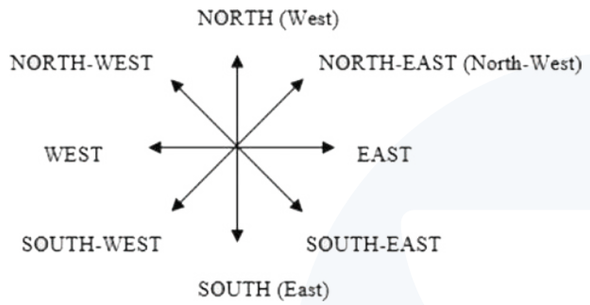
6. (D)





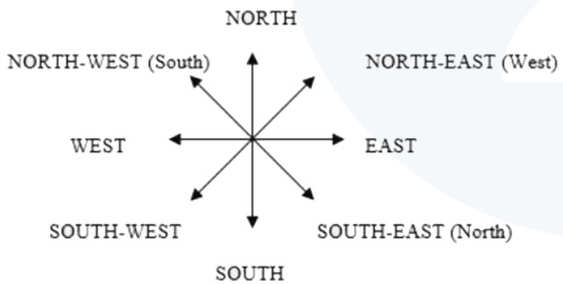
Pankaj is in the south-west of Shyam. Therefore, the correct answer is option D.

7. (C)



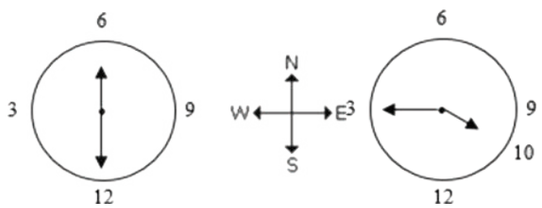
South will become east as per new details. Therefore, the correct answer is option C.

8. (B)



North-west will be the new south as per the diagram above. Therefore, the correct answer is option B.

9. (D)

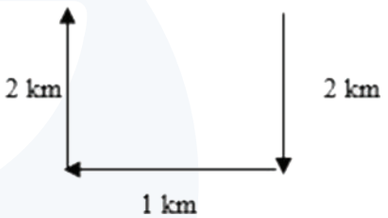


The minute hand will point in West direction at 10.15 A.M. Therefore, the correct answer is option D.

10. (B)

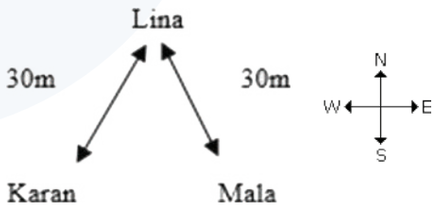
In the evening, sun sets in west. Hence then any shadow falls in the east. Since Hetal's shadow was to the right of Hetal, Rina was facing towards South. Therefore, the correct answer is option B.

11. (B)



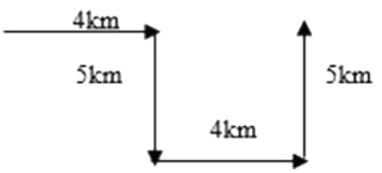
He rode 2 km southward. Therefore, the correct answer is option B.

12. (A)



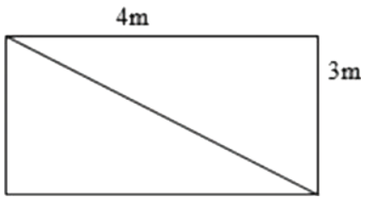
Mala is in the east of Karan. Therefore, the correct answer is option A.

13. (D)



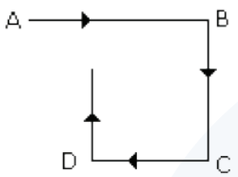
The required distance is 4 km + 4 km = 8 km. Therefore, the correct answer is option D.

14. (C)



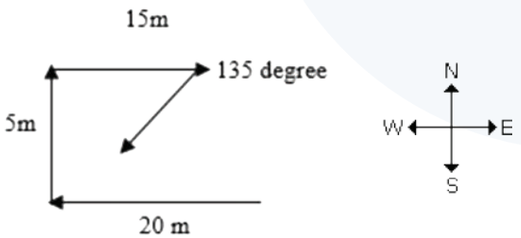
Using Pythagoras theorem, the diagonal length will be = 5 m. Total distance: 3 + 4 + 3 + 4 + 5 = 19 m
Therefore, the correct answer is option C.

15. (B)



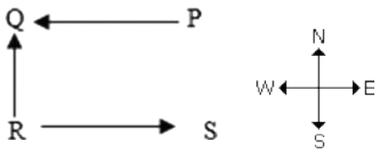
At the end, Gita is facing north. At the time of sunrise, the sun is in the east direction, and hence the shadow points towards the west at that time. As she is facing the north, then west is situated to her left. Therefore, her shadow is located to her left. Therefore, the correct answer is option B.

16. (C)



P is going in the south-west direction. Therefore, the correct answer is option C.

17. (C)

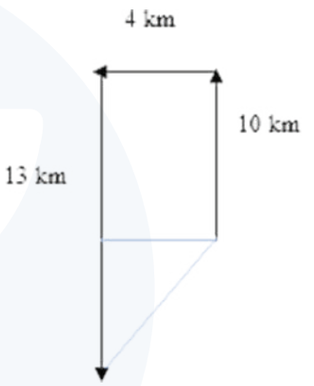


S is to the south of P. Therefore, the correct answer is option C.

18. (D)

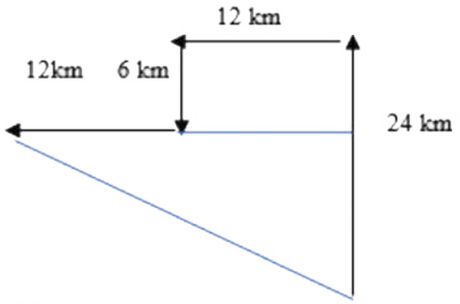
Sun rises in the east in the morning. Since the shadow of Suresh falls to his right he is facing south. Therefore, the correct answer is option D.

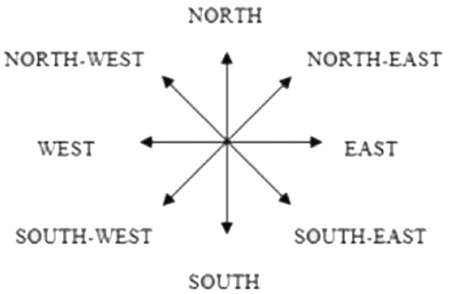
19. (A)



13 km-10 km = 3 km is the breadth
4 km is the length.
So, distance will be 5 km after applying Pythagoras theorem
($3^2 + 4^2 = 5^2$)
Therefore, the correct answer is option A.

20. (D)





$[(24)^2 + (18)^2]^{1/2} = 30$ km

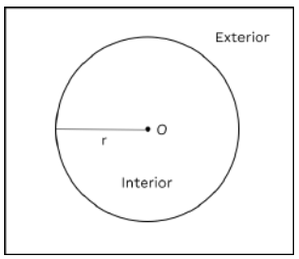
And it is north-west. Therefore, the correct answer is option D.

37 Venn Diagram

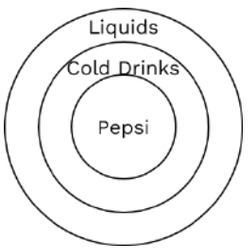
Venn diagram deals with questions that aim at analysing a candidate's ability to relate a certain group of given things or items and represent it diagrammatically. Generally, it uses circles to show the relations among things or finite groups of things. It helps to visually represent the similarities and differences between two concepts. The overlapping circles have something in common while circles that do not overlap do not have anything in common. For example, tomatoes and potatoes are two different things. So their circles won't overlap. However, if we consider tomatoes, potatoes, and vegetables, the circles of potatoes, and tomatoes will come inside a bigger circle of vegetables because potatoes and tomatoes both are vegetables.

Given below are a few types of Venn diagrams with their implication made clear.

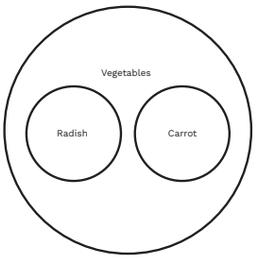
1. Suppose you are given a group of three items and those items evidently belong to three different categories, they will be represented as illustrated below. For example, fruits, vegetables, and spices.



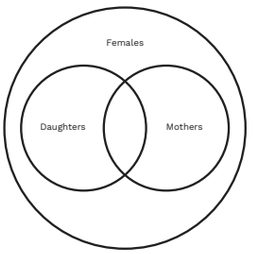
2. If one item belongs to the class of second and the second item belongs to the class of third, then the representation is in the form of three concentric circles, as represented below. For example, Pepsi, Cold Drinks, and Liquids.



3. If two separate items belong to the part of the third, for example, radish and carrot belong to the vegetable category, this will be represented as



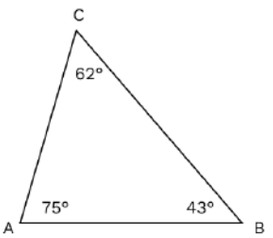
4. If the given two items belong to the class of the third in such a way that some items of each of these two groups are common in some particular trait, then such a relationship will be illustrated by a big circle inclusive of two intersecting smaller circles. For example, females, daughters, and mothers.



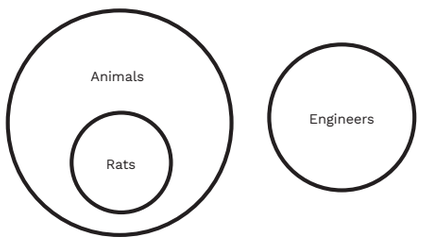
5. If three items are partly related to each other, they are represented as shown below.

For example, males{A}, engineers{B}, and postgraduate{C}.

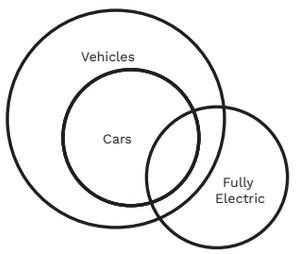
Some males may be engineers and some may be postgraduates. Similarly, some engineers may be males and some may be postgraduates. Also, some postgraduates can be engineers and some may be males.



6. If one item belongs to the second, and the third is entirely different from the two, then they can be represented by the below diagram. For example, animals, rats, and engineers.



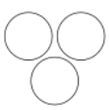
7. The first item is completely related to the second and the third item is partially related to the first and second items.
For example, car, vehicles, fully-electric. All the cars belong to vehicles, but some cars are fully electric but not all.

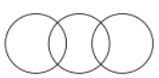


PRACTICE QUESTIONS

1. Which of the following diagrams indicates the best relation between passengers, car, and bus?

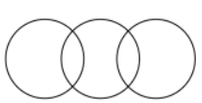
A. 

B. 

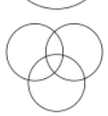
C. 

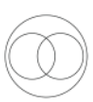
D. 

2. Which of the following diagrams indicates the best relation between amount, principal, and Interest?

A. 

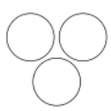
B. 

C. 

D. 

3. Which of the following diagrams indicates the best relation between teacher, lawyer, and dancer?

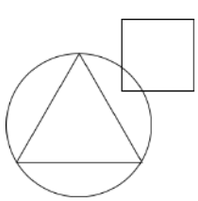
A. 

B. 

C. 

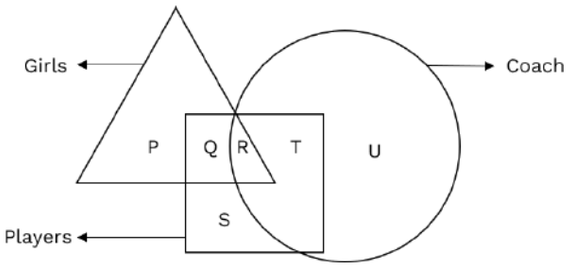
D. 

4. In an organisation of the environment board, professors are represented by a circle, legal experts by a square, and environmentalists by a triangle. Who is most represented in the board as shown in the following figure?



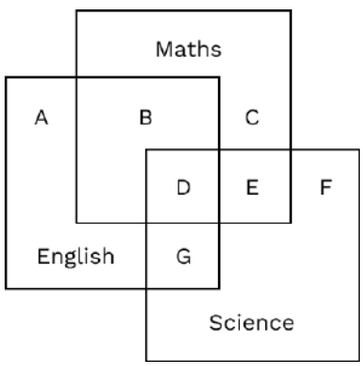
A. Environmentalists
B. Legal experts
C. Professors with legal background
D. Professors who are also environmentalists

5. In the following figure, triangle represents girls {from Carmel school}, rectangle represents players {from Football team} and circle-coach {coach of indoor stadium}. Which part of the diagram represents the girls who are players but not coaches?



A. P
B. Q
C. R
D. S

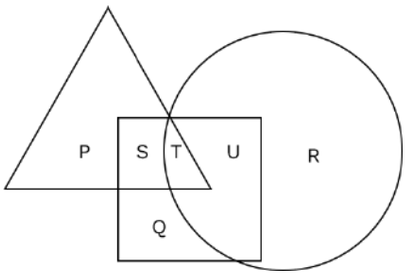
6. The diagram given below represents those students who like Maths, English, and Science.



Study the diagram and identify the students who like all three subjects.

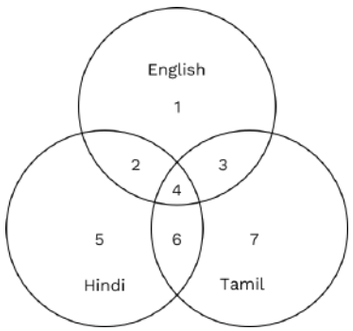
A. A + B + C
B. E + G
C. D + E + G
D. D

7. In the figure given next, the square represents kites, the triangle represents blue, and the circle represents pentagon. By which letter are the kites both of which are Blue in colour and Pentagon in shape represented?



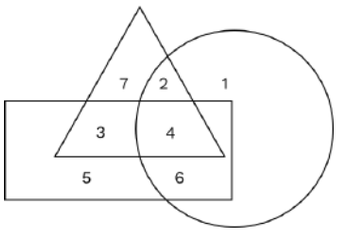
A. U
B. T
C. S
D. P

8. From the following diagram, which number represents the people who can speak only one language.



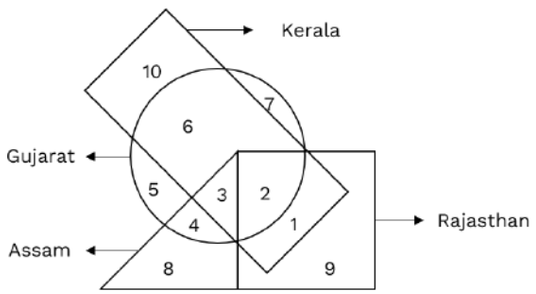
A. 2 + 3 + 4
B. 1 + 5 + 7
C. 4
D. 1 + 4 + 5 + 7

9. In the given figure, if triangle represents snacks, rectangle represents crunchy and circle represents sweet, then what is the number of those snacks which are sweet but not crunchy?



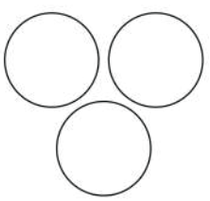
A. 3
B. 4
C. 6
D. 2

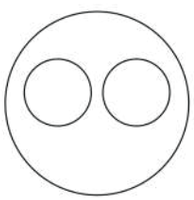
10. In the following diagram, various figures represent the states which people have visited. Which number indicates the people who visited Kerala, Rajasthan, and Gujarat but not Assam?

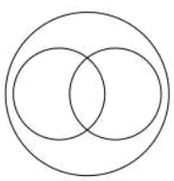


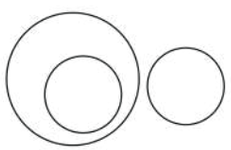
A. 1
B. 2
C. 10
D. 6

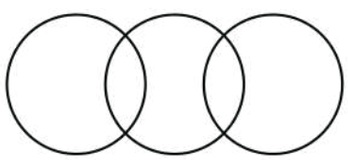
(Directions for questions from 11 to 20) Each of the following questions contains three items. Using the relationship between these items, match each question with suitable diagrams.

A. 

B. 

C. 

D. 

E. 

11. Ostrich, deer, whale

12. Lion, deer, mammal

13. Human beings, teachers, graduates

14. Plums, tomatoes, fruits

15. Flowers, clothes, whites

16. Uncle, parents, friends

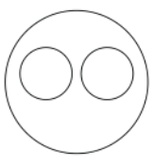
17. Jaipur, Rajasthan, Assam

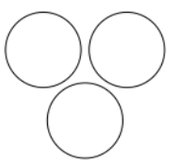
18. Engineer, doctor, people

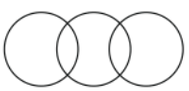
19. Thieves, lawyers, criminals

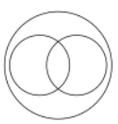
20. Sea, island, mountain

21. Find the diagram that shows the right relation between bike, furniture, and mouse?

A. 

B. 

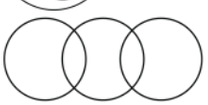
C. 

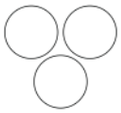
D. 

22. Which Venn diagram correctly illustrates the relationship between the following?

I. Train
II. Entertainment park
III. Satellite

A. 

B. 

C. 

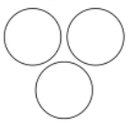
D. 

23. Identify the figure that best represents the relationship among the potato, vegetable, and pencil.

A. 

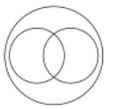
B. 

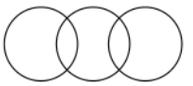
C. 

D. 

24. Which of the following diagrams best represents the relationship among brother, husband, and men?

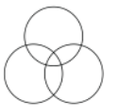
A. 

B. 

C. 

D. 

25. Which of the four figures will best represent the relationship among peacocks, birds, and mice?

A. 

B. 

C. 

D. 

SOLUTIONS

1. **(C)** Bus and car are different from each other but some passengers travel by bus and some travel by train.

2. **(B)** Principal and interest are different from each other. But both are parts of amount.

3. **(B)** All three are different professions.

4. **(D)** Professors who are also environmentalists are most represented in the board as an environmentalist is illustrated by the triangle and professors by the circle.

5. **(B)** Q part of the figure represents those girls who are players but not coaches.

6. **(D)** D indicates those students who like all three subjects.

7. **(B)** Because T represents the kites which are blue and pentagon.

8. **(B)** The regions represented by the numbers 1, 5, and 7 denote such people who can speak only one language.

9. **(D)** When compared with the above-given statement, we will get the answer as 2 as it represents snacks that are sweet but not crunchy.

10. **(B)** The required number is 2 as it includes Kerala, Rajasthan, and Gujarat but not Assam.

11. **(A)** The three have nothing in common.

12. **(B)** Lions and deer come in the mammal's category.

13. **(C)** Teachers and graduates come under human beings and some graduates can be teachers.

14. **(D)** Plums come under fruits, whereas tomatoes come under vegetables.

15. **(E)** Some flowers are white and some clothes are also white.

16. **(A)** Uncle, parents, and friends are entirely different from each other.

17. **(D)** Jaipur is part of Rajasthan and Assam is a separate state.

18. **(B)** Both engineers and doctors are people. But both of them are different from each other.

19. **(D)** All thieves are criminals, but lawyers are entirely different.

20. **(D)** Island is part of the sea, but the mountain is entirely different.

21. **(B)** The three are different from each other.

22. **(C)** The given three things are totally different from each other.

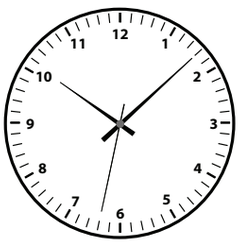
23. **(A)** Potato falls under the vegetable category and pencil neither is related to any of the given species nor is part of those.

24. **(B)** Husband and brother both fall under the men category, and there can be some husbands who are brothers and vice versa.

25. **(B)** Peacocks fall under the category of birds, and mice are not related to any of the two.

38 Clocks

Clock test-related questions are one form of a question that requires a lot of practice. Although these questions appear less frequently in exams, they are still important for GATE, JEE Main, and other engineering entrance examinations.



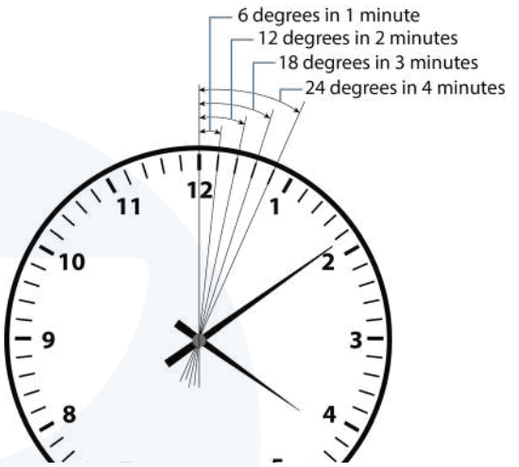
We'll try to cover some of the clock test problems and discuss the tactics and procedures for answering them in depth. Following that, there will be some practice questions for you to answer and a clock test to see how strong you are. You must be familiar with the concept of angle difference to comprehend the clock.

INTRODUCTION

Clocks are time-telling devices that measure and display the passage of time. Humans have been measuring time in various ways for millennia, including using sundials to measure the sun's movements, water clocks, candle clocks, and hourglasses.

