

Karnataka PGCET 2026 MCA

Question Paper With Solutions PDF

Conducted by Karnataka Examinations Authority (KEA)



General Instructions

- (i) The test is of 2 hours duration.
- (ii) Karnataka PGCET 2026 MCA Question Paper consists of 100 questions for 100 marks.
- (iii) Karnataka PGCET MCA Question Paper 2026 is divided into Mathematics, Computer Awareness, Analytical Ability and logical Reasoning, General Awareness and General English questions.
- (iv) Each correct answer carries 1 mark and there is no negative marking for incorrect answers.

1. Match the following List-I (verb forms) with List-II (non-finites):

List - I (Verb form)	List - II (Non-finites)
(a) Present participle	(i) Verb form used as a noun without "to"
(b) Infinitive	(ii) Verb form ending in -ing used as an adjective or for continuous tense
(c) Gerund	(iii) Base form of a verb often preceded by "to"
(d) Perfect participle	(iv) Having + past participle showing complete action before another action

Codes:

- (A) a - iv, b - ii, c - iii, d - i
- (B) a - iv, b - i, c - ii, d - iii
- (C) a - ii, b - iii, c - i, d - iv
- (D) a - ii, b - i, c - iii, d - iv

Correct Answer: (C) a - ii, b - iii, c - i, d - iv

Solution:

Step 1: Identify the function of the Present Participle.

A present participle is formed by adding the suffix *-ing* to the base form of a verb.

Examples:

- Running water
- A crying child
- She is singing.

The present participle performs two important functions:

1. It helps form continuous tenses.
2. It can function adjectivally by describing a noun.

Looking at List-II, statement (ii) says:

“Verb form ending in *-ing* used as an adjective or for continuous tense.”

This exactly describes a present participle.

Therefore,

$(a) \rightarrow (ii)$

Step 2: Identify the function of the Infinitive.

An infinitive represents the base form of a verb. It is generally preceded by the word “to”.

Examples:

- to read
- to write
- to learn
- to speak

The infinitive is considered the most basic verbal form and may function as a noun, adjective, or adverb depending upon context.

In List-II, statement (iii) reads:

“Base form of a verb often preceded by ‘to’.”

This is the precise definition of an infinitive.

Hence,

$(b) \rightarrow (iii)$

Step 3: Identify the function of the Gerund.

A gerund also ends in *-ing*, but unlike a present participle, it functions entirely as a noun.

Examples:

- Swimming is good exercise.
- Reading improves knowledge.
- He enjoys painting.

In each sentence, the *-ing* word behaves like a noun rather than an adjective.

List-II statement (i) says:

“Verb form used as a noun without ‘to’.”

Since a gerund is a noun form derived from a verb, this description matches perfectly.

Therefore,

$(c) \rightarrow (i)$

Step 4: Identify the function of the Perfect Participle.

A perfect participle is formed by using:

Having + Past Participle

Examples:

- Having completed the work, he went home.
- Having finished the examination, she relaxed.
- Having studied hard, the student performed well.

This structure indicates that one action was completed before another action occurred.
In List-II, statement (iv) states:

“Having + past participle showing completed action before another action.”

This is the exact definition of a perfect participle.

Hence,

$(d) \rightarrow (iv)$

Step 5: Form the final matching sequence.

Combining all the correct matches:

- | | | |
|------------------------|---|-------|
| (a) Present participle | → | (ii) |
| (b) Infinitive | → | (iii) |
| (c) Gerund | → | (i) |
| (d) Perfect participle | → | (iv) |

Thus, the complete matching arrangement is

$a - ii, b - iii, c - i, d - iv$

This corresponds to **Option (C)**.

Quick Tip: A quick way to distinguish a Gerund from a Present Participle is to identify its grammatical role. If the *-ing* form behaves like a noun, it is a Gerund. If it describes a noun or helps form a continuous tense, it is a Present Participle.

2. Match the following clauses with their functions:

List - I (Clauses)	List - II (Functions)
(a) Noun clause	(i) Modifies a noun and usually begins with <i>who, which, that</i>
(b) Adverbial clause	(ii) Functions as a noun within a sentence
(c) Relative clause	(iii) Modifies a verb, adjective or adverb (time, reason, condition, etc)
(d) Conditional clause	(iv) Expresses a condition often introduced by ' <i>if</i> ' or ' <i>unless</i> '

- (A) a - ii, b - iii, c - i, d - iv
 (B) a - iv, b - ii, c - iii, d - i
 (C) a - iii, b - iv, c - ii, d - i
 (D) a - ii, b - iv, c - i, d - iii

Correct Answer: (A) a - ii, b - iii, c - i, d - iv

Solution:

Step 1: Identify the function of the Noun Clause.

A noun clause is a subordinate clause that performs the same function as a noun within a sentence.

It may act as:

- Subject of a sentence
- Object of a verb
- Object of a preposition
- Complement of a verb

Examples:

- *What he said* was true.
- I know *that she is honest*.
- The problem is *whether they will agree*.

In each example, the highlighted clause functions as a noun.

Looking at List-II, statement (ii) says:

Functions as a noun within a sentence.

Therefore,

$(a) \rightarrow (ii)$

Step 2: Identify the function of the Adverbial Clause.

An adverbial clause modifies a verb, an adjective, or another adverb. It provides additional information regarding:

- Time
- Place
- Reason
- Purpose
- Condition
- Contrast
- Manner

Examples:

- We left *when the meeting ended*.
- She stayed home *because she was ill*.
- He works hard *so that he may succeed*.

These clauses provide circumstances surrounding the action.