The face of a dial watch or clock that we usually see is a circle whose circumference is divided into 60 equal parts, called minutes space. A clock generally has two hands. The smaller hand is called the hour hand or short hand, while the larger one is called the minute hand or long hand. The third hand is called the second hand. We don't take into consideration this second hand as the time-lapse or, say, the calculation of exact time up to seconds is a tedious exercise. But let's differentiate between these minute and second hands. First, consider the second and minute hands. In one hour, the minute hand makes one revolution and the second-hand goes around 60 times. This means that, in one minute, the second-hand passes over the minute hand 60 - 1 = 59 times and the two are also in line (but with 180 degrees between them) 59 times.

IMPORTANT POINTS



- One minute division in a watch is = 6° apart, i.e., in one minute, the 60-min hand moves 6°.
- One-hour division = 6° × 5 = 30° apart, i.e., in one hour, the hour hand moves 30° apart.
- Also, in one minute, the hour hand moves apart:
  - 15-min gap apart indicates a right angle or perpendicular.
  - 22 times in 12 h or 44 times in 24 h = right angle or perpendicular (1 day).
  - 30-minute interval apart at a straight angle or in a straight line (180°).
  - 11 times in 12 h or 22 times in 24 h for a straight angle (1 day).
  - In 12 h, the angle indicated by the hour hand equals 360°.
  - In 60 min, the angle drawn by the minute hand equals 360°.
  - Speed of hour hand = 0.5 DPM (degree per minute).

- Speed of minute hand = 6 DPM
- The angle of the hour hand from vertical at N o'clock = 30N

After going through the basics of the clock, we will be further looking at the types of questions that usually come in examinations regarding this topic such as:

1. Basic overlapping and coinciding of hands of the clock type questions
2. Angle-finding theory
3. Relative speeds of the hour and minute hands

Basic overlapping and coinciding of hands of the clock-type questions

First, these are some of the questions that are based on angles but don't need to be formulated. They are simply logic-based questions. These are called the basic overlapping and coinciding of hands of the clock-type questions.

The reason why we have these coinciding or overlapping situations between hands of the clocks is that the hands of a clock move at varying speeds, colliding and forming different angle forms among themselves at different times of the day.

These questions require thorough observation of a clock by a person and can be solved without applying any sort of formula or calculations. Look at the examples to understand these observational occurrences in a better way.

Point to remember: The hour hand and minute hand overlap each other 22 times in a day.

SOLVED EXAMPLES

1. In a day, how many times do the minute hand and hour hand coincide (or overlap or coincide together)?

A. 12 B. 22
C. 24 D. 48

Explanation: A day starts at 12 a.m. and ends at 11:59 p.m.; from 12 a.m. again a new day starts. If the hour hand and minute hand coincide or overlap each other, that means the angle between them is 0°. The first time they coincide in a day is at 12 a.m., then anywhere between 1 a.m. and 2 a.m., and it carries on in this way. The last time they will coincide is anywhere between 11 p.m. and 12 a.m.; then another day starts. So, if we calculate them in a span of 12 hours, they are coinciding for 11 times, then for a day, they will be coinciding for 11 × 2 = 22 times. Therefore, option B is the right answer.

2. In a day how many times the minute hand and hour hand are opposite to each other?

A. 44 B. 22
C. 42 D. 24

Explanation: Again we will be resorting to our earlier discussion. A day starts at midnight and ends at 11:59 p.m.; from midnight again a new day starts. If the hour hand and minute hand are opposite to each other, that means the angle between them is 180°. The first time they are opposite to each other in a day is somewhere between 12 and 1 a.m. (for now at this early stage, we would be solving this question by approximation method, but subsequently with the introduction of angle theory, we can do it precisely and accurately), then between 1 and 2 a.m., then between 2 and 3 a.m., and it carries on in this way. The last time they will coincide is between 11 p.m. and 12 a.m. So, if we calculate them in a span of 12 hours, they are opposite to each other for 11 times, then for a day they will be opposite to each other for 11 × 2 = 22 times. Therefore, option B is the right answer.

ANGLE-FINDING THEORY

We can find the angle between hour hand and minute hand of the clock by using this very important formula:

Angle between hands = **[$\frac{11}{2}$ × Minute – (30) × Hour]** when $\frac{11}{2}$ Minute > (30) Hour,

Angle between hands = **[(30) × Hour –** $\frac{11}{2}$ **× Minute]** when (30) Hour > $\frac{11}{2}$ Minute

SOLVED EXAMPLES

3. Find the angle between the hour hand and the minute hand at 2:20 o'clock?

A. 30 B. 40
C. 50 D. 52

Explanation: By simply using the angle-finding theory, we can find the angle between the two hands of the clock:
Angle between hands =
[($\frac{11}{2}$) Minute – (30) Hour]

Angle = [($\frac{11}{2}$) 20 – 30 × 2]

= [11 × 10 – 60]
= [110 – 60]
= 50°

4. Find the time between 3 and 4 o'clock when the hour hand and minute hand are at right angle to each other?

A. 30 $\frac{8}{11}$ min past 3

B. 31 $\frac{4}{11}$ min past 3

C. 32 $\frac{8}{11}$ min past 3

D. 33 $\frac{4}{11}$ min past 3

Explanation: When hour hand and minute hand are at right angles, then the angle between them is 90°. In such questions, where we are to find the angle between 1 hour span, say between 3 and 4, we will take the first unit, i.e., 3 because if we take 4 then the time will cross 4, then it will not be in between 3 and 4.
By simply using the angle-finding theory, we can find the angle between the two hands of the clock:

Angle between hands =
[($\frac{11}{2}$) Minute – (30) Hour]

90 = [($\frac{11}{2}$) minute – 30 × 3]

180 = ($\frac{11}{2}$) minute

180 × ($\frac{2}{11}$) = minute

360/11 = 32 minute ($\frac{8}{11}$) s

we can write it as 32 min 43 s ($\frac{8}{11}$ × 60 = 8 × 5.4 ≈ 43)

5. What is the possible time after 1, when a clock shows a 20° angle between the two hands of the clock between 1 p.m. and 2 p.m.?

A. 9 min 5 s past 1
B. 9 min 25 s past 1
C. 9 min 18 s past 1
D. 9 min 10 s past 1

Explanation: In this question, angle is given and here we have to find the time between 1 and 2 o'clock when the angle between minute and hour hands is 20°.

By simply using, the angle-finding theory, we can find the angle between the two hands of the clock:

Angle between hands =

$[(\frac{11}{2}) \times$ Minute $-$ (30) $\times$ Hour]

$20° = [(\frac{11}{2})$ minute $- 30 \times 1]$

$50 = (\frac{11}{2})$ minute

$50 * (\frac{2}{11}) =$ minute

$\frac{100}{11} = 9$ minute $(\frac{1}{11})$ s

we can write it as 9 min 5 s $(\frac{1}{11} \times 60 = 1 \times 5.4 \approx 5)$

RELATIVE POSITION OF THE HANDS

- The position of the minute hand relative to the hour hand is said to be the same, whenever the minute hand is separated from the hour hand by the same number of minute divisions and is on the same side (clockwise or anticlockwise) of the hour hand.
- Relative speed of the angle between minute hand and hour hand is 5.5°.

Proof

We see, a clock or a watch is a complete circle, so it has 360 degrees. Further, it is divided into 12 equal parts; i.e., each part is 360/12 = 30°.
As the minute hand takes a complete round in one hour, it covers 360° in 60 minutes.
Therefore, in 1 minute, it covers 360/60 = 6°.
Also, as the hour hand covers just one part out of the given 12 parts in one hour. This implies it covers 30° in 60 minutes, i.e., ½° per minute.
This implies that the relative speed of the minute hand is 6 − ½ = **5 ½ degrees per minute**.
(Relative speed in the same direction for two objects M1 and M2, where M1 > M2 is = M1 - M2)

- We will use the concept of relative speed and relative distance while solving problems on clocks.
- Any relative position of the hands of a clock is repeated 11 times in every 12 h.
- In every hour, the two hands are at right angles 2 times.
- In a day, the two hands are at right angles 44 times.
- If both the hands coincide, then they will again coincide after 65 min, i.e., in correct clock, both hands coincide at an interval of 65 min approx.

We would be practically understanding this concept. Just imagine hour hand and minute hand starting at 12 o'clock. After 1 h, the minute hand will be at 12, whereas the hour hand will be at 1. So, the difference between the time covered by both the hands is 55 'Minute Space.' So, it takes 1 hour to cover 55 minute spaces; for overlapping they should cover a total 60 minute space.
Thus, here is the calculation:
1 h → 55 min space.
? h → 60 min space.

$\frac{1 \times 60}{55}$ h = $\frac{60}{55}$ * 60 min (converting hour to minutes)

$= 65 \frac{5}{11}$ min.

⇒ If the two hands coincide in time less than 65 min, then the clock is too fast and if the two hands coincide in time more than 65 min, then the clock is too slow.

SOLVED EXAMPLES

6. A clock is started at afternoon, by 25 min past 8, the find the angle that the hour hand has turned through:

A. 255.25° B. 252.5°

C. 250° D. 241.5°

Explanation: In a clock, 12 h form 360°. So, one-hour forms 30°. Therefore, 8 h form 240° (30° × 8) degrees. In a minute, the hour hand moves 0.5°, so in 25 min it moves 0.5° × 25 = 12.5°. Thus, by 25 min past 8, the hour hand has turned through 240° + 12.5° = 252.5°.

7. At 8 a.m., a clock is set to show the right time. Every day, the clock loses 10 min. When the clock strikes 5 p.m. the next day, what time will it be?

A. 5:25 p.m. B. 4:45 p.m.

C. 5:42 p.m. D. 4:46 p.m.

Explanation: Time from 8:00 a.m. a day to 5:00 p.m. the next day = 33 hours

23 h 50 min of this clock = 24 h of the correct clock.

(23) $\frac{5}{6}$ of this clock = 24 h of the correct clock

33 h of this clock = $\frac{33 \times 143}{6 \times 24}$

= 32 h 46 min (approx.)

The correct time is 32 h 46 min after 08:00 a.m. = 46 min past 4 p.m.

8. A watch that gains consistently is 2 min slower at 1 p.m. on Sunday and 5 min faster at 8 p.m. the following Sunday. When was it correct?

A. 3 p.m. on Tuesday

B. 8 a.m. on Wednesday

C. 2 a.m. on Wednesday

D. 4 a.m. on Tuesday

Explanation: Time from 1 p.m. on Sunday to 8 p.m. on following Sunday = 7 days and 7 h = 7 × 24 + 7 = 175 h

The watch gains (2 + 5) min or 7 min in 175 h.

Now 7 min are gained in 175 h.

2 min are gained in (175 × $\frac{1}{7}$ × 2) h = 50 h = 2 days and 2 h

Watch is correct 2 days 2 h after 1 p.m. on Sunday.

It will be correct at 3 p.m. on Tuesday.

9. The minute hand of a clock overtakes the hour hand at an interval of 60 min of the correct time. How much a day does the clock gain or lose?

A. $120\frac{5}{11}$ min gain in a day

B. $135\frac{3}{11}$ min loss in a day

C. $130\frac{10}{11}$ min gain in a day

C. $126\frac{2}{11}$ min loss in a day

Explanation: In 1 h both the hands cover 55 min space.

$\Rightarrow \frac{60}{55} = \frac{12}{11}$ min space covered in 1 min of the actual time.

For the hands to coincide, they have to cover 60 min space

$\Rightarrow \frac{12}{11} \times 60 = \frac{720}{11} = 65\frac{5}{11}$ min in actual clock.

But it is given in the question that the clock coincides every 60 min.

Gain in 60 min $= 65\frac{5}{11} - 60 = 5\frac{5}{11} = \frac{60}{11}$ min in 60 min.

Gain in 1 min = $\frac{60}{11} \times \frac{1}{60} = \frac{1}{11}$ min in 1 min.

Loss in 24 h = $\frac{60}{11} \times (24 \times \frac{60}{60}) = \frac{1440}{11} = 130\frac{10}{11}$ min is gained in a day.

PRACTICE QUESTIONS

1. For how many times does the hands of a clock form a right angle in a day?

A. 22 B. 24
C. 44 D. 48

2. If the two hands in a clock are 4 min 48 s divisions apart, then the angle between them is

A. 23.6° B. 28°
C. 24.4° D. 28.8°

3. What will be the acute angle between the hands of a clock at 1:20?

A. 105° B. 90°
C. 80° D. 95°

4. In the same time that the hour hand moves by 21°, how many degrees does the minute hand move?

A. 248° B. 252°
C. 256° D. 260°

5. What is the possible time after 5, when a clock shows 45° angle between the two hands between 5 p.m. and 6 p.m.?

A. 32 min 5 s past 5 p.m.
B. 33 min 25 s past 5 p.m.
C. 34 min 18 s past 5 p.m.
D. 35 min 27 s past 5 p.m.

6. What is the total angle traced by both minute and hour hands at 4:24?

A. 131° B. 132°
C. 133° D. 134°

7. What will be the acute angle between hands of a clock at 5:40?

A. 105° B. 75°
C. 95° D. 70°

8. A clock is started in the morning, by 44 min past 6, the hour hand has turned through:

A. 215.25° B. 190°
C. 202° D. 241.5°

9. The reflex angle between the hands of a clock at 8 h 20 min is

A. 280° B. 192 °
C. 230° D. 210 °

10. Find the mirror image of the clock when the time is 06:12.

A. 5:20 B. 5:22
C. 5:48 D. 5:42

11. Approximately at what time between 12 p.m. and 1 a.m., will the minute hand and hour hand of the clock be exactly opposite to each other?

A. 01:36 B. 01:35
C. 01:43 D. 01:32

12. When will the minute and hour hands of the clock come together in a straight line between 4 and 5 o'clock?

A. 04:50 B. 04:52
C. 04:54 D. 04:56

13. What is the possible time when a clock shows 33° angle between the two hands of the clock between 1 p.m. and 2 p.m.?

A. 1:09 min B. 1:08 min
C. 1:07 min D. 1:06 min

14. A clock shows 7 o'clock in the morning. When the clock strikes 6 o'clock the next morning, how much will the hour's hand rotate?

A. 333° B. 300°
C. 330° D. 303°

15. At what time between 1:30 and 2 will the hands of a clock be at right angles?

A. 1:50 B. 1:52
C. 1:54 D. 1:56

16. A clock is set to show the correct time at 5 a.m. The clock uniformly loses 18 min in a day. What will be the actual time when the clock shows 5 p.m. the next day?

A. 4:33 p.m. B. 4:35 p.m.
C. 5:22 p.m. D. 4:42 p.m.

17. The minute hand of a clock overtakes the hour hand at an interval of 63 min of the correct time. How much a day does the clock gain or lose approximately?
A. 56 min gain in a day
B. 52 min loss in a day
C. 50 min loss in a day
C. 59 min gain in a day

18. At 4 p.m., a clock is set right. What is the correct time when the clock reads 9 p.m. on the same day if it gains 1 min in an hour?
A. $55\frac{5}{61}$ min past 8.
B. $54\frac{5}{61}$ min past 8.
C. $53\frac{6}{61}$ min past 8.
D. $55\frac{6}{61}$ min past 8.

19. The time was right at 1 a.m. on a watch. In a 24-h period, the clock loses 55 min. When the clock reads 1 p.m. on the fifth day, what is the true time?
A. 10 min past 1 p.m.
B. 14 min past 4 p.m.
C. 17 min past 2 p.m.
D. 20 min past 3 p.m.

20. At 4 a.m., a clock is set right. In a 24 h period, the clock advances (gains) 10 min. When the clock reads 9 p.m. the next day, what is the true time?
A. 24 min past 8 p.m.
B. 32 min past 8 p.m.
C. 42 min past 8 p.m.
D. 48 min past 8 p.m.

21. Mark the correct statements.
I. The angle between minute hand and hour hand at 3:20 o'clock is 30°.
II. In half a day, the minute hands and hour hand coincide (or overlap or coincide together) for 22 times.
A. Only I B. Only II
C. Both I and II D. Neither I and II

22. A clock shows the correct time at 10 a.m. The clock gains 10 min in 24 h. What will be the correct time when the clock shows 2 p.m. on the next day?
A. 24 min past 1 p.m.
B. 30 min past 1 p.m.
C. 40 min past 1 p.m.
D. 48 min past 1 p.m.

23. A watch, which gains uniformly, is 4 min slow at 12 noon on Sunday, and is 4 min 48 s fast at 2 p.m. on the following Sunday. When was it correct?
A. 3:36 p.m. on Wednesday
B. 4:18 p.m. on Thursday
C. 2:52 p.m. on Friday
D. 5:16 p.m. on Wednesday

24. The minute hand of a clock overtakes the hour hand at intervals of 62 min of the correct time. How much a day does the clock gain or lose approximately?
A. 86 min B. 89.2 min
C. 85.25 min D. 80.20 min

25. A clock is set right at 5 p.m. If it gains one minute in an hour, then what is the true time when the clock indicates 12 a.m. on the same day?
A. $51\frac{7}{61}$ min past 11.
B. $56\frac{5}{61}$ min past 11.
C. $53\frac{7}{61}$ min past 11.
D. $55\frac{5}{61}$ min past 11.

SOLUTIONS

1. **(C)** Since these types of questions can be easily solved here we will give an apt justification as to why they must be 44 times.

In 60 min, the minute hand rotates 360 degrees. This means that 6t, where t is the number of minutes past midnight, equals the angle of the minute hand.

In 60 min, the hour hand rotates 30 degrees. This means that 0.5t determines the tilt of the hour hand.

The hands start together at midnight. The first time they make a 90° angle is when the minute hand has moved 90 degrees further than the hour hand, so this is given by the equation:

$6t = 0.5t + 90$

$5.5t = 90$

$t = 16\ \frac{4}{11}$ (16 min and 4/11 s)

To put it another way, it's around 16 min past midnight.

When the minute hand has gained another 180 degrees on the hour hand and is 90 degrees behind it, the next time is:

$6t = 0.5t + 270$

$5.5t = 270$

$t = 49\ \frac{1}{11}$ (49 min and 1/11 s)

At about 11 minutes to 1 o'clock.

For every 180 degrees that the minute hand gains on the hour hand, there will be one 90° angle, so every $49\ \frac{1}{11} - 16\ \frac{4}{11} = 32\ \frac{8}{11}$ minutes

24 h is 1440 min. $\frac{1440}{32\frac{8}{11}} = 44$

2. **(D)** In a clock, each minute makes 6°

$\therefore$ 4 min 48 s $(\frac{48}{60} = \frac{4}{5})$ minutes will make

$6 \times 4\frac{4}{5} = 6 \times \frac{24}{5} = 28.8°$

3. **(C)** We can simply do this question by the angle-finding theorem.

Angle between hands =

$[(\frac{11}{2})$Minute – (30) Hour]

when $\frac{11}{2}$ Minute > (30) Hour,

Angle = $[\frac{11}{2}\ 20 - (30)\ 1] = 110 - 30 = 80°$

Alternatively: At 1 o'clock, minute hand will be 5 × 6 = 30° behind the hour hand.

In 20 minutes, the minute hand will gain

$\frac{11}{2} \times 20 = 110$

$\therefore$ Angle between hour hand and minute hand = 110 – 30 = 80°

4. **(B)** The hour hand moves 30° when it completes 1 h or 60 min and in the same time the minute hand moves 360°. So 'x' number of minutes will be covered in 21°:

$\Rightarrow \frac{21}{30} \times 60 = 42$ min

$\Rightarrow$ In the meanwhile, the minute hands will trace 42 × 6 = 252° [1 min = 6°]

5. **(D)** In this question, the angle is given and we have to find the time between 5 and 6 o'clock when the angle between minute and hour hands is 45°.

By simply using the angle-finding theory, we can find the angle between the two hands of the clock:

Angle between hands =

$[(\frac{11}{2})$ Minute – (30) Hour]

$45° = [(\frac{11}{2})$ minute $- 30 \times 5]$

$195 = (\frac{11}{2})$ minute

$195 \times (\frac{2}{11}) =$ minute

$\frac{390}{11} = 35$ minute $\frac{5}{11}$

we can write it as 35 min 27 s $(\frac{5}{11} \times 60 \approx 27)$

6. **(B)** In a clock, 12 h form 360°. So, 1 h forms 30°. Therefore, 4 h form 120° (30° × 4) degrees. In a minute, the hour hand moves 0.5°, so in 24 min it moves 0.5° × 24 = 12°. Thus, by 24 min past 4, the hour hand has turned through 120° + 12° = 132°.

7. **(D)** We can simply do this question by angle-finding theorem.

Angle between hands =

$[\frac{11}{2}$ **Minute – (30) Hour]**

when $\frac{11}{2}$ Minute > (30) Hour,

Angle = $[\frac{11}{2}$ 40 − (30)5] = 220 − 150 = 70°

Alternatively: At 5 'oclock, the minute hand will be 5 × 30 = 150° behind the hour hand.

In 40 min, the minute hand will gain $\frac{11}{2}$ × 40 = 220

∴Angle between hour hand and the minute hand = 220 − 150 = 70°.

8. **(C)** In a clock, 12 h form 360°. So, 1 h forms 30°. Therefore, 6 h forms 180° (30° × 6) degrees. In a minute, hour hand moves 0.5°, so in 44 min it moves 0.5° × 44 = 22°. Thus, by 25 min past 8, the hour hand has turn through 180° + 22° = 202°.

9. **(C)** To find the reflex angle of a given angle, we need to subtract the given measure from 360°. So, the reflex angle of 60° = 360° − 60° = 300°. Therefore, the reflex angle of 60° is equal to 300°.

The angle between hand =

[(30) Hour – $\frac{11}{2}$ **Minute]**

when (30) Hour > $\frac{11}{2}$ Minute

Angle = 30 × 8 − $\frac{11}{2}$ × 20

Angle = 240 − 110 = 130°

Now the reflex angle is = 360° − 130° = 230°

10. **(C)** We need to subtract from 12:00 or 11:60 to get mirror image time. Mirror image of 06:12; 11:60 − 06:12 = 5:48

11. **(D)** When the hour hand and the minute hand are opposite to each other, then the angle between them is 180°. In such questions where we are to find an angle between 1 h span, say, between 3 and 4, we will take the first unit, i.e., 3 because if we take 4, then the time will cross 4, then it will not be in between 3 and 4.

By simply using the angle-finding theory, we can find the angle between the two hands of the clock:

Angle between hands= **[(30) Hour –** $\frac{11}{2}$ **Minute]** when (30) Hour > $\frac{11}{2}$ Minute

180 = 30 × 12 − $\frac{11}{2}$ × min

$\frac{11}{2}$ × min = 360 − 180 = 180

Minute = 180 × $\frac{2}{11}$ = $\frac{360}{11}$ = 32 min 43 min

($\frac{8}{11}$ × 60 ≈ 43)

12. **(C)** When the hour hand and minute hand of the clock come in a straight line then the angle between them is 180°. In such questions where we are to find the angle between 1 h span, say, between 3 and 4, we will take the first unit, i.e., 3 because if we take 4, then the time will cross 4, then it will not be in between 3 and 4.

By simply using the angle-finding theory, we can find the angle between the two hands of the clock:

Angle between hands =

$[\frac{11}{2}$ **Minute** − **(30) Hour]**

when (30) Hour < $\frac{11}{2}$ Minute

180 = $\frac{11}{2}$ × min − 30 × 4

$\frac{11}{2}$ × min = 180 + 120 = 300°

Minute = 300 × $\frac{2}{11}$ = $\frac{600}{11}$ = 54 min 32 s

($\frac{6}{11}$ × 60 ≈ 32)

13. (D) In this question, the angle is given, and we have to find the time between 1 and 2 o'clock when the angle between the minute and hour hands is 33°.
By simply using the angle-finding theory, we can find the angle between the two hands of the clock:

Angle between hands =

[$(\frac{11}{2})$ Minute – (30) Hour]

when (30) Hour < $\frac{11}{2}$ Minute

33 = [$(\frac{11}{2})$ minute – 30×1]

33 = $(\frac{11}{2})$ minute

33 × $(\frac{2}{11})$ = 6 minutes

14. (C) In 12 hours, the hand turns 360°.
Here, the difference between time = 11 hours
Then, required angle = 11 × 30 = 330°

15. (C) In this question, the angle is given, and we have to find the time between 1:30 and 2 o'clock when the angle between the minute and hour hands is 90°.
By simply using the angle-finding theory, we can find the angle between the two hands of the clock:
Angle between hands =

[$(\frac{11}{2})$ Minute – (30) Hour]

90 = [$(\frac{11}{2})$ minute – 30 × 1.5]

135, (90 + 45 = 135) = $(\frac{11}{2})$ minute

135 × $\frac{2}{11}$ = 24 min 22 s ($\frac{4}{11}$ × 60 ≈ 22)

So, the time between 1:30 and 2 at which the angle between hands of the clock is at 90° would be 24 min 22 s past 1:30, that's approximately at 1:54

16. (A) Time from 5:00 a.m. a day to 5:00 p.m. the next day = 36 h
23 h 42 min of this clock = 24 h of the correct clock.

(23) $\frac{7}{10}$ of this clock = 24 h of the correct clock

36 h of this clock = $\frac{36 \times 23\left(\frac{7}{10}\right)}{24}$

= 35 h 33 min (Approx.).
The correct time is 35 h 33 min after 05:00 a.m.
= 4 h 33 min.
Alternatively: We know that 18 min is lost in a day. Total no of hours from 5 a.m. to 5 p.m. is 36 h, that's 1.5 day.
If 18 min is lost in 1 day, then by unitary method, we can calculate the minutes lost in 1.5 day as well. It will be 27 min (18 × 1.5 = 27).
Now we need to find the actual time when the clock shows 5 p.m. on the next day; It will be 27 min before 5 p.m., that's 4:33 p.m. (5:00 – 0:27 = 4:33).

17. (A) In 1 hour both the hands cover 55 min space.
⇒ 60/55 = 12/11 min space covered in 1 min of the actual time.
for the hand to coincide, hands have to cover 60 min space
⇒ 12/11 × 60 = 720/11 = $65\frac{5}{11}$ min in actual clock.
But the clock coincides every 63 min.

Gain in 60 min= $65\frac{5}{11}$ - 63 = $2\frac{5}{11}$ = $\frac{27}{11}$ min in 60 min.

Gain in 1 min = $\frac{27}{11} \times \frac{1}{60} = \frac{27}{660}$ s in 1 min.

Gain in 24 h ⇒ $\frac{27}{11} \times (24 \times \frac{60}{63}) = \frac{38880}{693} \approx$ 56 min is gained in a day

18. (A) Time interval indicated by incorrect clock = 9 p.m. – 4 p.m. = 5 h.
Time gained by incorrect clock in one hour

= + 1 min = $+\frac{1}{60}$ h.

Using the formula →

$$\frac{\text{True time interval}}{\text{Time interval in incorrect clock}}$$

$$= \frac{1}{1 + \text{hour gained in 1 h by incorrect clock}}$$

$$\Rightarrow \frac{\text{True time interval}}{5} = \frac{1}{1+\frac{1}{60}}$$

$$\Rightarrow \text{True time interval} = 5 \times \frac{60}{61} = 4\ \frac{57}{61}$$

$\therefore$ True time = 4 p.m. + $4\ \frac{57}{61}$ h = 8 p.m. + $\frac{57}{61}$ h = 8 p.m. + $\frac{57}{61}$ × 60 min.

= $55\ \frac{5}{61}$ min past 8.

19. (B) Time from 1 a.m. on a day to 1 p.m. on the 5th day = 132 h.

23 h 05 min of this clock = 24 h of the correct clock.

$(23\frac{1}{12}$ h) $\frac{277}{12}$ h of this clock = 24 h of the correct clock.

132 h of this clock = $[24 \times (\frac{12}{277}) \times 132]$ h of the correct clock

$\Rightarrow \frac{38,016}{277}$ = 137 h 14 min, $(\frac{67}{277} \times 60)$

Therefore, the correct time is 137 h 14 min after 1 a.m.

This is 14 min past 4 p.m.

20. (D) Time from 4 a.m. on a day to 9 p.m. on the following day = 29 h.

24 h 10 min of this clock = 24 h of the correct clock.

$(24\frac{1}{6}$ h) $\frac{145}{6}$ h of this clock = 24 h of the correct clock.

29 h of this clock = $[24 \times (\frac{6}{145}) \times 29]$ h of the correct clock

= 28 h 48 min of the correct clock.

Therefore, the correct time is 28 h 48 min after 4 a.m.

This is 48 min past 8 p.m.

21. (D) Statement I is incorrect**.** By simply using the angle-finding theory, we can find the angle between the two hands of the clock:

Angle between hands= $[(\frac{11}{2})$ Minute – (30) Hour]

Angle = $[(\frac{11}{2})\ 20 - 30 \times 3]$

= [11 × 10 – 90]

= [110 – 90]

= 20°

Statement II is again incorrect. A day starts at 12 a.m. and ends at 11:59 p.m.; from 12 a.m. again a new day starts. If the hour hand and the minute hand coincide or overlap each other, that means the angle between them is 0. The first time they coincide in a day is at 12 a.m., then anywhere between 1 a.m. and 2 a.m., and it carries on in this way. The last time they coincide is anywhere between 11 p.m. and 12 a.m.; then another day starts. So, if we calculate them in a span of 12 h, they are coinciding for 11 times, then for a day they will be coinciding for 11 × 2= 22 times. Here we have been asked to find for half a day, which will be 11 times.

22. (D) Time from 10 a.m. on a day to 2 p.m. on the following day = 28 h.

24 h 10 min. of this clock = 24 h of the correct clock.

$\frac{145}{6}$ h of this clock = 24 h of the correct clock.

28 h of this clock = $[24 \times \frac{6}{145} \times 28]$ h of the correct clock

≈ 27 h 48 min of the correct clock.

Therefore, the correct time is 27 h 48 min. after 10 a.m., that's 48 min past 1 p.m.

23. (D) From Sunday 12 noon to the following Sunday at 2 p.m. = 7 days 2 h = 170 h.

The watch gains $4 + 4\frac{48}{60} = 8\frac{4}{5}$ min in 170 h.

$\therefore$ The watch gains 4 min in $\frac{4}{8\frac{4}{5}} \times 170 = \frac{5}{11}$

x 170 = 77 h 16 min $(\frac{3}{11}$ x 60 ≈ 16).

Now, 77 h 16 min = 3 days 5 h 16 min
3 days 5 h 16 min from Sunday noon = 5:16 p.m. on Wednesday.

24. (D) In 60 min, the minute hand gains 55 min over the hour hand in an accurate clock.
The minute hand must gain 60 min over the hour hand to re-join the hour hand.

55 min. are gained in $(\frac{60}{55} \times 60)$ min = 65 $\frac{5}{11}$ min.

But, they are together after 62 min.

$\therefore$ Gain in 62.min = $65\frac{5}{11} - 62 = 3\ \frac{5}{11}$ min.

Gain in 24 h = $\frac{38}{11} \times 60 \times \frac{24}{62}$ min = $\frac{27,360}{341}$ min $\approx$ 80.2 min

$\therefore$ The clock gains 80.2 min approximately in 24 h.

25. (C) Time interval indicated by incorrect clock = 5 p.m. – 12 a.m. = 7 h.
Time gained by incorrect clock in one hour = +1 min = $+\frac{1}{60}$ h.

Using the formula→

$$\frac{\text{True time interval}}{\text{Time interval in incorrect clock}} = \frac{1}{1 + \text{hour gained in 1 h by incorrect clock}}$$

$$\Rightarrow \frac{\text{True time interval}}{7} = \frac{1}{1+\frac{1}{60}}$$

$\Rightarrow$ True time interval = $7 \times \frac{60}{61} = 6\ \frac{54}{61}$

$\therefore$ True time = 5 p.m. + $6\ \frac{57}{61}$.h = 11 p.m. + $\frac{54}{61}$ h = 11 p.m. + $\frac{54}{61} \times 60$ min.

$\Rightarrow 53\ \frac{7}{61}$ min past 11.

39 Calendars

Calendar test-related questions require a lot of practice. Although such questions appear less frequently in tests, these are important with respect to GATE, JEE Main, and other engineering entrance examinations. If you understand the fundamentals of these problems, solving them will become second nature to you. It's possible that you'll be asked if the year in question is a leap year or not! You will be given a date and a day, and you will be asked to predict which day falls on that date the next year, as well as many others. In such questions, one has to find the days of the week on a particularly given date. The process of finding it is tied with obtaining the number of odd days.

We'll try to cover some of the calendar test problems and discuss the tactics and procedures for answering them in depth. Then some practice questions are given for you to answer and a calendar test to see how much you have mastered the concept. You must be familiar with the concept of odd days in order to comprehend the calendar.

INTRODUCTION TO CALENDAR

A calendar is a mechanism for keeping track of days. This is accomplished by naming time intervals, which are commonly days, weeks, months, and years. Within such a system, a date is the designation of a single, unique day. A calendar is a physical record of such a system (typically made of paper). The calendar we use today is called 'The Gregorian calendar'. The Gregorian calendar is the most widely used calendar on the planet. Pope Gregory XIII introduced it in October 1582 as a revision and replacement for the Julian calendar. The main adjustment was to space leap years differently, resulting in an average calendar year of 365.2425 days, which is closer to the 365.2422-day 'tropical' or solar' year determined by the earth's movement around the sun. The time in which the earth travels around the sun is called as a solar year, and it is equal to 365 days 5 h 48 min and 47 $^{1}/_{2}$ s.

1. A year contains 365.2422 days approximately.
2. The common year or a non-leap year consists of 365 days.
3. The difference between a common year and a solar year is therefore 0.2422 of a day and we consider it by adding a whole day to every fourth year.
4. This is the reason why we have 366 days in every 4th year.
5. The years which have the extra day are called leap years. The day is inserted at the end of February, the difference between 4 common years and 4 solar years is 0.969 of a day.

If, therefore, we add a whole day to every 4th year, we add too much by 0.0312 of a day. To take account of this, we omit the extra day three times every 400 years.

Calendars: Important terms

1. *Day:* It is the basic unit of the calendar. A day has 24 h and 7 days makes up a week.
2. *Week:* A week consists of 7 days, which are Sunday, Monday, Tuesday, Wednesday, Thursday, Friday, and Saturday. Approximately 52 weeks makes up a year.
3. *Month:* A month has 28/29/30/31 days. A month is the 12th part of a year, or a year consists of 12 months.
4. *Year:* Year is the time taken by earth to make one revolution around the sun. A year is the 100th part of a century.
5. *Date:* A date is a term given to each day in general. The 28th/29th/30th/31st part of a month is the date. The 365th/366th part of a year (Lunar/Leap Year) is also known as the date.

6. *Century:* A block of 100 years is called a century.
7. *Ordinary Year:* The year which is not a leap year is called an ordinary year. An ordinary year has 365 days.
8. *Leap Year:* There are 366 days in a leap year. If the year is not a century, any year divisible by four is a leap year. A leap year occurs once every fourth century and once every other century. If the year is divisible by both 4 and 400, it is a leap year.
   For example: 1700 is not a leap year because it is not divisible by both 4 and 400.
9. *What is meant by odd days?*
   On a given date, we must determine the day of the week. We use the concept of 'odd days' to do this. Odd days occur when the number of days in a certain time exceeds the total number of weeks.
   We have clearly understood the relevance of finding odd days in relation to the concept of finding days that fall on a specific day up to this point. Now we'll look into how to figure out how to calculate these odd days for a particular date.

Counting of Odd Days: As we all know that, 1 ordinary year contains 365 days which is = 52 weeks + 1 day
Therefore, 1 ordinary year has 1 odd day.
So, we can say that 1 leap year = 366 days = (52 weeks + 2 days)
Therefore, 1 leap year has 2 odd days.
Now we will be calculating number of odd days in a century.
1 century or 100 years = 76 ordinary years + 24 leap years.
The number of odd days = (76 x 1 + 24 x 2) odd days = 124 odd days.
Now, 124 days = (17 weeks + days) = 5 odd days.
So, the number of odd days in a century or 100 years = 5
Then the number of odd days in 200 years = (5 x 2) = 3 odd days.
Number of odd days in 300 years = (5 x 3) = 1 odd day.
Number of odd days in 400 years = (5 x 4 + 1) = 0 odd day.
Similarly, each one of 800 years, 1,200 years, 1,600 years, 2,000 years etc. has 0 odd days.
Day of the week related to odd days (assuming that 1 AD January 1st is a Monday):

NO. OF DAYS:	0	1	2	3	4	5	6
DAY:	Sun.	Mon.	Tue.	Wed.	Thu.	Fri.	Sat.

PRACTICE QUESTIONS

1. How many leap years are there between 1900 and 2000?
A. 20 B. 25
C. 24 D. 26

2. Today is Wednesday. After 57 days, what day will it be?
A. Monday B. Tuesday
C. Sunday D. Thursday

3. What will be the day of the week on 17th August 2011?
A. Saturday B. Sunday
C. Wednesday D. Monday

4. If 7th April 2005 is Thursday, what was the day of the week on 7th April 2004?
A. Sunday B. Tuesday
C. Saturday D. Wednesday

5. On what date of March 2005 did the first Monday fall?

A. 4th March
B. 5th March
C. 7th March
D. 8th March

6. FFrom the options given below, find the ones that are leap years

I. 1988 II. 1800
III. 1830 IV. 1920

A. Only IV and I
B. Only IV, I, and II
C. Only IV and III
D. Only IV and III

7. If 25th April 2020 was Saturday, what will be the day on 25th April 2021?

A. Monday B. Tuesday
C. Wednesday D. Sunday

8. If today is Monday, then what will be the day after 149 days?

A. Monday B. Tuesday
C. Wednesday D. Thursday

9. If 20th February 2012 was Monday, what was the day on 20th February 2013?

A. Saturday B. Sunday
C. Tuesday D. Wednesday

10. If today is Thursday, then what will be the day after 1,757 days?

A. Monday B. Tuesday
C. Wednesday D. Thursday

11. Which of the following is a leap year?

A. 1500 B. 1600
C. 1700 D. 1800

12. If 29th March 2006 was on Wednesday, what was the day on 1st April 2007?

A. Saturday B. Sunday
C. Tuesday D. Wednesday

13. How many days are there in y weeks y days?

A. $y^2 + y$ B. $2y + y$
C. $7y^2$ D. $8y$

14. How many non-leap years are there from 1701 to 1800?

A. 24 B. 26
C. 75 D. 76

15. For how many times does the 29th day of a month occur from 1601 to 2000?

A. 4097 B. 4703
C. 4497 D. 3333

16. If 21st February 1988 was on Sunday, what was the day on 20th April 1989?

A. Saturday B. Friday
C. Tuesday D. Wednesday

17. The date is February 21st, and the day is Sunday. It is a leap year. After 5 years, determine the day of the week on this date.

A. Thursday B. Sunday
C. Saturday D. Friday

18. It was Wednesday on 1st January, 1997. What was the day of the week 1st January, 2001?

A. Monday B. Tuesday
C. Wednesday D. Sunday

19. If every second Saturday and all Sundays are holidays for months of July and August 2020, then find the total number of working days for these months.

A. 47 B. 48
C. 49 D. 50

20. On what date of January 2005 did the first Saturday fall?

A. 1th January B. 2th January
C. 3th January D. 5th January

21. What was the day of the week on 23rd July 1776?

A. Monday B. Tuesday
C. Saturday D. Sunday

22. Which of the years next to 2004 will have the same calendar as that of the year 2004?

A. 2028 B. 2030
C. 2032 D. 2034

23. On which date does the 2nd Friday of March 2023 fall?

A. 9th March B. 10th March
C. 11th March D. 12th March

24. Mark the correct statements.

I. 1700 was a leap year.
II. The calendar of 2001 will be repeated in 2006.
III. 15th August 1947 was on Friday.

A. Only I and II B. Only II and III
C. Only III D. Only II

25. What was the day of the week on 19th June 1998?

A. Monday B. Wednesday
C. Friday D. Sunday

26. Fourth Saturday and every Sunday are a holiday in a 28 days' month. Read the following sentences and mark the correct inferences.

I. Total working days will be 23 in the given month
II. 4th Saturday will fall on the 27th day.

A. Only I B. Only II
C. Both I and II D. Neither of them

27. On which date does the 3rd Wednesday of November 2030 fall?

A. 18th November B. 19th November
C. 20th November D. 21th November

28. The year next to 1997 will have the same calendar as that of the year 1997?

A. 1997 B. 2000
C. 2001 D. 2003

29. What will be the day of the week on 23rd August 2015?

A. Sunday B. Saturday
C. Wednesday D. Monday

30. On what dates of February 2002 did Friday fall?

A. 1st, 8th, 14th, and 22nd.
B. 1st, 8th, 15th, and 21st.
C. 1st, 8th, 15th, and 22nd.
D. 1st, 7th, 15th, and 22nd.

SOLUTIONS

1. **(C)** We have been asked to calculate the years which are multiples of 4 between 1900 and 2000, so we must exclude 1900 and 2000. Though they are multiples of 4, the question demands years between them, so we must exclude them.
So, the leap year would be 1904, 1908, 1912..... 1996
Here, we will be solving this question by using Arithmetic Progression: -
Nt = [(L2 - L1)/d] + 1 [where, Nt = no of terms, L1 = first term, L2 = last term, d = common difference.]
Nt = 1996 - 1904 = 92/4 = 23 + 1 = 24
So, the number of years which are divisible by 4 are 24. So, there are 24 leap years between 1900 and 2000.

2. **(D)** Each day of the week is repeated after 7 days. If today is Wednesday, that means after 7 days, it will again be Wednesday. Dividing (57/7 = 1 odd day). So, after 57 days, it will be Thursday.

3. **(C)** 17th August 2011 = (10 years from 2000 + period from 1/1/2011 to 17/8/2011)
The no. of odd days in 1600 years = 0
The no. of odd days in 400 years = 0
10 years = (2 leap years + 8 ordinary years) = (2 x 2 + 8 x 1) = 12 = 5 odd days.
No. of days from 1st January to 17th August = (31 + 28 + 31 + 30 + 31 + 30 + 31 + 17) = 229 days = (32 weeks + 5 days) = 5 odd days.
Total number of odd days = (0 + 0 + 5 + 5) = 10 = 3 odd days.

So, the day on 17th august 2011 was Wednesday.

4. **(D)** The year 2004 is a leap year. So, it has 2 odd days.
But February 2004 is not included because we are calculating from April 2004 to April 2005.
So, it has 1 odd day only.
The day on 7th April 2005 will be 1 day beyond the day on 7th April 2004.
Given that, 7th April 2005 is Thursday.
7th April 2004 is Wednesday (1 day before 7th April 2005).

5. **(C)** First we have to find the day on 1st March 2005
1/3/2005= (2004 years + period from 1/1/2005 to 1/3/2005)
Odd days in 1600 years = 0
Odd days in 400 years = 0
4 years = (1 leap year + 3 ordinary years) = (1 × 2 + 3 × 1) = 5 odd days.
Jan., Feb., Mar. (31 + 28 + 1 = 60 days = (8 weeks + 4 days) = 4 odd days.
Total numbers of odd days = (0 + 5 + 4 = 9) = 2 days
That 1st March was Tuesday. So, the first Monday falls on 7th March.

6. **(A)** A leap year is the one that is divisible by 4. So, 1988 and 1920 are leap years but not 1830. 1800 is not a leap year because it is a century year, and to be a leap year it must be divisible by both 4 and 400. Therefore, only statements I and IV are correct.

7. **(D)** Here we will use the concept of odd days. Since 2020 is a leap year so it has 2 odd days. But here we would not add 2 days to get the day on the same day next year because February 2020 which has an extra 1 day in leap year does not include in the span of 25th April 2020 to 25th April 2021. So, we will add only 1 odd day to get the day on the same date the next day. Therefore, it was Sunday on 25th April 2021.

8. **(C)** In questions where we have been asked to find the day after 'n' number of days, we have to simply divide that number of days (n) from 7 because days repeat themselves after 7 days. If it is completely divisible by 7, then that day will be the same as the given day. In this question = 21 weeks + 2 odd days, so this is not completely divisible by 7. Therefore, we need to add this odd day to the present day to get the actual day after 149 days. So, it will be Wednesday.

9. **(D)** Now this question is on the same line as the previous question. Here we will use the concept of odd days. Since 2012 is a leap year, it has 2 odd days. But here is a twist as this would add 2 days to get the day on the same day next year because February 2012 which has an extra 1 day in a leap year is included in the span of 20th February 2012 to 20th February 2013. So, we will add 2 odd days to get the day on the same date next year. Therefore, it was Wednesday on 20th February 2013.

10. **(D)** In questions where we have been asked to find the day after 'n' number of days, we have to simply divide that number of days (n) from 7 because days repeat themselves after 7 days. If it is completely divisible by 7, then that day will be the same as the given day. In this question = 251, so this is completely divisible. Therefore, after 1757 days, it will again be Thursday.

11. **(B)** Leap year is the one which is divisible by both 4 and 400, but the twist is that for century years it must be divisible by 400 as well to be called a leap year. So out of all options, only 1600 is divisible by both 4 and 400. Therefore, it is only a century year.

12. **(B)** Now this question is on the same line as the previous questions. Here we will use the concept of odd days. Since 2006 is a non-leap year, it has 1 odd day. So, we will add a 1-day odd day to get the day on the same date the next day. Therefore, it was Thursday on 29th March 2007. Now, adding 3 (29th to 1st) more days to this outcome

date we will get the required day. So, it will be Sunday on 1st April 2007.

13. **(D)** Let us understand this question through examples. Suppose y = 2, then the total number of days will be 7 × 2 + 2 = 16 or y = 5 then the number of days will be 7 × 5 + 5 = 40. So, by these examples that days are multiple of 8, so we can say that 7y + y = 8y.

14. **(D)** We have been asked to calculate the years which are not multiples of 4 from 1701 to 1800.
So, the leap years would be 1704, 1708, 1712..... 1796 {Note: 1800 is not a leap year}
Here, we will solve this question by using Arithmetic Progression:
Nt = [(L2 - L1)/d] + 1 [where, Nt=no of terms, L1 = first term, L2 = last term, d = common difference.]
Nt = 1796 - 1704 = 92/4 = 23 + 1 = 24
So, the number of years which are divisible by 4 are 24. So, there are 24 leap years from 1701 to 1800. But here we have to find non-leap years so we will simply subtract 24 from number of years from 1701 to 1800, which is 100. There a total number of non-leap years are 76.

15. **(C)** Total number of years from 1601 to 2000 is 400. So, in 400 years, we have 97 leap years. But February has only 28 days in a non-leap year and 29 days in leap year; therefore, we would not calculate non-leap years containing February months since it doesn't have 29 days.
The total number of months are ⇒ 400 × 11 = 4400 (excluding all Februarys)
Now add these 97 Februarys to the total number of months to get the actual number of months that has 29th days. (4400 + 97 = 4497)
Therefore, we have 4497 months which have 29th days from 1601 to 2000.

16. **(B)** Now this question is on the same line as the previous question. Here we will use the concept of odd days. Since 1988 was a leap year, it has 2 odd days. But here is a twist as this would add 2 days to get the day on the same day next year because 29th February 1988, which has an extra 1 day in a leap year, is included in the span of 21st February 1988 to 20th April 1989. So, we will add 2 odd days to get the day on the same day the next day. Therefore, it was Tuesday on 21st February 1989. Now we will add 59 more days (22nd February 1988 to 20th April 1989 = 8 + 31 + 20 = 59) to get the exact day. So, we have 3 odd days and adding this to Tuesday, we get Friday on 20th April 1989.

17. **(C)** It has been given in the question that this is a leap year. As a result, each of the next three years will have one odd day (the idea of odd days in an ordinary year). Then there are two odd days in leap year, and one odd day the next year. Therefore (3 + 2 + 1) = 6 odd days will be there. Hence the day of the week will be 6 odd days that's 5 days beyond Sunday. So, it will be Saturday on the date after 5 years.

18. **(A)** On 31st December 1996 it was Tuesday.
Number of odd days from 1996 to 2000 = (2 + 1 + 1 + 1 + 2) = 7 days.
On 31st December 2000, it was Sunday.
Thus, on 1st January 2001, it is Monday.

19. **(C)** For solving this question first we are supposed to find the day on 1st July 2020.
Counting of odd days:
1600 years have 0 odd days.
400 years have 0 odd days.
19 years = (4 leap years + 15 ordinary years) = [(4 × 2) + (15 × 1)] = 23 (3 weeks + 2 days) = 2 odd days
No. of days from 1st of January to 30th June = (31 + 29 + 31 + 30 + 31 + 30) = 182 days = 29 weeks = 0 odd days
Total number of odd days = (0 + 2) = 2.
Therefore, 1st July was on Wednesday.
Now the total number of days in July and August is 62. So we have these following days on which Sundays will fall: 5th July, 12th July, 19th July, 26th July, 2nd Aug, 9th Aug, 16th Aug, 23rd Aug, 30th Aug
2nd Saturdays will fall on: 11th July, 25th July, 8th Aug, 22nd Aug.

So, the total number of holidays will be 13 therefore total numbers of working days are (62 – 13= 49)

20. (A) First we have to find the day on 1st January 2005
1/1/2005= (2004 years + period from 1/1/2005 to 1/3/2005)
Odd days in 1600 years = 0
Odd days in 400 years = 0
4 years = (1 leap year + 3 ordinary years) = (1 × 2 + 3 × 1) = 5 odd days.
So, it was Friday on 31st December 2004; therefore, 1st January 2005 was Saturday.

21. (A) 23rd July 1776 = (1775 years + Period from 1st Jan 1776 to 23rd July 1776)
Counting of odd days:
for the 1600 years have 0 odd days.
for the 100 years have 5 odd days.
for the upcoming 75 years we have = (18 leap years + 57 ordinary years) = [(18 × 2) + (57 × 1)] = 93 (13 weeks + 2 days) = 2 odd days
1775 years have (0 + 5 + 2) odd days = 7 odd days = 0 odd days.
No. of days from 1st of January to 23rd of July = (31 + 29 + 31 + 30 + 31 + 30 + 23) = 205 days= (29 weeks + 2 days)
Total number of odd days = (0 + 2) = 2.
The required day was 'Tuesday'.

22. (C) We have a general rule for repetition of a calendar.
Repetition of leap year ⇒ Add + 28 to the given year.
The given year is 2004 which is a leap year. So simply adding 28 to the given year we will get the year for which the calendar for 2004 will be repeated.
Therefore, the calendar for the year 2004 will be the same for the year 2032.

23. (D) To solve this question first, we are supposed to find the day on 1st March 2023.
Counting of odd days:
1600 years have 0 odd days.
400 years have 0 odd days.
22 years = (5 leap years + 17 ordinary years) = [(5 × 2) + (17 × 1)] = 27 (3 weeks + 6 days) = 6 odd days
January and February→ 31 + 28 = 59 days = 8 weeks 3 odd days = 3 odd days
Total number of odd days = (6 + 3) = 2.
Therefore, 1st March 2023 will be on Wednesday
So, the 1st Friday will fall on 3rd of March and subsequently, the 2nd Friday will fall on the 10th of March.

24. (A) Statement I is incorrect. For a century year, it can be called a leap year only when it is divisible by both 4 and 400. Since 1700 is not divisible by 400, it is not a leap year but an ordinary year.
Statement II is again incorrect because calendars repeat themselves in the given order:
leap year = after 28 years
1 year after leap year = 6 years from this year.
2 years after leap year = 6 years from this year.
3 years after leap year = 11 years from this year.
Now, the given year is 2001, which is 1 year from a leap year so it will repeat after 6 years from this year that is in 2007.
Statement III is correct. Odd days in 1600 years = 0
Odd days in 300 years = 1
46 years = (35 ordinary years + 11 leap years) = (35 × 1 + 11 × 2) = 57 (8 weeks + 1 day) = 1 odd day
Number of days from 1st January to 15th of August (31 + 28 + 31 + 30 + 31 + 30 + 31 + 15) = 227 days = (32 weeks + 3 days) = 3 odd days.
Total number of odd days = (0 + 1 + 1 + 3) = 5 odd days.
Hence, as the number of odd days = 5, the given day is Friday.

25. (C) 17th June 1998 = (1997 years + Period from 1.1.1998 to 17.6.1998)
The number of odd days in 1600 years = 0
The number of odd days in 300 years = 1
For the upcoming 97 years we have = 24 leap years + 73 ordinary years.

Number of odd days in 97 years (24 x 2 + 73) = 121 = 2 odd days.
Number of days from 1st January to 19th June ⇒ (31 + 28 + 31 + 30 + 31 + 19) = 170 days = 24 weeks 2 days = 2 odd days.
Total number of odd days = (0 + 1 + 2 + 2) = 5.
The given day is Friday.

26. As given in the question, the month starts on Sunday so every 7th day from 1st date of this month would be a Sunday. Therefore, Sundays fall on 1st, 8th, 15th, 22th.
Now the 1st Saturday will fall on the 7th then subsequently on the 14th, 21st, 28th.
Total no. of working days will be (28 - 5 = 23) 23 days.
4th Saturday will fall on the 28th day
So, only statement I is true.

27. To solve this question, first we need to find the day on 1st November 2030.
Counting of odd days:
1600 years have 0 odd days.
400 years have 0 odd days.
29 years = (7 leap years + 22 ordinary years) = [(7 x 2) + (22 x 1)] = 36 (5 weeks + 1 days) = 1 odd days
From 1st January to 31st October → (31 + 28 + 31 + 30 + 31 + 30 + 31 + 31 + 30 + 31) = 304 days = 43 weeks 3 odd days = 3 odd days
Total number of odd days = (1 + 3) = 4. So, on 31st October it will be Thursday.
Therefore, 1st November 2030 will be on Friday
So, 1st Wednesday will fall on 6th of November and subsequently 2nd Wednesday will fall on 13th and 3rd Wednesday will fall on 20th November 2030.

28. We have a general rule for repetition of a calendar.
For the repetition of a leap year ⇒ Add + 28 to the given year.
For the repetition of a non-leap year, follow these steps:
Step 1: Add + 11 to the given year. If result is a leap year, go to step 2.
Step 2: Add + 6 to the given year.
Given year is 1997, which is a non-leap year.
Step 1: Add + 11 to the given year (i.e., 1997 + 11) = 2008, which is a leap year.
Step 2: Add + 6 to the given year (i.e., 1997 + 6) = 2003
Therefore, the calendar for the year 1997 will be the same for the year 2003.

29. 23th August 2015 = (14 years from 2000 + period 1/1/2015 to 23/8/2015)
Odd days in 1600 years = 0
Odd days in 400 years = 0
14 years = (3 leap years + 11 ordinary years) = (2 × 3 + 11 × 1) = 17 = 3 odd days.
No. of days from 1st of January to 23rd of August = (31 + 28 + 31 + 30 + 31 + 30 + 31 + 23) = 235 days = (33 weeks + 4 days) = 4 odd days.
Total number of odd days = (0 + 0 + 3 + 4) = 7 = 0 odd days.
So, the day on 23rd August 2015 was Sunday.

30. We shall find the day on 1st January 2002.
1st February 2002 = (2001 years + period from 1.1.2002 to 1.2.2002)
The no. of odd days in 1600 years = 0
The no. of odd days in 400 years = 0
Since 2001 is an ordinary year, it has 1 odd day.
January has 31 days = 3 odd days.
Total number of odd days = (0 + 1 + 3) = 4, so 31st January was Thursday.
On 1st February, 2002 it was Friday.
In February 2002, Friday fell on 1st, 8th, 15th, and 22nd.

40 Series

A series is a collection of letters, numbers, or both arranged in such a way that each term in the collection follows a set of rules. These rules can be based on mathematical operations, the place of letters in alphabetical order, and so on. In these questions, one is required to figure out the logic used to form the sequence or series of numbers/alphabets. By understanding the logic, one is required to deduce either a continuation, the immediate next term, a missing term, or a wrong term within the series.

The various types of series are discussed below:

1. Number series

A number series is a set of numbers that are arranged in a specific order and follow a predetermined pattern.
In this section, we'll look at questions in which you're given a sequence of numbers (which are referred to as the terms of the series). Throughout the series, these numbers/terms follow a consistent pattern. Candidates are prompted to either locate a missing word or the incorrect series term.
Prominently, the following patterns of reasoning have been observed in the analytical questions.

Addition or subtraction basic

This series only has questions that include addition or subtraction operations. They could be even or odd numbers or even a sub-series that follows a set pattern within itself.
This can be understood with the help of the following examples:

- With normal even number series:
  53, 43, 35, 29, 25, ____.
  Here, the pattern followed is:
  (53 − 43 = 10),
  (43 − 35 = 8),
  (35 − 29 = 6),
  (29 − 25 = 4).
  Thus, the answer should be (25 − 2 = 23).

- With prime numbers
  13, 15, 18, 23, 30, ____.
  Here, the pattern followed is –
  (13 + 2 = 15),
  (15 + 3 = 18),
  (18 + 5 = 23),
  (23 + 7= 30),
  Thus, the answer should be a sum of the next prime number and the previous number in the series, that is, (30 + 11 = 41).

- Combination sub-series
  16, (4,3) 23, (6,5) 34, (8,7) 49, ____.
  Here, the series has a sub-series of even numbers (starting from 4) and prime numbers (starting from 3).
  16 + 4 + 3 = 23,
  23 + 6 + 5 = 34,
  34 + 8 + 7 = 49.
  Thus, the answer here should be the sum of the previous number in the series + the next number in the prime series + the next number in the even series, that is, (49 + 10 + 11 = 70).

- Decimal addition or subtraction
  1.5, 2.3, 3.1, 3.9, ____.
  Here, the next figure is a sum of 0.8 and the previous figure. Thus,
  (1.5 + 0.8),
  (2.3 + 0.8),
  (3.1 + 0.8).
  Hence, the answer should be (3.9 + 0.8 = 4.7).

Multiplication or division of numbers

This can easily be understood through the following examples:

- 9, 81, 729, 6,561, ____.
  Here, 9 is multiplied to get the next number.
  Thus, (9 × 9 = 81),
  (9 × 81 = 729),
  (729 × 9 = 6,561),
  Thus, the answer is (6561 × 9 = 59,049).

- 54, 9, 36, 6, ____, 3.
  Here, the bigger number once divided by 6 leaves the next smaller number as the quotient. Thus, (54/6 = 9), (36/6 = 6); therefore, the missing number should be (6 × 3 = 18).

- 1/4, 1/8, 1/16, 1/24, 1/32, _____.
  Here, 1/4 being the starting point, the next element is multiplied by 1/n where n is an even number starting from 2. Thus, the series goes like this:
  (1/4 × ½),
  (1/4 × ¼),
  (1/4 × 1/6),
  (1/4 × ⅛).
  This leads us to conclude that (1/4 × 1/10 = 1/40) is the answer.

Squares or cubes and like powers

Needless to say, this form of number series focuses on patterns with squares and cubes of numbers.

- 626, 126, 26.
  Here, 5 has been raised to consecutive powers and each result is thus increased by 1. Then it has been arranged in descending order.
  Thus, (5^4 + 1 = 626)
  (5^3 + 1 = 126),
  (5^2 + 1 = 26).

- 1, 4, 27, 16, 125, 36, 343, ____.
  Here, the series starts with 1. All the squares are of even numbers and cubes of odd numbers. Since 343 is a cube of 7, the next element will be the square of 8, that is, 64.

Combination

Sometimes in the given series, one has to make use of multiple logic to identify the pattern. Let us understand it better with the following examples:

- 49, 56, 64, 72, 81, ____.
  Here, the series the following pattern:
  Square of 7 = 7 × 7 = 49.
  Then, the number whose square it was, is multiplied by the next natural number.
  7 × 8 = 56.
  Then again, the new number is square; thus,
  8 × 8 = 64.
  Similarly,
  8 × 9 = 72.
  9 × 9 = 81.
  Thus, the missing element should be (9 × 10 = 90).

- 8, 6, 9, 23, 87, ____.
  In the given series, there are multiplication and subtraction operations performed with a particular logic:
  8 × 1 – 2 = 6
  6 × 2 – 3 = 9
  9 × 3 – 4 = 23
  23 × 4 – 5 = 87
  Thus, the answer should be,
  87 × 5 – 6 = 429.

- 64, 45, 28, ____.
  In the given series, there are multiplication and subtraction operations performed in descending order.
  16 × 4 = 64.
  15 × 3 = 45.
  14 × 2 = 28.
  Thus, the answer should be,
  13 × 1 = 13.

- 0.2, 0.3/2, 0.9/8, ____.
  0.2 × ¾ = 0.3/2.
  0.3 × ¾ = 0.9/8.
  Thus, the answer should be,
  0.9/8 × ¾ = 2.7/32.

2. Letter series

It is a logical arrangement of the letters of the English alphabet in a specific way. They are arranged in a way that each term in the series is identified by following a set of rules. Some of these rules can be based on the positions of different letters in alphabetical order.
The numerical positions of the letters in the alphabets are given below:
There are mainly two types of letter series:

ALPHABET POSITIONS													
Letter	A	B	C	D	E	F	G	H	I	J	K	L	M
Position	1	2	3	4	5	6	7	8	9	10	11	12	13
Reverse Order	26	25	24	23	22	21	20	19	18	17	16	15	14
Letter	Z	Y	X	W	V	U	T	S	R	Q	P	O	N
Position	26	25	24	23	22	21	20	19	18	17	16	15	14
Reverse Order	1	2	3	4	5	6	7	8	9	10	11	12	13

a. Alphabet series

The letters of the English alphabet are arranged in a particular pattern in this type of series. For example, reverse order of letters, the position of letters in alphabetical order, etc.

b. Continuous Pattern Series

Understand with example

Example 1: Which term will come next in the series? A, C, E, G, ?
Now, we can see that as per the positions of these letters in the alphabet, they are at 1, 3, 5 and 7. The gap between the two consecutive terms is two. So, the next term would be of position 9, i.e., I.

Example 2: Which term will come next? ACE, CEF, EGG, GIH, ?
Now, for the first letters of each term, the pattern followed is +2. So the first letter in next term would be I. For the second letter of each term, the pattern followed is +2. So, the second letter in the next term would be K. Lastly, for the last letters in each term, the pattern followed is +1. So, the last letter in next term would be I. So, the next term would be IKI.

In this type, a series of small/capital letters given follow a specific pattern. However, some letters are missing from the series which have to be found out.

3. Alphanumeric series

Understand with example

Example 1: Find the missing letters: abca_c_bc_b_a_c
Now, the pattern followed here is abc/abc/abc/abc/abc. So the missing letters in that order are baacb.

Example 2: Find the missing letters: ab_db_dcc_ad_bca
Now, the pattern followed here is abcd/badc/cbad/dbca. So the missing letters in that order are cabd.

The term alphanumeric means a combination of numbers and alphabets. So, alphanumeric series questions are a combination of numbers, alphabets and symbol-based series which candidates need to answer. The alphanumeric series generally covers 2-3 questions in the reasoning ability section of various entrance examinations.

The questions might include upper and lowercase alphabets, symbols, and punctuation marks. These questions are easy to solve and carry a considerable weightage in the reasoning section.

Tips to solve alphanumeric series questions

Here are some tips to help you prepare for the alphanumeric series topic:

- Analyse the alphanumeric pattern and try to crack that pattern for the pattern-based series. These questions usually revolve around changes in the pattern's ascending or descending order.
- There is no pattern in the short series, which mainly comprises alphabets, numbers, and symbols. In these, check the questions and straightaway answer them.
- In the missing number series, check the entire series to find the answer and recheck the series to ensure there is no error.

PRACTICE QUESTIONS

[Q. 1-15] Find the missing element.

1. 31, 2, 41, 3, ____, 4, 61, 5, 71, 6
A. 24 B. 52 C. 51 D. 55

2. 19, 37, 55, 73, ____.
A. 91 B. 83 C. 109 D. 82

3. 90, 110, 132, ____, 182, 210.
A. 146 B. 138 C. 164 D. 156

4. 1, 2, 6, 15, 31, 56, ___.
A. 90 B. 92 C. 89 D. 87

5. 13, 32, 59, ___.
A. 78 B. 97 C. 94 D. 65

6. 11, 17, 39, 85, ____.
A. 134 B. 157 C. 163 D. 129

7. 2, 1, 1/3, 1/15, ___.
A. 1/105. B. 1/115. C. 1/125. D. 1/95

8. 0.7, 1.2, 1.4, 1.4, 2.1, 1.6, ___.
A. 2.7 B. 3.1 C. 2.8 D. 5.6

9. 2, 3, 10, 39, ____, 885.
A. 687 B. 456 C. 234 D. 172

10. 3, 9, 21, ___, 93.
A. 21 B. 42 C. 63 D. 45

11. 110, 1331, 120, 1728, ____.
A. 121 B. 143 C. 2197 D. 130

12. 10, 6, 8, 15, ____.
A. 34 B. 17 C. 4 D. 18

13. 132, 156, ____ , 210, 240, 272.
A. 135 B. 169 C. 182 D. 178

14. 2, 4, 16, 256, ____.
A. 65,536 B. 8,192 C. 16,384
D. 32,768

15. 53, 53, 40, 40, 27, 27, _____.
A. 12 B. 14 C. 16 D. 18

16. In the below statement, how many vowels are preceded by a symbol?
Statement: U ! 2 4 O T & I @ # E 1 *
A. One B. Two C. Three D. Four

17. In the below series, which is the second element to the left of the sixth element from the right?

B * 6 8 J L % U @ # V 3 &
A. @ B. & C. L D. U

18. Which number becomes the highest when its digits are arranged in ascending order?
A. 895 B. 768 C. 321 D. 742

19. How many consonants are immediately followed by symbols and preceded by a number in the below series?
@ 9 6 B F J 7 M & % A I
A. One B. Two C. Three
D. None

20. In the given series, when numbers are multiplied with each other, whose product would be lowest?
289 123 111 823 308
A. 289 B. 123 C. 111 D. 308

Directions (21-25): Find the wrong number in the series given below.

21. 27, 125, 343, 625, 1000
A. 27 B. 625 C. 343 D. 1000

22. 8, 24, 48, 80, 120, 166
A. 24 B. 48 C. 120 D. 166

23. 2, 4, 12, 60, 240, 1440
A. 4 B. 12 C. 60 D. 240

24. 4, 11, 25, 55, 109, 221
A. 55 B. 109 C. 25 D. 11

25. 3, 12, 4, 20, 5, 25, 6, 42
A. 12 B. 20 C. 25 C. 42

SOLUTIONS

1. **(C)** The sequence is a combination of two given series:
i. 31, 41, 52, 61, 71 and
ii. 2, 3, 4, 5, 6
Thus, the answer is (41 + 10) = 51.

2. **(A)** The pattern followed here is
2 × 9 + 1 = 19
4 × 9 + 1 = 37
6 × 9 + 1 = 55
8 × 9 + 1 = 73
10 × 9 + 1 = 91.

3. **(D)** The pattern followed here is
9 × 9 + 9 = 90.
10 × 10 + 10 = 110.
11 × 11 + 11 = 132.
Thus, the answer should be: 12 × 12 + 12 = 156.

4. **(B)** Here, the pattern followed is:
Difference between each element – 1, 4, 9, 16, 25 = squares of (1, 2, 3, 4, 5).
Thus, the answer should be, 56 + 36 = 92.

5. **(C)** The following pattern is followed here:
3 × 4 + 1 = 13.
5 × 6 + 2 = 32.
7 × 8 + 3 = 59.
Thus, the answer should be, 9 × 10 + 4 = 94.

6. **(C)** The following pattern is followed here:
11
$11 + (3^2 - 3) = 17$
$17 + (5^2 - 3) = 39$
$39 + (7^2 - 3) = 85$
$85 + (9^2 - 3) = 163$
Hence, the next number in the given sequence is 163.

7. **(A)** This problem is based on prime numbers and division. The series starts with 2 and thereafter each element is divided by each prime number. Thus, the answer should be
1/(3 × 5 × 7) = 1/105

8. **(C)** The series is divided into two sub-series:
First sub-series: 0.7, 1.4, 2.1, ___. Addition of 0.7 after every element.

Second sub-series: 1.2, 1.4, 1.6. Addition of 0.2 after every element.
Thus, the answer should be (2.1 + 0.7 = 2.8).

9. (D) The series follows the following pattern:
$2 \times 1 + (1^2) = 3$
$3 \times 2 + (2^2) = 10$
$10 \times 3 + (3^2) = 39$
$39 \times 4 + (4^2) = 172$
$172 \times 5 + (5^2) = 885$

10. (D) The first difference is 6 and the second is 12.
So, if we have to take the difference as 6, 12, 24 and 48, the answer is 21 + 24 = 45.

11. (D) The series follows the following pattern:
$11 \times 10 = 110$
$11^3 = 1331$
$12 \times 10 = 120$
$12^3 = 1728$
Thus, the answer should be (13 × 10 = 130).

12. (A) The series follows the following pattern:
10
$10 \times 0.5 + 1 = 6$
$6 \times 1 + 2 = 8$
$8 \times 1.5 + 3 = 15$
Thus, the answer should be 15 × 2 + 4 = 34.

13. (C) The series follows the following logic:
11 × 12 = 132, 12 × 13 = 156, 13 × 14 = 182, 14 × 15 = 210, 15 × 16 = 272,
Thus, the answer is 13 × 14 = 182.

14. (A) This is a simple series in which the following number is a square of the previous number. Thus, the answer is the square of 256, that is, 65,536.

15. (B) In this series, each number is repeated, then 13 is subtracted to arrive at the next number. Thus, the answer here should be (27 – 13 = 14).

16. (B) Two vowels: 'E' is preceded by '#' and 'I' is preceded by '&'.

17. (C) The sixth element from the left is U, and the second to its left is L.

18. (B) The ascending order series becomes
895 — 589
768 — 678
321 — 123
742 — 247

19. (A) 'M' is followed by '&' and preceded by 7.

20. (D) Any number multiplied by 0 would be 0, which is the lowest.

21. (B) All numbers except 625 are cubes.

22. (D) The wrong term is 166.

23. (C) 2 × 2 = 4, 4 × 3 = 12, 12 × 4 = 48, 48 × 5 = 240, 240 × 6 = 1440. The wrong term is 60.

24. (A) 4 × 2 + 3 = 11, 11 × 2 + 3 = 25, 25 × 2 + 3 = 53, 53 × 2 + 3 = 109, 109 × 2 + 3 = 221. The wrong term is 55.

25. (C) 3 × 4 = 12, 4 × 5 = 20, 5 × 6 = 30, 6 × 7 = 42. The wrong term is 25.

41 Odd One Out

The concept of the 'odd one out' engages a person's thinking abilities around a certain area or subject that is presented in a confusing manner with similar objects or writings.

To identify the odd one out accurately, one must improve their logical thinking skills by distinguishing those objects (or set of alternatives) using well-established ideas.

You must differentiate the objects and select one alternative from the list that is unique or out of the ordinary, i.e., one that is unrelated to the rest.

For example, when we compare elements such as lion, cat, tiger, cheetah, bear, and fox, we can see that they form a group of animals. How do we categorize them? If we want to segregate one animal from the rest, it will almost certainly be the cat, because it is the only domestic animal in the herd. The remaining animals (Lion, Tiger, Cheetah, Bear, and Fox) are wild animals.

HOW TO FIND THE ODD ONE OUT

The aim is to solve it using common sense, but we can also pick the different one or odd one out by focusing on the following categories:

- Even or odd
- Category of the object
- Gender of the object
- The object's use and application

Make a concerted effort to distinguish between the options provided. Except for one, all of the options can be linked to one another and will fall into the same category.

Examine all of the alternatives and try to connect them using their common characteristics/ purposes.

There are two kinds of questions are asked on this topic:

1. Single words
2. Pair of words

These can also be subdivided into three subtypes:

1. Numbers
2. Words
3. Letters

Let's look at the following *examples* to understand the concept better.

SOLVED EXAMPLES

Example 1. Choose the odd one out from the following options.

A. Scanner B. Joystick
C. Stylus D. Printer

Answer: D

Explanation: Option D is the correct answer because except for the printer which is an output device, the remaining given options are input devices.

Example 2. Choose the odd one out from the following options.

A. 121, 163 B. 49, 81
C. 225, 289 D. 1, 9

Answer: A

Explanation: Option A is the correct answer because the two given numbers in all the other options are squares of consecutive natural odd numbers.

Example 3. Choose the odd one out from the following options.

A. Strawberry B. Apple
C. Papaya D. Guava

Answer: A

Explanation: Option A is the correct answer because all the other fruits given in the options have seeds on the inside whereas strawberries have seeds on the outside.

Example 4. Choose the odd one out from the following options.

A. Jar
B. Pitcher
C. Saucer
D. Mug

Answer: B

Explanation: Option B is the correct answer because all the given options are a type of container that contain liquid whereas saucer is a type of a small plate or shallow bowl that supports a cup used to serve tea or coffee.

Example 5. Choose the odd one out from the following options.

A. Diamond
B. Iron
C. Gold
D. Silver

Answer: A

Explanation: Option A is the correct answer because except for diamond, rest all the options given, i.e., Iron, Silver and Gold, are metals.

PRACTICE QUESTIONS

Directions: Each of the following questions contains four options, three of which are similar in a way and one of which is different. Choose the odd one out.

1. Choose the odd one out.
A. Freedom of speech
B. Right against exploitation
C. Freedom of religion
D. Right to make contract

2. Choose the odd one out.
A. Seismology
B. Epicentre
C. Crater
D. Richter Scale

3. Choose the odd one out.
A. Retinol
B. Amylase
C. Calciferol
D. Phylloquinone

4. Choose the odd one out.
A. Silicon
B. Potassium
C. Arsenide
D. Germanium

5. Choose the odd one out.
A. Alligator
B. Humpback Whale
C. Coyote
D. Leopard

6. Choose the odd one out.
A. Brother : Sister
B. Wife : Husband
C. King : Queen
D. Horse : Mare

7. Choose the odd one out.
A. HNUTRDE
B. OLCDU
C. INRA
D. OMSEU

8. Choose the odd one out.
A. V. V. Giri
B. Zail Singh
C. P. V. Narsimha Rao
D. K. R. Narayanan

9. Choose the odd one out.
A. Orange
B. Watermelon
C. Cucumber
D. Bitter Gourd

10. Choose the odd one out.
A. Kidney
B. Eye
C. Leg
D. Liver

11. Choose the odd one out.

A. Dollar B. Yen
C. Won D. Ounce

12. Choose the odd one out.

A.  B. 

C.  D. 

13. Choose the odd one out.

A. Mercury B. Saturn
C. Venus D. Mars

14. Choose the odd one out.

A. Jute B. Wool
C. Paper D. Glass

15. Choose the odd one out.

A. Garlic B. Lemon
C. Potato D. Ginger

16. Choose the odd one out.

A.  B. 

C.  D. 

17. Choose the odd one out.

A. 4721 B. 5682
C. 1891 D. 9154

18. Choose the odd one out.

A. MNPR B. BCLQ
C. ACLT D. VYRS

19. Choose the odd one out.

A. Nathu la B. Saltoro Kangri
C. Kongka la D. Khambatki Ghat

20. Choose the odd one out.

A. Tel Aviv B. Czechia
C. Angola D. Lebanon

21. Choose the odd one out.

A. 64 B. 343
C. 400 D. 512

22. Choose the odd one out.

A. D B. O
C. P D. G

23. Choose the odd one out.

A. 393 B. 482
C. 221 D. 510

24. Choose the odd one out.

A. GHJLO B. LMORV
C. PQSVZ D. ABDGK

25. Choose the odd one out.

A. 57 B. 17
C. 26 D. 37

SOLUTIONS

1. **(D)** is the correct option because except the right to make contract, all the other options mention fundamental rights of an Indian citizen that are provided to him by the Indian Constitution.

2. **(C)** is the correct answer because all the other options, except for craters which are circular depressions in the ground generated by volcanic activity, are linked to earthquakes in one or the other way.

3. **(B)** is the correct option because except for Amylase, which is an enzyme or special protein that helps us in digesting our food, all the other options are chemical names for vitamins like vitamin A, vitamin D, and vitamin K.

4. **(B)** is the correct answer because except potassium which is a chemical element, the rest, i.e., silicon, arsenide, and germanium, are semiconductors.
5. **(A)** is the correct answer because alligators are reptiles, whereas the remaining animals given in the options are classified as mammals.
6. **(B)** is the correct answer because in all the other pairs, the first one is masculine while the second one is feminine, but in option (b), the first one is feminine while the second one is masculine.
7. **(D)** is the correct answer because we get THUNDER, CLOUD, and RAIN by arranging the alphabets in HNUTRDE, OLCDU, and INRA, which are all connected to each other except OMSEU, which stands for MOUSE.
8. **(C)** is the correct answer because P.V. Narsimha Rao was the 9th Prime Minister of India, whereas all the other names mentioned have been the Presidents at various points.
9. **(A)** is the correct answer because oranges grow on trees, but the vegetables or fruits that are given in the rest of the options grow on creeper plants.
10. **(D)** is the correct answer because all the other organs mentioned like kidneys, eyes, and legs, are present in the human body in pairs, but there is only one liver in the human body.
11. **(D)** is the correct answer because an ounce is a unit of weight, whereas the rest of the given options are currencies of various nations like the USA, Japan, and South Korea.
12. **(C)** is the correct answer because only the circle in option C has an acute angle, whereas all the other circles given in the options have an obtuse angle.
13. **(B)** is correct because no other planet in the given options be it Mercury, Venus, or Mars has rings around it, except Saturn.
14. **(D)** is the correct answer because only glass is a non-biodegradable material among the given options, whereas jute, wool, and paper are all biodegradable materials and do not harm the environment.
15. **(B)** is the correct answer because except for the lemon plant which belongs to the family of shrubs, all other options like garlic, potato, and ginger are examples of modified stems.
16. **(D)** is the correct answer. With the exception of (D), all of the others have the same smaller pattern linked to them. The triangle, on the other hand, is linked to a rhombus in option (D).
17. **(A)** is the correct answer because in all the other options, the sum of the second and fourth digits of the number is equal to the third digit of the number.
    1891 → 8 + 1 = 9 (third digit from right)
    5682 → 6 + 2 = 8 (third digit from right)
    4721 → 7 + 1 = 8 (not the third digit from right)
    9154 → 1 + 4 = 5 (third digit from right)
18. **(C)** is the correct answer because none of the other options have a vowel in them, but the group of alphabets in option C consists of an 'A' too.
19. **(B)** is the correct answer because all the other options such as Nathu la, Kongka la, and Khambatki Ghat are various mountain passes, whereas Saltoro Kangri is a peak in Asia.
20. **(A)** is the correct answer because all the other options are the names of various countries, whereas Tel Aviv is the capital city of Israel.
21. **(C)** is the correct answer because all the other options are the perfect cube of a number such as:
    $8^3 = 512$ $7^3 = 343$ $4^3 = 64$
    But 400 is not a perfect cube.

22. **(B)** is the correct answer because out of all the options given, only O is the alphabet that has the same mirror image.

23. **(D)** is the correct answer because in all the other options given, the product of the first and last digits, is equal to the digit in the middle but option D does not follow that pattern.

24. **(A)** is the correct answer because in all the other options that are given, between every two consecutive alphabets 0, 1, 2, and 3 alphabets are missing respectively. But option (A) does not follow that pattern.

25. **(A)** is the correct answer because the pattern that is followed here is as follows:
$(4 \times 4) + 1 = 17$ $(5 \times 5) + 1 = 26$
$(6 \times 6) + 1 = 37$
But option A does not follow this pattern.

42 Analogy

A comparison of two objects or systems of objects that emphasises the similarities between them is referred to as analogy. The word 'analogy' literally means 'resemblance,' as in possessing similar characteristics. Analogy questions assess an aspirant's ability to comprehend the connection between two specified objects and apply that understanding to get the answer to the question. It is crucial to remember that while an aspirant's intellectual ability is important in analysing the similarities between two or more options, a broad understanding of diverse word usages enhances a person's efficiency.

In analogy, questions can be asked on any kind of relationship, a few types of which are mentioned below:

TYPES	EXAMPLES
Quantity and Unit	Length : Metre Weight : Kilogram Volume : Litres Force : Newton Power : Watt Pressure : Pascal
Worker and Tool	Carpenter : Hammer Farmer : Plough Gardener : Harrow Surgeon : Scalpel Sculptor : Chisel
Masculine and Feminine	Waiter : Waitress Monk : Nun Earl : Countess Fox : Vixen Bachelor : Spinster
Part to Whole	Fin : Fish Blade : Fan Chapter : Book Arc : Circle Steering : Car
Word and Synonym	Inept : Incompetent Dearth : Scarcity Encumber : Burden Audacity : Impudence Dissipate : Squander
Word and Antonym	Contradict : Agree Varied : Monotonous Expand : Condense Arid : Fertile Plentiful : Sparse
Country and Currency	Bangladesh : Taka Italy : Lira Argentina : Peso Iran : Rial Burma : Kyat
Field of Study and Subject	Ornithology : Birds Onomatology : Names Palaeontology : Fossils Oology : Eggs Pedology : Soil
Country and Capital	Canada : Ottawa UK : London France : Paris Nepal : Kathmandu Kenya : Nairobi Ukraine : Kyiv
Universal Pair	Cushion : Couch Cheese : Mouse Pepper : Salt Table : Chair Fork : Knife
Animal and Baby	Lion : Cub Kangaroo : Joey Cat : Kitten Deer : Fawn Swan : Cygnet

TYPES	EXAMPLES
Animal and Sound	Cow : Moo Owl : Hoot Goat : Bleat Donkey : Bray Camel : Grunt
Instrument and Measurement	Thermometer : Temperature Anemometer : Wind Seismograph : Earthquakes Ammeter : Current Odometer : Distance
Object and Function	Spoon : Eat Keyboard : Type Helmet : Protect Shovel : Dig Scissors : Cut
Cause and Effect	Cold : Shivering Itch : Scratch Spin : Dizzy Rain : Flood Study : Pass
Games and Playing Areas	Golf : Course Boxing : Ring Cricket : Pitch Skating : Rink Wrestling : Arena

In this topic, there are several kinds of questions that might be asked in the examinations. Let us discuss a few of such types.

- **'Complete the Analogous Pair' Type Questions**: Two words are given here. In some sense, these words are associated with each other. There is also a third word. The respondent must identify the relation between the first two words and select the word from the options that has the same relationship to the third word as the first two.

  Example: Mouth : Speak :: Ears : ?

  A. See B. Hear
  C. Breathe D. Touch

Solution: In this example, we know that mouth is used to speak. Therefore, we need to look for the same relation between the third word and the correct alternative as well. Now, we know that ears are used to hear sound; hence option B is the right answer.

- **Alphabet Type Questions**: Two pairs of alphabets are given in this type of questions, and they are related in the same way. The respondent must identify the relation between the two and select a group of alphabets that is related to the third group given in the question.

  Example: ABC : DEF :: PQR : ?

  A. TUV B. XYZ
  C. STU D. RQP

Solution: Here, we can see that DEF comes immediately after ABC in terms of the alphabetic order. Therefore, option C is the right answer as STU comes immediately after PQR.

- **Number-Type Questions**: In this, a pair of numbers is given in the question. The candidate needs to determine how the two numbers are related to each other, and select the alternative that is similarly related to the third number given in the question.

  Example: 25 : 5 :: 81 : ?

  A. 9 B. 3
  C. 6 D. 12

Solution: We know that 25 is the square of 5. So, we need to check if any of the alternatives has 81 as its square. Since 9 is the root of 81, option A is the right answer.

To understand the concept in a better way, let us look at the following *examples*.

SOLVED EXAMPLES

Example 1. Right to Information Act : 2005 :: Right to Education Act : ?

A. 2006 B. 2009
C. 2012 D. 2007

Answer: B

Explanation: Option B is the correct answer because the Right to Information Act was enacted in the year 2005. Similarly, the Right to Education Act was enacted in the year 2009.

Example 2. Anaemia : Iron :: Scurvy : ?

A. Vitamin C B. Iodine
C. Zinc D. Vitamin A

Answer: A

Explanation: Option A is the correct answer because anaemia is a disease which is caused by iron deficiency, whereas scurvy is a disease which is caused by vitamin C deficiency.

Example 3. Horse : Stable :: Pig : ?

A. Burrow B. Coop
C. Fold D. Sty

Answer: D

Explanation: Option D is the correct answer because the place where a horse lives is called a stable, whereas the place where a pig lives is called a sty.

Example 4. Hand : Gloves :: Eyes : ?

A. Pupil B. Sunglasses
C. Read D. Eyesight

Answer: B

Explanation: Option B is the correct answer because the second is worn on the first as gloves are worn in hands whereas sunglasses are worn on the eyes.

Example 5. Death : Life :: Fantasy: ?

A. Fiction B. Reality
C. True D. Story

Answer: B

Explanation: Option B is the correct answer because death is the opposite of life. Similarly, reality is the opposite of fantasy.

PRACTICE QUESTIONS

Directions: On both sides of the '::' in each of the questions given below, there is a specific link between two provided pairings. On the other side of '::,' one word is given, and another word must be picked from the alternatives, having the same relationship with this word as the words in the given pair. Identify the appropriate option from the given alternatives.

1. Carmine : Red :: Aureolin : ?

A. Yellow B. Pink
C. White D. Green

2. Monday : Saturday :: January : ?

A. March B. February
C. November D. December

3. Patricide : Father :: Regicide : ?

A. Parent B. Brother
C. King D. Old man

4. Mudhif : Iraq :: Chalets : ?

A. Russia B. Switzerland
C. Africa D. Iceland

5. 2 : 6 :: 3 : ?

A. 12 B. 14
C. 8 D. 15

6. Lal Bahadur Shastri: Uttar Pradesh:: Mahatma Gandhi: ?
A. Maharashtra B. Delhi
C. Madhya Pradesh D. Gujarat

7. CAT : 60 :: LOT : ?
A. 120 B. 3600
C. 1440 D. 828

8. Mt. Vesuvius : Italy :: Mauna Loa : ?
A. Martinique B. Africa
C. Turkey D. Hawaii

9. Gir National Park : Gujarat :: Nagarhole National Park : ?
A. Karnataka B. Kerala
C. Andhra Pradesh D. Nagaland

10. Kuchipudi : Andhra Pradesh :: Sattriya : ?
A. Bihar
B. Assam
C. Chhattisgarh
D. Himachal Pradesh

11. Quesadillas : Mexico :: Churros : ?
A. Greece B. France
C. Turkey D. Spain

12. Colombia : Bogota :: Ecuador : ?
A. Cairo B. Beirut
C. Baku D. Quito

13. World Tourism Day : 27th September :: World Population Day : ?
A. 1st July B. 12th October
C. 11th July D. 19th November

14. Estrange : Alienate :: Fastidious : ?
A. Lax B. Frivolous
C. Finicky D. Obdurate

15. rJA : Ajr :: mBA : ?
A. aBm B. Abm
C. ABm D. ABM

16. Cynophobia : Dogs :: Chionophobia : ?
A. Snow B. Touch
C. Travel D. Cats

17. Brain : Dura mater :: Heart : ?
A. Medulla
B. Epicardium
C. Pleural membrane
D. Aorta

18. Lion : Roar :: Dolphin : ?
A. Bray B. Click
C. Chortle D. Caw

19. Hunger : Satiate :: Thirst : ?
A. Water B. Drink
C. Liquid D. Quench

20. Notaphilist : Banknotes :: Arctophile : ?
A. Flies B. Postcards
C. Teddy bears D. Umbrellas

21. Absolve : Accuse :: Boisterous : ?
A. Placid
B. Desolate
C. Clamorous
D. Repugnant

22. 46 : 82 :: 37 : ?
A. 68 B. 55
C. 85 D. 99

23. Earth : Planet :: Sirius : ?
A. Asteroid B. Galaxy
C. Star D. Satellite

24. Flour : Cake :: Lumber : ?
A. Wood B. House
C. Tree D. Forest

25. Champagne : Grapes :: Rum : ?
A. Apple B. Rice
C. Flour D. Sugarcane

SOLUTIONS

1. **(A)** is the correct answer because Carmine is a shade of Red and in the same way, Aureolin is a shade of Yellow.
2. **(C)** is the correct answer because Monday and Saturday are alternate days of the week, in the same order, in which January and November are alternate months of the year.
3. **(C)** is the correct answer because in the term given in the question, 'cide' is the root word which means 'to kill'. Therefore, patricide means killing one's father, whereas regicide means killing a king.
4. **(B)** is the correct answer because in this question, the first is the type of houses traditionally famous in the country denoted by the second.
5. **(A)** is the correct answer because the square of 2 plus 2 is equal to 6. Similarly, the square of 3 plus 3 is equal to 12.
   $(2 \times 2) + 2 = 6$
   $(3 \times 3) + 3 = 12$
6. **(D)** is the correct answer because Lal Bahadur Shastri was born in the state of Uttar Pradesh in India and Mahatma Gandhi was born in the state of Gujarat in India.
7. **(B)** is the correct answer because if we take the place value of each letter in the word and multiply it, we get:
   $CAT = 3 \times 1 \times 20 = 60$
   $LOT = 12 \times 15 \times 20 = 3600$
8. **(D)** is the correct answer because Mt. Vesuvius is an active volcano located in Italy. Similarly, Mauna Loa is an active volcano located in Hawaii.
9. **(A)** is the correct answer because Gir National Park is located in the state of Gujarat, whereas Nagarhole National Park (also known as Nagarhole Tiger Reserve) is located in the state of Karnataka.
10. **(B)** is the correct answer because Kuchipudi is a famous folk dance, originated in the 17th century, in the state of Andhra Pradesh, whereas Sattriya is a famous folk dance, originated in the 15th century, in the state of Assam.
11. **(D)** is the correct answer because Quesadilla is a famous cuisine from Mexico, whereas Churro is a famous cuisine from Spain.
12. **(D)** is the correct answer because Bogota is the capital city of Colombia. Similarly, Quito is the capital city of Ecuador.
13. **(C)** is the correct answer because the World Tourism Day is observed on 27th September and, similarly, the World Population Day is observed on 11th of July.
14. **(C)** is the correct answer because alienate is a synonym of estrange which means to make someone feel isolated. Similarly, finicky is synonymous to fastidious which means the quality of being very attentive to and very concerned about the details and accuracy.
15. **(B)** is the correct answer because to get the 2nd group, reverse the order of the letters in the first group and substitute the middle capital letter with a small letter. So, mBA : Abm if we follow the same pattern.
16. **(A)** is the correct answer because in the term given in the question, the root word is 'phobia' which means an extreme or irrational fear of something. Therefore, fear of dogs is called cynophobia whereas fear of snow is called chionophobia.
17. **(B)** is the correct answer because dura mater is the outermost layer of the human brain, whereas epicardium is the outermost layer of the human heart.
18. **(B)** is the correct answer because the sound that a lion makes is called a roar. Similarly, the sound that a dolphin makes is called click.
19. **(D)** is the correct answer because the act of eradicating the first is referred to as the second. So, a person 'satiates' his

hunger by eating and 'quenches' his thirst by drinking.

20. **(C)** is the correct answer because in the term given in the question, the root word is 'phil', which means to love. A notaphilist collects banknotes, whereas an arctophile collects teddy bears.

21. **(A)** is the correct answer because placid is an antonym of boisterous as placid means being calm and boisterous means being noisy and energetic. In the same way, accusing is the opposite of absolving as accusing means claiming that someone has done something wrong and absolving means to declare someone free from guilt.

22. **(B)** is the correct answer because the following is the pattern followed in the question:

46 : 82 = (4 + 6) : (8 + 2)
10 : 10
Similarly,
37 : 55 = (3 + 7) : (5 + 5)
10 : 10

23. **(C)** is the correct answer because Earth is a planet in the solar system, whereas Sirius is the brightest star.

24. **(B)** is the correct answer because the first refers to the material used to make the second as flour is used to make a cake and lumber is used to make a house.

25. **(D)** is the correct answer because Champagne is made with grapes, whereas Rum is made of sugarcane. The relationship between the two terms is product and the raw material used to make it.

43 Seating Arrangement

This section of the GATE exam looks into the seating arrangement problems that students have to practice with during their preparation for GATE and other engineering entrance exams. Seating arrangement problems test your ability to reach conclusions after decoding a particular scenario that is presented to you in the question paper. These questions could be highly misleading and confusing to solve if tackled with the wrong approach; however, if you have your basics correct, even the lengthiest of the questions take less than 5 minutes to solve.

In order to solve this section, one has to be aware of his ability to comprehend data. While some people prefer not making diagrams while trying to solve problems, it is highly encouraged if you can make them. Diagrams help you in keeping the track of events that are going on throughout the problem.

Basic tips to solve the seating arrangement section:

- Read the problem in its entirety before making any statements or diagrams.
- Jot down all the information in one place. It can be a diagram or a short note. This information does not have to be elaborative. This information is there so that you do not have to go back to the question for referencing again and again.
- Use your vivid imagination and be a part of a problem. Imagining yourself in the problem helps you understand the scenario better and hence make decisions better. It will help you in keeping a track of where things or people are more accurately
- Always draw diagrams where the information is a lot. Once you are able to figure out the diagram, the rest of the problem becomes very easy for you.
- While making a diagram pay attention to the things which are definitely known in the problem first. Like:
  FACT ONE: A is sitting at the right of B
  FACT TWO: B is sitting at the immediate right of B.

Here the second fact must be noted first as it is an absolute fact. More about immediate and simple left/right is explained later.

Here is a sample problem to try on your own:

A, B, C, and D are four people sitting in a row. If A is sitting on the immediate left of B and C is sitting on the immediate left of D. D and A are at the extremes.

What is the correct order of seating?

A. BCDA B. ACDA
C. ABCD D. DCAB

Explanation:

From the first sentence we can figure out that A is sitting on the immediate left of B; hence, one pattern is fixed: **AB**

We can also infer that C is at the immediate left of D; hence, another pattern can be found: CD

Now the possible combinations we can have are **ABCD and CDAB.**

Looking at the last line, we find out that A and D are at extremes; hence, the only possible combination can be ABCD, which is the answer.

IMMEDIATE LEFT/RIGHT	LEFT/RIGHT
In this case, the person or the thing will always be exactly one position right/left from the other person or thing.	In this case, the person or the thing can be anywhere in any position left or right of the other person or thing
E.g.: If B is sitting at the immediate right of A, the sequence would be AB.	E.g.: If B is sitting at the right of A, the sequence can be: A_ _ _ B or AB or A_ _ _ _ _B, etc.

Type of seating arrangements

Single-row arrangement problems: These are the easiest of the seating arrangement problems that you will face. The previous problems we solved were one of the same kinds. Let us have a look at a different and slightly more complex problem to have a better understanding.

Example:
Six students P, Q, R, S, T, and U are sitting in a row. T and U are sitting in the centre. P and Q are sitting at the ends. R is sitting to the left of P.
Who is sitting immediate right of Q?
Answer: S
Explanation:
If we go by the problem line by line, we get to this pattern: Q S T U R P, which makes it clear.

Double-row arrangement problems:
These double-row problems are a bit more complex than the single-row problems; however, if we move step by step, it gets easier to solve. Remember not to be confused and go one step at a time.

Example:
Two volleyball teams of 6 players each assembled in two rows in front of each other facing north and south, respectively. Team Titans had Vyom, Raj, Yash, Manik, Suresh, and Deepak as players and they were facing north. Team Spikers had Andrew, Joe, Kevin, Paul, Jimmy, and Stuart as players and they were facing south.
Only one person stood between Vyom and Yash, who was standing at the extreme left end of the row. Joe, who was standing at the extreme left end, stood second to the left of Andrew. Kevin was facing the one who was an immediate neighbour of Vyom. Raj was facing Paul. Jimmy, who was standing at one of the extreme ends of the row, stood third to the right of the one who faced Deepak. Manik was facing the one who stood second to the left of Andrew.

Who among the following stood third to the right of the one, who was facing the one, who was second to the left of Jimmy?

Answer:
Manik was sitting third to the right of one, who is facing the one, who is second to the left of Jimmy.
Explanation:

Team Spikers Facing South	Jimmy	Kevin	Stuart	Andrew	Paul	Joe

←Right End Left end→

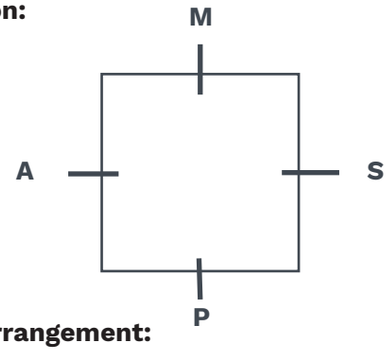
Team Titans Facing North	Yash	Suresh	Vyom	Deepak	Raj	Manik

← Left End Right End→

Rectangular arrangement
This section is also moderately easy to solve. One must make a diagram in order to get a proper understanding of the question and hence be able to solve it.

Example:
S, M, A, and P are playing UNO. A is to the right of M, who is to the right of S. Who is to the right of A?
Answer: P

Explanation:



Circular Arrangement:

This category deals with fairly tough questions revolving around the topic. In this area, the amount of details is a lot so a high degree of caution is to be maintained while jotting down the required info.

There are two kinds of questions one will face in this area:

- Inward facing: The right, in this case, is in the anticlockwise direction and the left is in the clockwise direction. Here the people are facing **towards the centre.**
- Outward-facing: The right, in this case, is in the clockwise direction and the left is in the anticlockwise direction. Here the people are facing **away from the centre.**

Example:

Eight friends P, Q, S, T, U, V, W, and X are sitting in a circle, but not necessarily in the same order. Four of them are facing outside and four of them are facing the centre.

U faces outside, both the immediate neighbours of U face the centre. X sits second to the right of U. Q sits third to the left of U. T faces the centre. Both the immediate neighbours of T face outside. W sits second to the left of P. Q sits third to the right of X. V is an immediate neighbour of T. S is an immediate neighbour of W. T is not an immediate neighbour of Q.

Who amongst the following sits third to the right of P?

Answer: V

PRACTICE QUESTIONS

1. Jashn, Prakrit, Rekha, Xeo, Surya, and Zara are sitting in a row facing north. Surya and Zara are in the centre. Jashn and Prakrit are at both ends. Rekha is sitting to the left of Jashn.

Who sits immediate right of Prakrit?

A. Jashn B. Xeo
C. Surya D. Zara

2. Seven persons, M, N, O, P, Q, R, and S, are sitting in a circular manner all facing inside. M is third to the left of O, who is second to the right of the person, who sits immediately next to R. P sits second to the left of M. N sits third to right of Q.

Which of the following statement(s) is (are) true?

I. S sits immediately next to M.
II. Q is second to the left of R.
III. O is third to the right of S.

A. Only I B. Only III
C. Both II and III D. Both I and II

3. Arpit, Bhitam, Chanakya, Dhruv, and Emma are sitting on a bench facing north. Arpit is sitting next to Bhitam, Chanakya is sitting next to Dhruv, Dhruv is not sitting with Emma who is on the left end of the bench. Chanakya is in the second position from the right. Arpit is to the right of Bhitam and Emma. Arpit and Chanakya are sitting together.

In which position Arpit is sitting?

A. Between Bhitam and Dhruv
B. Between Bhitam and Chanakya
C. Between Emma and Dhruv
D. Between Chanakya and Emma

4. Anamika, Bhoomika, Chandni, Deepika, Elisa, Falguni, and Gauri are sitting in a row facing north:

(a) Falguni is to the immediate right of Elisa.

(b) Elisa is 4th to the right of Gauri.
(c) Chandni is the neighbour of Bhoomika and Deepika.
(d) The person who is third to the left of Deepika is at one of the ends.
What is the position of Anamika?
A. Extreme Right
B. 2nd from the left
C. Centre of the row
D. 3rd from the right

5. In a bike race, seven bikes of different companies—Honda, Suzuki, Bajaj, TVS, Hero, Piaggio, and Yamaha—are standing facing to the east in the following order:
(a) Honda is next to the right of Yamaha.
(b) Yamaha is fourth to the right of Bajaj.
(c) TVS is between Suzuki and Piaggio.
(d) Bajaj which is third to the left of Suzuki is at one end.
Which one of the following is the correct position of Hero?
A. Next to the left of Honda
B. Next to the left of Piaggio
C. Between Piaggio and Yamaha
D. Fourth to the right of TVS

6. Five friends are sitting in a row in a park facing north. Sukesh is to the left of Rakesh and to the right of Bablesh. Mikhilesh is to the right of Reshmi. Reshmi is between Rakesh and Mikhilesh.
Who is second from the left in the row?
A. Reshmi
B. Mikhilesh
C. Bablesh
D. Sukesh

7. Eight friends (A, B, C, D, E, F, G, and H) are sitting in two opposite rows, facing each other. Each row has 4 persons. A is between F and G and is facing north. H is opposite to E who is to the immediate left of B. C is between D and B. H is to the immediate right of G.
Which of the following pairs of persons has a second person sitting to the immediate left of the first person?
A. FA
B. GA
C. EB
D. CD

(Questions 8 to 12) Study the following information to answer the questions given below.

Eight women (Aria, Betty, Cathy, Damaris, Emily, Fiona, Gina, and Hannah) are sitting around a circular table. A few of them are facing the centre of the table and others are facing the opposite direction.
Gina sits second to the left of Aria. Damaris and Hannah are sitting right next to each other and facing the same direction. Aria sits third to the left of Fiona. The immediate neighbours of Cathy face the same direction. Damaris sits second to the right of both Aria and Betty. The one who sits immediately to the right of Aria faces the centre of the table and her immediate neighbours face opposite directions. Fiona sits third to the right of Gina and both of them face opposite directions. Emily sits second to the right of both Cathy and Hannah.

8. How many women are seated between Emily and Fiona?
A. Two
B. Three
C. One
D. No one

9. What is Hannah's position with respect to Emily?
A. Second to the right
B. Immediate left
C. Second to the left
D. Immediate right

10. How many women face outside?
A. Three
B. Four
C. Five
D. Six

11. Four of the following women are alike in some way according to their seating arrangement. Which of the following women does not belong to the group?

A. Fiona
B. Aria
C. Cathy
D. Betty

12. What is the position of Gina with respect to Hannah?
A. Immediate left
B. Immediate right
C. Third to the left
D. Third to the right

(Questions 13 to 17) Study the following information to answer the questions given below.

Eight people—Ethan, Isaac, Kevin, Lokesh, Madhan, Otis, Shree, and Ravi—are sitting in a straight line, not necessarily in the same order facing North.
Otis sits third to the left of Madhan. Ravi sits at one of the extreme ends of the line, and only two people sit between Madhan and Kevin. Ethan is not an immediate neighbour of Lokesh. Only one person sits between Shree and Ravi. Kevin is not an immediate neighbour of Ravi. Only three people sit between Shree and Lokesh.

13. Which is the correct seating arrangement?
A. Ravi, Otis, Shree, Madhan, Isaac, Ethan, Lokesh, Kevin
B. Ravi, Otis, Ethan, Shree, Madhan, Isaac, Lokesh, Kevin
C. Ravi, Otis, Shree, Ethan, Madhan, Lokesh, Isaac, Kevin
D. Ravi, Otis, Shree, Ethan, Madhan, Isaac, Lokesh, Kevin

14. Where is Ravi with respect to Ethan?
A. Second to the right
B. Third to the left
C. Second to the left
D. Third to the right

15. How many people sit between Otis and Shree?
A. One
B. Two
C. Three
D. No one

16. Which of the following is correct?
A. Otis and Ravi are at the extreme ends of line
B. Lokesh sits second to the left of Madhan
C. Only one person sits between Madhan and Ethan
D. Shree and Ethan are immediate neighbours

17. Who are the immediate neighbours of Madhan?
A. Ethan, Kevin
B. Shree, Lokesh
C. Isaac, Ethan
D. Kevin, Shree

(Question 18 to 22) Study the following information to answer the questions given below.

In a conference hall, 10 persons are present, 5 men and 5 women are sitting in two parallel lines, facing each other. Five men, namely, Ajnkya, Bhoomij, Chirayu, Dharmendra, and Ehsan are facing the south and the five women, Mrignayani, Navya, Oshiyana, Priya, and Arunima are facing towards the north.

- Bhoomij, who is just next to the left of Dharmendra, is opposite Arunima.
- Chirayu and Navya are diagonally opposite to each other.
- Ehsan is opposite Oshiyana who is just next to Mrignayani.
- Priya, who is just to the left of Arunima, is opposite Dharmendra.
- Mrignayani is at the left corner of her line.

18. Which two people are sitting at the two extreme ends of the line?
A. Ehsan, Bhoomij
B. Ajinkya, Chirayu
C. Chirayu, Dharmendra
D. Dharmendra, Bhoomij

19. Who is sitting right in front of Dharmendra?
A. Navya
B. Mrignayani
C. Oshiyana
D. Priya

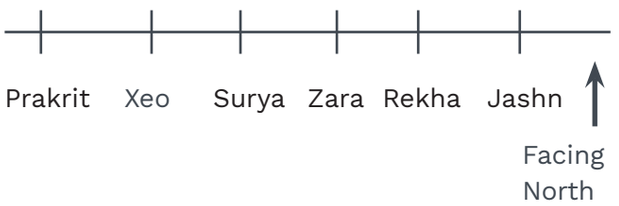
20. Who sits exactly in between Mrignayani and Navya?
A. Priya
B. Oshiyana
C. Arunima
D. Cannot be determined

21. Who is sitting opposite Oshiyana?
A. Chirayu
B. Ehsan
C. Dharmendra
D. Bhoomij

22. Who is sitting at the right corner of the women's line?
A. Mrignayani
B. Oshiyana
C. Arunima
D. Navya

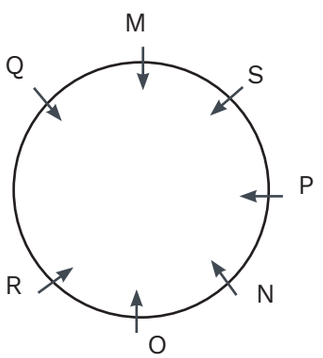
SOLUTIONS

1. The seating arrangement would be as follows: Prakrit, Xeo, Surya, Zara, Rekha, Jashn

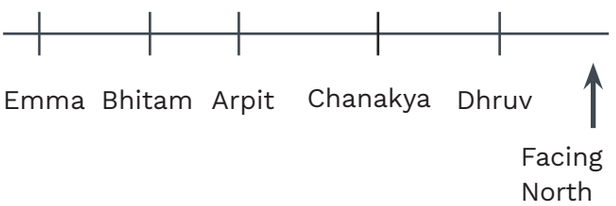


2. M is third to the left of O, who is second to the right of the person, who sits immediately next to R.
We get,
P sits second to the left of M.

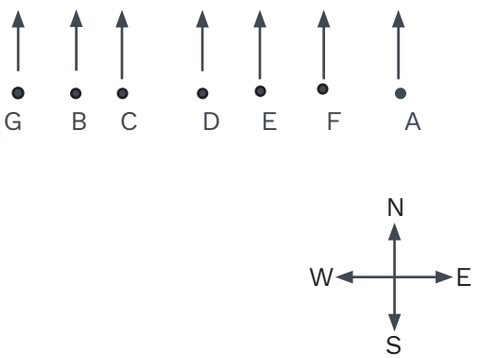
N sits third to right of Q.
Hence, we get



3. The following order will be there:



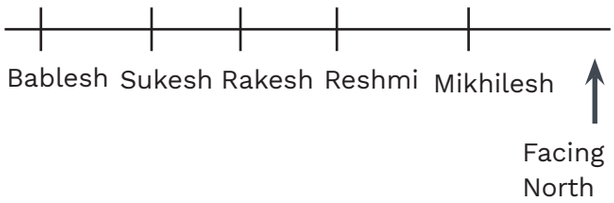
4. The following order will be there:



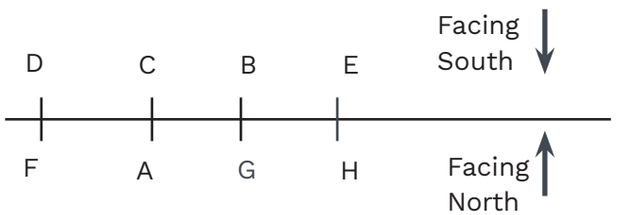
5. The order would be: Bajaj, Piaggio, TVS, Suzuki, Yamaha, Honda, and Hero.

Facing East ↑	Bajaj	Piaggio	TVS	Yamaha	Suzuki	Honda	Hero

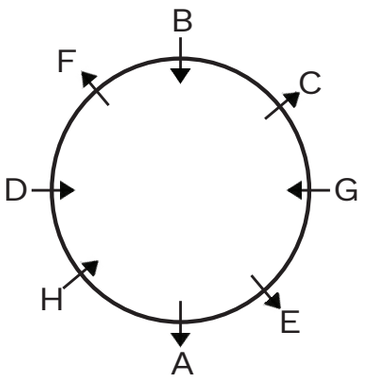
6. The order would go like: Bablesh Sukesh Rakesh Reshmi Mikhilesh



7. Given all eight friends are sitting in two opposite rows, facing each other. Each row has 4 persons. A is between F and G and is facing north. H is to the immediate right of G. H is opposite to E who is to the immediate left of B. C is between D and B. Among FA, GA, EB, CD, only GA is true because in this, second person A is sitting immediate left of the first person G. In all other second person is sitting immediate right to the first person.



(Solutions 8-12):
From the given observations, it can be concluded that this is the seating arrangement:

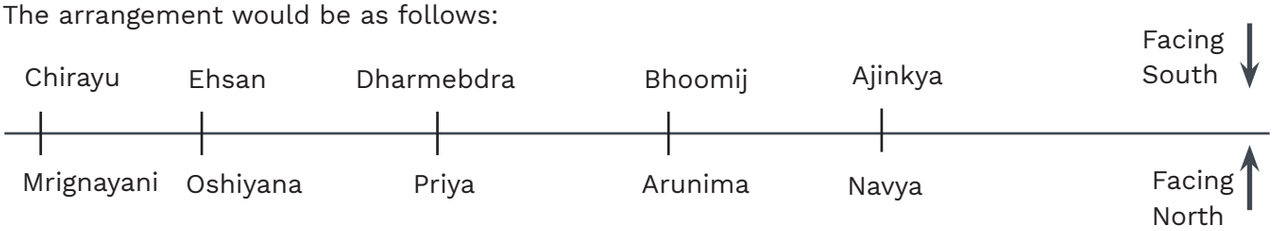


8. Three women (Betty, Cathy, and Gina) sit between Emily and Fiona
9. Hannah is second to the right of Emily
10. Four women
11. Betty, Fiano, Aria, and Cathy all face outwards whereas Betty does not
12. Gina is third to the right of Hannah

(Solutions 13-17):
From the given observation, it can be inferred that this is the seating arrangement:

13. Ravi, Otis, Shree, Ethan, Madhan, Isaac, Lokesh, Kevin
14. Ravi is third to the left of Ethan
15. No one—Otis and Shree—are immediate neighbours
16. Shree and Ethan are immediate neighbours
17. Ethan and Isaac are the immediate neighbours of Madhan

(Solutions 18-22):
The arrangement would be as follows:



18. Ajinkya and Chirayu sit at the extreme ends.
19. Priya is sitting right in front of Dharmendra.
20. Priya is sitting exactly between Mrignayani and Navya.
21. Ehsan is sitting opposite Oshiyana.
22. Navya is sitting at the right corner of the women's line.

44 Constraint-Based Puzzles

Puzzles are raw data for a sequence or order of events that must be arranged systematically for the sequence or order of events to be accurately depicted. Candidates are given information in a jumbled, haphazard format in puzzles. It tests the candidate's ability to decipher the sequence and analyse given information into a meaningful and judgmental form, to arrive at a final decision or conclusion by following a systematic pattern of linking and interlinking one or more pieces of information with one another.

There are various types of puzzles some of which are given below:

1. **Floor Puzzle:** In this type of puzzle, the information is given regarding the people living on different floors of the same or different buildings. They have to figure out the sequence which matches each person with the floor number or name.
2. **Scheduling Puzzle:** In this type of puzzle, the information is given regarding the different parameters based on the dates, months or years.
3. **Multiple-Variable Puzzle:** In this type of puzzle, different kinds of information of different subjects are given. It can be different things belonging to different people in different colours.
4. **Square/Circular Arrangement Puzzle:** This type of puzzle includes the seating arrangement of different people around a square or circular table. These are usually covered under the seating arrangement topic.
5. **Box Puzzle:** In this type of puzzle, information regarding different boxes is given and the boxes need to be arranged one above another.

PRACTICE QUESTIONS

Questions 1-5: Seven boxes P, Q, R, S, T, U, and V are placed one above the other, but not necessarily in the same order. Each of them has a different weight, i.e., 75 kg, 80 kg, 70 kg, 60 kg, 55 kg, 85 kg, and 45 kg, but not necessarily in the same order. S does not have a box weighing 45 kg. There are only two boxes below the box which weigh 85 kg. There are only three boxes between box V and the box which weigh 85 kg. V does not have a box either weighing 60 kg or weighing 55 kg. The box weighing 55 kg is immediately above box R. The box weighing 45 kg is immediately above the box which weighs 75 kg and immediately below the box which weighs 60 kg. R has a box weighing 80 kg. The box weighing 70 kg is immediately above box Q. There are only two boxes between the box whose weight is 60 kg and box U. Neither P nor S has a box weighing 55 kg.

1. Which of the following weights does box T have?

A. 85 kg B. 70 kg
C. 55 kg D. 45 kg

2. Which of the following weights does box P have?

A. 45 kg B. 75 kg
C. 85 kg D. 55 kg

3. Which of the following weights does box S have?

A. 45 kg B. 75 kg
C. 85 kg D. 55 kg

4. Who has the box weighing 85 kg?

A. Q B. P
C. U D. R

5. Who has the box weighing 60 kg?

A. Q B. P
C. U D. R

Questions 6-10: Eight persons P, Q, R, S, T, U, V, and W are issued debit cards on the 13th and 17th of each month from March to June. No one is issued a debit card on the same day. U, V, and W got their cards on the 13th date of consecutive months in the same order. W gets his debit card earlier than P and Q, who got their cards in the month of June. Two persons got their debit card between W and P. T got his debit card earlier than S but later than R.

6. Who got their debit cards in May?

A. W, S B. P, W
C. U, S D. R, V

7. Who got their debit cards in June?

A. W, S B. Q, P
C. U, S D. R, V

8. Who got their debit cards in April?

A. W, S
B. Q, P
C. V, S
D. V, T

9. Who got their debit cards in March?

A. W, S
B. U, P
C. U, R
D. R, V

10. Who got their debit cards on 17th dates of all the 4 months?

A. R, T, S, P
B. V, T, S, P
C. R, W, S, P
D. R, T, Q, P

Questions 11-15: Seven people A, B, C, D, E, F, and G live on 7 different floors in a building. The ground floor is numbered 1, the first floor is numbered 2, and so on. A lives on the floor immediately below B and immediately above C who lives on an even-numbered floor. There is a gap of two people between B and F. Also, there is a gap of two people between A and E. E does not live below C and F lives below B. D lives somewhere above G.

11. Who lives on the 5th floor of the building?

A. G B. D
C. A D. Either G or D

12. Who lives on the 7th floor of the building?

A. G
B. D
C. A
D. Either G or D

13. Who lives on the 1st floor of the building?

A. G B. B
C. F D. E

14. Who lives on the 4th floor of the building?

A. G B. D
C. A D. B

15. Who lives on the 3rd floor of the building?

A. G B. D
C. A D. B

Questions 16-20: There are seven members in a family: M, N, O, P, Q, R, S. Each of them owns a different car and their incomes are also different. There are four males among them. No female member owns a Hyundai or BMW car. The person with a BMW earns the most. P owns Audi and earns less than R who owns Mercedes. O who owns Skoda earns more than M and less than P. S's wife has the least income. Q is an unmarried lady who owns Honda. She earns less than M and more than only N. The person who owns Hyundai does not have the least income.

16. Who among the following has the least income?

A. M B. N
C. M or N D. O

17. Which car is owned by M?

A. Hyundai
B. Maruti
C. Mercedes
D. Cannot be determined

18. How many of the family members earn more than the person who owns Mercedes?

A. 4 B. 3
C. 2 D. 1

19. Which of the following is the combination of three female members in the family?

A. OQN
B. PQN
C. RQN
D. Cannot be determined

20. Which of the following is the correct combination?

A. S—Audi—M
B. O—Skoda—F
C. Q—Honda—F
D. N—Honda—F

SOLUTIONS

1. **(C)** Out of the seven boxes, there are only two boxes below the box that weighs 85 kg. There are only three boxes between box V and the box which weighs 85 kg.

So,

BOX	WEIGHT
V	
	85 kg

The box weighing 45 kg is immediately above the box which weighs 75 kg and immediately below the box which weighs 60 kg. V does not have a box either weighing 60 kg or weighing 55 kg.

BOX	WEIGHT
V	
	60 kg

BOX	WEIGHT
	45 kg
	75 kg
	85 kg

The box weighing 70 kg is immediately above the box Q. V does not have a box either weighing 60 kg or weighing 55 kg.

BOX	WEIGHT
V	70 kg
Q	60 kg
	45 kg
	75 kg
	85 kg

R has a box weighing 80 kg. The box weighing 55 kg is immediately above the box R.

BOX	WEIGHT
V	70 kg
Q	60 kg
	45 kg
	75 kg
	85 kg
	55 kg
R	80 kg

There are only two boxes between the box whose weight is 60 kg and box U.

BOX	WEIGHT
V	70 kg
Q	60 kg
	45 kg
	75 kg
U	85 kg
	55 kg
R	80 kg

Neither P nor S has a box weighing 55 kg. S does not have a box weighing 45 kg.

BOX	WEIGHT
V	70 kg
Q	60 kg
P	45 kg
S	75 kg

BOX	WEIGHT
U	85 kg
	55 kg
R	80 kg

One box T is left and only one place is remaining. So, he will sit there.

BOX	WEIGHT
V	70 kg
Q	60 kg
P	45 kg
S	75 kg
U	85 kg
T	55 kg
R	80 kg

Hence, T has a box weighing 55 kg.

2. (A)

BOX	WEIGHT
V	70 kg
Q	60 kg
P	45 kg
S	75 kg
U	85 kg
T	55 kg
R	80 kg

Hence, P has a box weighing 45 kg.

3. (B)

BOX	Weight
V	70 kg
Q	60 kg
P	45 kg
S	75 kg
U	85 kg
T	55 kg
R	80 kg

Hence, S has a box weighing 75 kg.

4. (C)

BOX	WEIGHT
V	70 kg
Q	60 kg
P	45 kg
S	75 kg
U	85 kg
T	55 kg
R	80 kg

Hence, U has a box weighing 85 kg.

5. (A)

BOX	WEIGHT
V	70 kg
Q	60 kg
P	45 kg
S	75 kg
U	85 kg
T	55 kg
R	80 kg

Hence, Q has a box weighing 85 kg.

6. (A) U, V, and W got their debit cards on the 13th of consecutive months in the same order.

MONTH	CASE I		CASE II	
	13	17	13	17
March			U	
April	U		V	
May	V		W	
June	W			

W gets its card earlier than P and Q who got their cards in June. Thus, case (I) gets eliminated.

MONTH	CASE II	
	13	17
March	U	
April	V	
May	W	
June	Q/P	P/Q

Two people got their cards between W and P.

MONTH	CASE II	
	13	17
March	U	
April	V	
May	W	
June	Q	P

T got its card earlier than S but later than R.

MONTH	CASE II	
	13	17
March	U	R
April	V	T
May	W	S
June	Q	P

Thus, W and S got their debit cards in May.

7. (B)

MONTH	CASE II	
	13	17
March	U	R
April	V	T
May	W	S
June	Q	P

Thus, Q and P got their debit cards in June.

8. (D)

MONTH	CASE II	
	13	17
March	U	R
April	V	T
May	W	S
June	Q	P

Thus, V and T got their debit cards in April.

9. (C)

MONTH	CASE II	
	13	17
March	U	R
April	V	T
May	W	S
June	Q	P

Thus, U and R got their debit cards in March.

10. (A)

MONTH	CASE II	
	13	17
March	U	R
April	V	T
May	W	S
June	Q	P

Thus, R, T, S, P got their debit cards on 17th of all the 4 months.

11. (A) A lives on the floor immediately below B and immediately above C, who lives on an even-numbered floor.

7		
6		B
5		A
4	B	C
3	A	
2	C	
1		

(Case 1) (Case 2)

There is a gap of two persons between B and F. Also, there is a gap of two persons between A and E.
E does not live below C. F lives below B.

7		
6	E	B
5		A
4	B	C
3	A	F
2	C	E
1	F	

(Case 1) (Case 2)

Since, E does not live below C, case 2 gets eliminated.
D lives somewhere above G.

7	D
6	E
5	G
4	B
3	A
2	C
1	F

Thus, G lives on the 5th floor.

12. (B)

7	D
6	E
5	G
4	B
3	A
2	C
1	F

Thus, D lives on the 7th floor.

13. (C)

7	D
6	E
5	G
4	B
3	A
2	C
1	F

Thus, F lives on the 1st floor.

14. (D)

7	D
6	E
5	G
4	B
3	A
2	C
1	F

Thus, B lives on the 4th floor.

15. (C)

7	D
6	E
5	G
4	B
3	A
2	C
1	F

Thus, A lives on the 3rd floor.

16. (B) According to the given information, the arrangement is as follows in order of their income (from highest to lowest):

INCOME	PERSON	CAR	SEX
Highest	S	BMW	M
	R	Mercedes	M/F
	P	Audi	M/F
	O	Skoda	M/F
	M	Hyundai	M
	Q	Honda	F
Lowest	N	Maruti	F

Therefore, N has the least income. Option B is correct.

17. (A) According to the given information, the arrangement is as follows in order of their income (from highest to lowest):

INCOME	PERSON	CAR	SEX
Highest	S	BMW	M
	R	Mercedes	M/F
	P	Audi	M/F
	O	Skoda	M/F
	M	Hyundai	M
	Q	Honda	F
Lowest	N	Maruti	F

Therefore, M owns a Hyundai car. Option A is correct.

18. (D) According to the given information, the arrangement is as follows in order of their income (from highest to lowest):

INCOME	PERSON	CAR	SEX
Highest	S	BMW	M
	R	Mercedes	M/F
	P	Audi	M/F
	O	Skoda	M/F
	M	Hyundai	M
	Q	Honda	F
Lowest	N	Maruti	F

Therefore, there is only one member S who earns more than R who owns a Mercedes car. Option D is correct.

19. (D) According to the given information, the arrangement is as follows in order of their income (from highest to lowest):

INCOME	PERSON	CAR	SEX
Highest	S	BMW	M
	R	Mercedes	M/F
	P	Audi	M/F
	O	Skoda	M/F
	M	Hyundai	M
	Q	Honda	F
Lowest	N	Maruti	F

Therefore, Q and N are definitely the female members but the third female is among R, P, and O. So, it cannot be determined. Option D is correct.

20. (C) According to the given information, the arrangement is as follows in order of their income (from highest to lowest):

INCOME	PERSON	CAR	SEX
Highest	S	BMW	M
	R	Mercedes	M/F
	P	Audi	M/F
	O	Skoda	M/F
	M	Hyundai	M
	Q	Honda	F
Lowest	N	Maruti	F

Therefore, Q—Honda—F is the correct combination. Option C is correct.

45 Data Sufficiency

INTRODUCTION

Data sufficiency is an important topic of the reasoning section. Data sufficiency questions contain a problem followed by two or three statements containing certain data or information, which may be required for solving the given problem. You have to determine which all statements are required to answer the problem. Thus, questions based on data sufficiency are meant to judge the candidate's ability to determine the information necessary to solve a given question (rather than the actual solution of the same). You should be able to determine the minimum information required for solving the problem so that you may arrive at the most appropriate answer choice.

Questions on data sufficiency may be asked from topics such as ranking, arrangements, coding-decoding, mathematical problems, blood relationships, directions, and so on. (a) You need to remember the steps involved in solving a particular data sufficiency question and follow them in this particular order: Check the first statement, then check the second statement, and lastly, if required, combine the two statements to get the answer. The answer may be in the form of YES or NO; in both cases, the given statement will be sufficient to give the answer. When you are unable to find a definite answer then the given statement is not sufficient. Note: Do not make any assumptions while solving data sufficiency questions.

EXEMPLAR QUESTIONS

1. In a certain code, 'jil jua jia' means 'please take care'. Which code word means 'please'?

I. 'tak sil jia' means 'we take him'.

II. 'est pros jil' means 'I care for'.

A. If the data in only statement I are sufficient to answer the question while the data in statement II are alone not sufficient to answer the question.

B. If the data in only statement II are sufficient to answer the question while the data in statement I are alone not sufficient to answer the question.

C. If data even in both the statements I and II together are not sufficient to answer the question.

D. If data in both statements I and II together are necessary to answer the question.

Answer: D

Explanation: From the statement I → 'jia' means 'take'.

From statement II → 'jil' means 'care'

so, by resolving all the statements, we can say that 'jua' means 'please'

Therefore, option D is correct.

2. How is Tia related to Aliya?

I. Tia's husband is the only son of Aliya's mother.

II. Tia's brother and Aliya's husband are cousins.

A. If the data in only statement I are sufficient to answer the question while the data in statement II are alone not sufficient to answer the question.

B. If the data in only statement II are sufficient to answer the question while the data in statement I are alone not sufficient to answer the question.

C. If the data either in statement I or in statement II alone are sufficient to answer the question

D. If data in both statements I and II together are necessary to answer the question.

Answer: B

Explanation: From the statement I → Tia's husband is Aliya's brother (only son of her mother) ⇒ Tia is Aliya's sister-in-law and Aliya is a male, then Tia should be the wife of Aliya. Hence, the relation is not defined. Therefore, option B is correct.

From statement II → Tia's brother = cousin of Aliya's husband. Therefore, Tia will be the cousin of Aliya's husband.

Then, Tia is Aliya's cousin-in-law, whose gender need not be defined. So, the data in statement II are sufficient to answer the question while the data in statement I are alone not sufficient to answer the question.

3. Towards which direction is Charu from Riva?

I. Anij is towards the west of Bilal and northeast of Riva.

II. Charu is towards the south of Anij.

A. If the data in only statement I are sufficient to answer the question, while the data in statement II alone are not sufficient to answer the question.

B. If the data in only statement II are sufficient to answer the question, while the data in statement I alone are not sufficient to answer the question.

C. If data even in both the statements I and II together are not sufficient to answer the question.

D. If data in both statements I and II together are necessary to answer the question.

Answer: C

Explanation: From the statement I → we will get to know that Anij and Bilal are in straight lines and Anij is to the west of Bilal. Secondly, Anij is to the northeast of Riva.

From statement II, we get to know that Charu is to the south of Anij, but the twist here is that we don't know the directions of Charu and Riva with respect to each other's whether they are in straight lines or not. Therefore, we can't answer this question. So, the data in both statements I and II together are not necessary to answer the question. Therefore, option C is correct.

PRACTICE QUESTIONS

1. Which statements show that → A can be either C or D but not both?

I. some A is C and B but no C is B

II. some C is E but not A is E

III. no B is E and some E is D

A. If data in only statements I and II will be suffice to answer

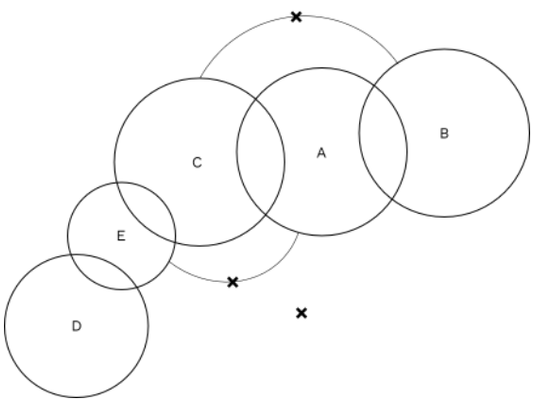
B. If data in only statements I and III will be suffice to answer

C. If data in all the statements I, II, and III will be suffice to answer

D. If data in even all the statements will not be suffice to answer

Answer: D

Explanation: By resolving all the statements, we get this result



So, we can say that data in even all the statements will not be suffice to answer. Therefore, option D is correct.

2. In a certain code 'dua lopa jima' means 'we are best'. Which code word means 'we'?

I. 'al sim jima' means 'best of luck'.

II. 'est pros dua' means 'are you there'.

A. If the data in only statement I are sufficient to answer the question, while the data in statement II alone are not sufficient to answer the question.

B. If the data in only statement II are sufficient to answer the question, while the data in statement I are alone not sufficient to answer the question.

C. If data even in both the statements I and II together are not sufficient to answer the question.

D. If data in both statements I and II together are necessary to answer the question.

Answer: D

Explanation: From the statement I → 'jima' means 'best'.

From the statement, II → 'dua' means 'are'.

So, by resolving all the statements, we can say that 'lopa' means 'we'

Therefore, option D is correct.

3. In a certain code 'ar br cr dr' means 'let it be now'. And 'ar fr dr hr' means 'now just be yourself'. Which code word means 'it'?

I. 'fr br dr jr' means 'just it's be it'.

II. 'vr zr br ar' means 'now this is it'.

A. If the data in only statement I are sufficient to answer the question, while the data in statement II alone are not sufficient to answer the question.

B. If the data in only statement II are sufficient to answer the question while the data in statement I are alone not sufficient to answer the question.

C. If the data either in statement I or in statement II alone are sufficient to answer the question

D. If data even in both statements I and II together are not sufficient to answer the question.

Answer: C

Explanation: From question → 'ar' and 'dr' can either be 'now' or 'be'.

From statement I and question statement → 'dr' means 'be' and 'br' means 'it'.

From statement II and question statement → 'ar' means 'now' and 'br' means 'it'.

So, by resolving both statements I and II individually, we can say that 'br' means 'it'; therefore, the data either in statement I or in statement II alone are sufficient to answer the question. Therefore, option C is correct.

4. Who is the granddaughter of T?

I. I is the sister-in-law of G and G is the husband of K. A is the grandson of T who is the father-in-law of K.

II. B has only two sons and one of them is F. K is sister-in-law of F. C is the sister of A who is the son of I.

A. If the data in only statement I are sufficient to answer the question, while the data in statement II alone are not sufficient to answer the question.

B. If the data in only statement II are sufficient to answer the question, while the data in statement I alone are not sufficient to answer the question.

C. If the data either in statement I or in statement II alone are sufficient to answer the question.

D. If data in both statements I and II together are necessary to answer the question.

Answer: D

Explanation: From statement I → I and K are females; they are sister-in-law because I is G's sister-in-law, that is, she is G's brother's wife.

From statement II → 'T has only two sons and one of them is F and also given K is F's sister-in-law. As resolved from statement I, K is G's

wife. Therefore, F and G are brothers and sons of T.

From both the statements, we get to know that T and B are husband and wife who have 2 children, F and G whose wives are I and K respectively. From statement II, we get to know that A is the son of I and C is the sister of A. From statement I, A is the grandson of T; therefore, C is the granddaughter of T.

So, the data in both statements I and II together are necessary to answer the question. Therefore, option D is correct.

5. In a certain code 'jo so ro to' means 'I am a boy'. And 'ao do wo so' means 'where should I go'. Which code word means 'am'?

I. 'yo uo jo io' means 'there is a girl'.

II. 'no mo ro co' means 'boy you can leave'.

A. If the data in only statement I are sufficient to answer the question, while the data in statement II alone are not sufficient to answer the question.

B. If the data in only statement II are sufficient to answer the question while the data in statement I are alone not sufficient to answer the question.

C. If the data either in statement I or in statement II alone are sufficient to answer the question

D. If data in both statements I and II together are necessary to answer the question.

Answer: D

Explanation: From the statement, I → 'jo' means 'a'.

From statement II → 'ro' means 'boy'.

From the question → 'so' means 'I'.

So, by resolving all the statements, we can say that 'to' means 'am'.

Therefore, option D is correct.

6. Who is the aunt of X?

I. F is the son-in-law of Z, who is the father of T and P. Y is the son of F.

II. W is the grandmother of X, who is the daughter of U. M is the daughter-in-law of W, who has 3 children T, P, and U.

A. If the data in only statement I are sufficient to answer the question while the data in statement II alone are not sufficient to answer the question.

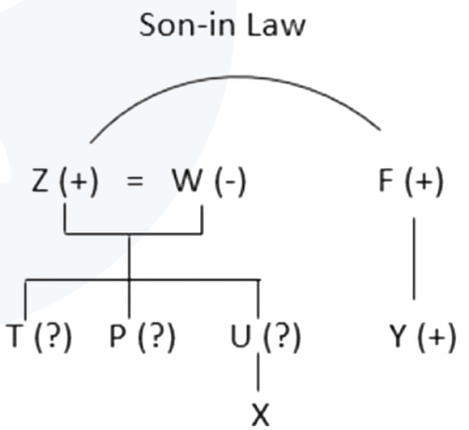
B. If the data in only statement II are sufficient to answer the question while the data in statement I alone are not sufficient to answer the question.

C. If data even in both statements I and II together are not sufficient to answer the question.

D. If data in both statements I and II together are necessary to answer the question.

Answer: C

Explanation: From both the statements we would get the relations between these peoples as shown in the diagram.



Still, we can't determine the relationship between them because the genders of T, P, and U are not defined. Moreover, M's relationship with X could not be established till we get to know the gender of U. If U was a male, then probably M might be his wife and then she will be X's mother. In the second case, even if the gender of U is male, then M might be the wife of either P or T, whose gender is still unknown. So, the data even in both statements I and

II together are not sufficient to answer the question. Therefore, option C is correct.

7. Zen is in which direction with respect to Xavier?

I. Yasir is to the south of Xavier and Zen is to the east of Prateek, which is to the north of Yasir.

II. Prateek is to the south of Xavier.

A. If the data in only statement I are sufficient to answer the question, while the data in statement II alone are not sufficient to answer the question.

B. If the data in only statement II are sufficient to answer the question, while the data in statement I alone are not sufficient to answer the question.

C. If data even in both statements I and II together are not sufficient to answer the question.

D. If data in both statements I and II together are necessary to answer the question.

Answer: D

Explanation: From statement I → we will get two directions. (1) Xavier is to the north of Yasir. (2) Prateek is to the north of Yasir.

From statement II, we get to know that Prateek will lie somewhere between Xavier and Yasir and, therefore, Zen will be in the south-east with respect to Xavier.

So, the data in both statements I and II together are necessary to answer the question. Therefore, option D is correct.

8. Which direction is Abhay facing?

I. Ajay is to the right of Abhay.

II. Anil is sitting opposite Ajay, who is facing north.

A. If the data in only statement I are sufficient to answer the question, while the data in statement II alone are not sufficient to answer the question.

B. If the data in only statement II are sufficient to answer the question, while the data in statement I alone are not sufficient to answer the question.

C. If the data either in statement I or in statement II alone are sufficient to answer the question

D. If data even in both the statements I and II together are not sufficient to answer the question.

Answer: D

Explanation: From the statement I → we will get to know that Ajay and Abhay are sitting in straight lines, but their direction of the face is unknown.

From statement II, we get to know that Anil is south of Ajay who is facing north.

From both the statements, the face of the direction of Abhay is still unknown; therefore, the data in both statements I and II together are not necessary to answer the question. Therefore, option D is correct.

9. Towards which direction is Parul from Rohit?

I. Sam is towards the west of Mohit and northeast of Rohit.

II. Parul is towards the south of Sam.

A. If the data in only statement I are sufficient to answer the question while the data in statement II alone are not sufficient to answer the question.

B. If the data in only statement II are sufficient to answer the question while the data in statement I alone are not sufficient to answer the question.

C. If the data either in statement I or in statement II alone are sufficient to answer the question

D. If data even in both statements I and II together are not sufficient to answer the question.

Answer: D

Explanation: From the statement I → we will get to know that Sam and Mohit are in straight lines and Sam is to the west of Mohit. Secondly, Sam is to the northeast of Rohit.

From statement II, we get to know that Parul is to the South of Sam, but the twist here is that we don't know the directions of Parul and Rohit with respect to each others, whether, they are in straight lines or not. Therefore, we can't answer this question. So, the data in both statements I and II together are not sufficient to answer the question. Therefore, option D is correct.

10. In a certain code, 'sel ta rei jai' means 'love to be here'. And 'rei hoe mi sel' means 'you should be love'. Which code word means 'love'?

I. 'mi del si ta' means 'you are to sign'.

II. 'jai del sel bu' means 'love sign is here'.

A. If the data in only statement I are sufficient to answer the question, while the data in statement II alone are not sufficient to answer the question.

B. If the data in only statement II are sufficient to answer the question while the data in statement I alone are not sufficient to answer the question.

C. If the data either in statement I or in statement II alone are sufficient to answer the question

D. If data in both statements I and II together are necessary to answer the question.

Answer: B

Explanation: From question → 'rei' and 'sel' can either be 'love' or 'be'.
From the statement I → 'ta' means 'to'.
From statement II and question statement → 'sel' means 'love' and 'jai' means 'here'.
So, by resolving only statement II, we can say that 'sel' means 'love'.
Therefore, option B is correct.

11. Who is the sister of D?

I. G is the grandson of C who is the father-in-law of H. D is the uncle of L.

II. A, who has only two children: one son and one daughter K. G and L are brothers, who are the children of H.

A. If the data in only statement I are sufficient to answer the question, while the data in statement II alone are not sufficient to answer the question.

B. If the data in only statement II are sufficient to answer the question, while the data in statement I alone are not sufficient to answer the question.

C. If the data either in statement I or in statement II alone are sufficient to answer the question

D. If data even in both the statements I and II together are not sufficient to answer the question.

Answer: D

Explanation: By resolving both the sentences, we would get an unrecognised relationship between these people. There is a major missing relation between G and A as to whether they are husband and wife or not. If it would have been given, then D would be the brother of K, a lady. L and G would be the sons of K and H. And K and D would have been the children of G and A. So, the data even in both the statements I and II together are not sufficient to answer the question. Therefore, option D is correct.

12. Towards which direction is Ranji from Rita?

I. Salmond is towards the west of Moron and northeast of Rita. Calon is to the east of Rita.

II. Ranji is towards the south of Salmond and Calon.

A. If the data in only statement I are sufficient to answer the question, while the data in statement II alone are not sufficient to answer the question.

B. If the data in only statement II are sufficient to answer the question, while the data in statement I alone are not sufficient to answer the question.

C. If the data either in statement I or in statement II alone are sufficient to answer the question

D. If data in both statements I and II together are necessary to answer the question.

Answer: D

Explanation: From the statement I → we will get to know that Salmon and Moron are in a straight line, and the former is the west of the latter. Calon and Rita are in straight lines and the former is to the east of the latter.

From statement II, we get to know Ranji is to the south of both Rita and Calon; therefore, she is to the southwest of Rita. So, the data in both statements I and II together are necessary to answer the question. Therefore, option D is correct.

13. There are 6 people, G, I, S, A, P, Q, sitting around the circular table randomly. Find the position of A with respect to I?

I. G is second left of P and I is third left of G.

II. S is not an immediate neighbour of G and A sits third right of S.

A. If the data in only statement I are sufficient to answer the question, while the data in statement II alone are not sufficient to answer the question.

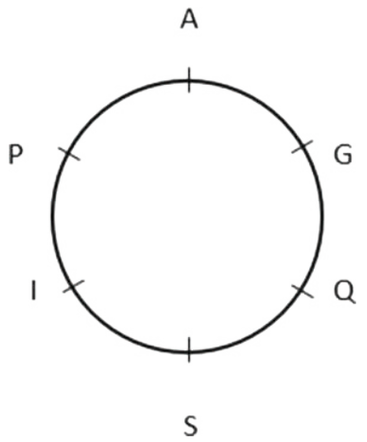
B. If the data in only statement II are sufficient to answer the question, while the data in statement I alone are not sufficient to answer the question.

C. If the data either in statement I or in statement II alone are sufficient to answer the question.

D. If data in both statements I and II together are necessary to answer the question.

Answer: D

Explanation: From the statements I and II → we will get to know that G is the second left of P and I is the third left of G. If S is not the immediate neighbour of G then only one place is left for it, i.e., second right of G. So, A and Q will be at immediate left and right of G, respectively. So in this way, A is to the second to the left of I.



So, the data in both statements I and II together are necessary to answer the question.

Therefore, option D is correct.

14. What is the possible time after 1, when a clock shows 20° angle between the two hands of the clock.

I. The hour hand must be between 1 and 2.

II. The minute hand must be after 2 o'clock in the watch.

A. If the data in only statement I are sufficient to answer the question, while the data in statement II alone are not sufficient to answer the question.

B. If the data in only statement II are sufficient to answer the question, while the data in statement I alone are not sufficient to answer the question.

C. If the data either in statement I or in statement II alone are sufficient to answer the question

D. If data even in both the statements I and II together are not sufficient to answer the question.

Answer: A

Explanation: In this question, the angle is given, and here we have to find the time between when the angle between minute and hour hands is 20°. But the prerequisite for clock questions is that the position of the hour hand must be between 2 consecutive

hours like between 1 and 2 or between 3 and 4, but there are no such conditions for the minute hand. So, the data in only statements I are sufficient to answer the question, while the data in statement II alone are not sufficient to answer the question. Therefore, option A is correct.

By simply using the angle-finding theory, we can find the angle between the two hands of the clock: Angle between hands = **[(11 ÷ 2) Minute – (30) Hour]**

$20° = [(\frac{\text{Total no. of units}}{\text{Total no. of minutes}}) \text{ Minute} – 30 \times 1] \rightarrow 50 = (\frac{\text{Total no. of units}}{\text{Total no. of minutes}}) \text{ Minute}$, we can write it as: 9 min 5 s $(\frac{1,00,000}{4} \times 60 = 1 \times 5.4 \approx 5)$

15. Among the seven students P, Q, R, S, T, U, and V, who scored 2nd highest in the English test?

I. P scored more than only R. Two students scored more than V, who scored more than P and Q.

II. T scored less than S, who scored more than Q.

III. R scored less than S, who does not score the highest.

A. If the data in only statements I and II are sufficient to answer the question, while the data in statements, II and III alone are not sufficient to answer the question.

B. If the data in only statements II and III are sufficient to answer the question, while the data in statements I and II alone are not sufficient to answer the question.

C. If the data in all the statements are necessary to answer the question.

D. If the data in only statements I and III are sufficient to answer the question, while the data in statements II and III alone are not sufficient to answer the question.

Answer: C

Explanation: From statements I and II:

P scored more than only R. Two students scored more than V, who scored more than P and Q → ? > ? > V > ? > ? > P > R

T scored less than S, who scored more than Q. So, no proper information is given.

From statements II and III:

T scored less than S, who scored more than Q. R scored less than S, who did not score the highest. So, no proper information is given.

From both I, and III:

P scored more than only R. Two students scored more than V, who scored more than P and Q. R scored less than S, who did not score the highest.

→ ? > ? > V > ? > ? > P > R

So, no proper information is given.

From I, II, and III

→ U > S > V > Q/T > Q/T > P > R

So, from I, II and III, it is clear that S scored the 2nd highest. Therefore, option C is correct.

16. In which month of the year 1999 did Amit go to Delhi for vacation?

I. Amit's son remembers that he went after 20th July 1999.

II. Amit remembers that he went before 10th August 1999.

III. Vinayak, a friend of Amit, remembers that he went to Delhi either in the 7th or 8th month of the year 1999.

A. If the data in only statements I and II are sufficient to answer the question, while the data in statements II and III alone are not sufficient to answer the question.

B. If the data in only statements II and III are sufficient to answer the question, while the data in statements I and II alone are not sufficient to answer the question.

C. If the data in all the statements are necessary to answer the question.

D. If data even in statements I, II, and III are not sufficient to answer the question.

Answer: D

Explanation: From statements I and II:

Amit's son remembers that he went after 20th July. Amit remembers that he went before 10th August 1999. So, from I and II, Amit went in either July or August.

From statements II and III:

Vinayak, a friend of Amit, remembers that he went to Delhi in the 7th or 8th month of the year 1999. Amit remembers that he went before 10th August 1999. So, from II, and III, Amit went in either July or August.

From I and III, Amit's son remembers that he went after 20th July 1999. Vinayak, a friend of Amit, remembers that he went to Delhi either in the 7th or 8th month of the year 1999. So, from I and III, Amit went either in July or August.

Combining all statements:

Amit can go in either July or August; hence, question cannot be answered even with the information in all three statements. Therefore, option D is correct.

17. There are 8 people, A, B, C, D, E, F, G, H, sitting around the circular table randomly facing outside. Find the position of B with respect to C?

I. A is to the third right of D, and G is not an immediate neighbour of C.

II. C is the third right of H, and D is the fourth right of G. E is the second to the right of A.

A. If the data in only statement I are sufficient to answer the question, while the data in statement II alone are not sufficient to answer the question.

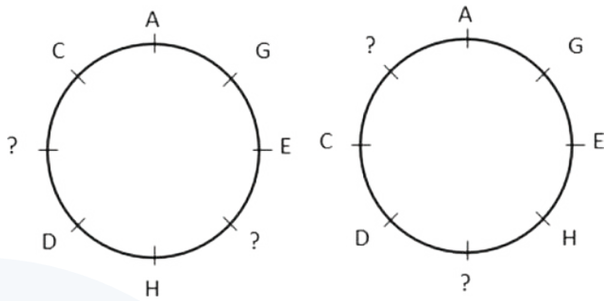
B. If the data in only statement II are sufficient to answer the question, while the data in statement I alone are not sufficient to answer the question.

C. If the data either in statement I or in statement II alone are sufficient to answer the question.

D. If data even in both the statements I and II together are not sufficient to answer the question.

Answer: D

Explanation: From statements I and II → we will have two settings on which H is the immediate neighbour of D and, in others, it is not as shown in the diagram. But in both the figures, we can't determine the position of B since nothing is talked about.



So, the data in both statements I and II together are not sufficient to find the position of B with respect to C. Therefore, option D is correct.

18. What was the price of the house P in 2010?

I. The ratio of the price of P to Q in 2010 was 7:8.

II. The price of house Q in 2011 was Rs 650,000 and it has increased by 30% from 2010.

III. The ratio of the price of houses P and Q in 2011 was 6:7.

A. If the data in only statements I and II are sufficient to answer the question, while the data in statements II and III alone are not sufficient to answer the question.

B. If the data in only statements II and III are sufficient to answer the question, while the data in statements I and II alone are not sufficient to answer the question.

C. If the data in all the statements are necessary to answer the question.

D. If the data in only statements I and III are sufficient to answer the question, while the data in statements II and III alone are not sufficient to answer the question.

Answer: A

Explanation: From statements I and II:

Price of house Q in 2010 = 650000 × $\frac{A1P1 + A2P2}{A1 + A2}$

= Rs 500000

Price of house P in 2010 = 500000 ×

= Rs 437500

Therefore, the data in only statements I and II are sufficient to answer the question, while the data in statements II and III alone are not sufficient to answer the question. Therefore, option A is correct.

19. How many boys are taller than Alana in his class?

I. When students of Alan's class are ranked in descending order of their heights, Alan's rank is 19th from the top among all the students and 13th among girls.

II. Alana's rank from the bottom on the basis of height among girls is 19th and among all students is 27th.

A. If the data in only statement I are sufficient to answer the question, while the data in statement II alone are not sufficient to answer the question.

B. If the data in only statement II are sufficient to answer the question, while the data in statement I alone are not sufficient to answer the question.

C. If the data either in statement I or in statement II alone are sufficient to answer the question.

D. If data even in both the statements I and II together are not sufficient to answer the question.

Answer: A

Explanation: From the statement I, we will get to know that (19 – 13) = 6 boy students are taller than Alana.

From statement II, we get to know that (27 - 19) = 8 boy students are shorter than Alana. But from II alone it is not known how many girls are there in the class. So, data in only statement I are sufficient to answer the question, while the data in statement II alone are not sufficient to answer the question. Therefore, option A is correct.

20. What is Kailash's rank in the class of 50 students?

I. Reita, who is 9th from the top in the class, is above Radhe by 17 ranks, who is below Kailash by 6 ranks.

II. Namita, who is between Kailash and Kaveri, is 25th from the bottom.

A. If the data in only statement I are sufficient to answer the question, while the data in statement II alone are not sufficient to answer the question.

B. If the data in only statement II are sufficient to answer the question, while the data in statement I alone are not sufficient to answer the question.

C. If the data either in statement I or in statement II alone are sufficient to answer the question.

D. If data in both statements I and II together are necessary to answer the question.

Answer: A

Explanation: From the statement I, we will get to know that

Reita's rank = 9th from the top, Radhe is 26th from the top and Kailash is 20th from the top.

So, data in only statement I are sufficient to answer the question, while the data in statement II alone are not sufficient to answer the question.

From statement II, we get to know that Namita's rank is (50 – 25 + 1) = 26th from the top.

Therefore, option A is correct.

21. Who among Malan, Troy. Richard, Ken, and Peter, is the tallest?

I. Troy is taller than Richard, Malan and Peter but shorter than Ken.

II. Richard, Troy, and Malan are shorter than Ken but taller than Peter.

A. If the data in only statement I are sufficient to answer the question, while the data in statement II alone are not sufficient to answer the question.

B. If the data in only statement II are sufficient to answer the question, while the data in statement I alone are not sufficient to answer the question.

C. If the data either in statement I or in statement II alone are sufficient to answer the question

D. If data even in both the statements I and II together are not sufficient to answer the question.

Answer: C

Explanation: From the statement I, we will get to know that

Ken > Troy > Richard, Malan, and Peter. Hence, Ken is the tallest.

From statement II, we get to know that Ken > Richard, Troy, Malan > Peter. Hence Ken is the tallest.

Therefore, the data either in statement I or in statement II alone are sufficient to answer the question. Therefore, option C is correct.