In List-II, statement (iii) states:

Modifies a verb, adjective or adverb (time, reason, condition, etc.).

Hence,

$(b) \rightarrow (iii)$

Step 3: Identify the function of the Relative Clause.

A relative clause is also known as an adjective clause because it modifies a noun or pronoun. It usually begins with relative pronouns such as:

who, whom, whose, which, that

Examples:

- The boy *who won the prize* is my friend.
- The book *that I purchased* is interesting.
- The house *which stands on the hill* is beautiful.

In every case, the clause describes or modifies a noun.

List-II statement (i) says:

Modifies a noun and usually begins with *who, which, that*.

Therefore,

$(c) \rightarrow (i)$

Step 4: Identify the function of the Conditional Clause.

A conditional clause expresses a condition that must be fulfilled for another action or event to occur.

Such clauses are commonly introduced by:

if, unless, provided that, in case

Examples:

- *If it rains*, we will stay indoors.
- *Unless you study*, you may not succeed.
- *If she arrives early*, we will begin the meeting.

These clauses establish a condition for the main clause.

List-II statement (iv) reads:

Expresses a condition often introduced by *if* or *unless*.

Thus,

$(d) \rightarrow (iv)$

Step 5: Form the final matching sequence.

Combining all the correct matches:

(a) Noun clause $\rightarrow$ (ii)
(b) Adverbial clause $\rightarrow$ (iii)
(c) Relative clause $\rightarrow$ (i)
(d) Conditional clause $\rightarrow$ (iv)

Therefore,

$a - ii, \quad b - iii, \quad c - i, \quad d - iv$

This arrangement corresponds exactly to **Option (A)**.

Quick Tip: A quick identification method is to look at the function of the clause. If it behaves like a noun, it is a Noun Clause. If it describes a noun, it is a Relative Clause. If it modifies a verb or gives information about time, reason, place, or condition, it is an Adverbial Clause. If it specifically introduces a condition using words like *if* or *unless*, it is a Conditional Clause.

3. Choose the correct word to complete the sentence:

His speech was so _____ that everyone lost interest halfway through.

- (A) Engaging
- (B) Monotonous
- (C) Lively
- (D) Exciting

Correct Answer: (B) Monotonous

Solution:

Step 1: Analyze the contextual clue provided in the sentence.

The sentence states:

“His speech was so _____ that everyone lost interest halfway through.”

The phrase “*lost interest*” conveys a negative reaction from the audience. It suggests that the speech failed to maintain attention and was probably dull, repetitive, or uninteresting.

Hence, the word filling the blank should have a negative meaning associated with boredom or lack of variety.

Step 2: Evaluate Option (A) – Engaging.

The word **Engaging** means:

- Interesting
- Attractive
- Able to capture and hold attention
- Pleasant and enjoyable

Example:

“The teacher gave an engaging presentation that kept the students attentive throughout the class.”

If a speech is engaging, listeners usually become more interested rather than losing interest.

Thus, the statement

“His speech was so engaging that everyone lost interest halfway through.”

creates a contradiction.

Therefore, Option (A) is incorrect.

Step 3: Evaluate Option (B) – Monotonous.

The word **Monotonous** refers to something that is:

- Repetitive

- Lacking variety
- Dull
- Tedious
- Unchanging in tone or style

Example:

“The lecture became monotonous because the speaker continued repeating the same points.”

A monotonous speech often causes listeners to lose concentration and become bored because there is little variation in delivery, content, or tone.

Substituting the word into the sentence:

“His speech was so monotonous that everyone lost interest halfway through.”

The sentence now becomes perfectly logical and meaningful.

Therefore, Option (B) is a strong match for the given context.

Step 4: Evaluate Option (C) – Lively.

The word **Lively** means:

- Energetic
- Animated
- Full of enthusiasm
- Interesting and active

Example:

“The lively discussion encouraged everyone to participate actively.”

A lively speech generally increases audience involvement and attention.

Thus, the statement

“His speech was so lively that everyone lost interest halfway through.”

does not make logical sense.

Hence, Option (C) is incorrect.

Step 5: Evaluate Option (D) – Exciting.

The word **Exciting** means:

- Thrilling
- Stimulating
- Interesting
- Capable of creating enthusiasm

Example:

“The exciting announcement captured everyone’s attention immediately.”

An exciting speech would normally make people more attentive rather than causing them to lose interest.

Therefore,

“His speech was so exciting that everyone lost interest halfway through.”

is illogical.

Hence, Option (D) is incorrect.

Step 6: Determine the most appropriate answer.

After examining all four options, we observe:

- Engaging → Positive meaning; contradicts the result.
- Monotonous → Dull and repetitive; perfectly explains the result.
- Lively → Positive meaning; contradicts the result.
- Exciting → Positive meaning; contradicts the result.

Therefore, the only word that logically fits the context is:

Monotonous

Hence, the correct answer is **Option (B)**.

Quick Tip: In sentence-completion questions, always focus on context clues. Expressions such as “so ... that”, “because”, “therefore”, and “as a result” often reveal whether the missing word should carry a positive or negative meaning. Matching the tone of the blank with the outcome stated in the sentence helps eliminate incorrect options quickly.

Read the following passage and answer the questions (4-6):

Technology has transformed the way people communicate. In the past, letters took days or even weeks to reach their destination. Today, messages can be sent instantly through e-mails and mobile applications. While this has made communication faster and more convenient, it has also reduced face-to-face interactions. Many people now prefer texting over meeting in person, which may affect social relationships in the long run.

4. How were messages sent in the past?

- (A) Through mobile apps
- (B) Through emails
- (C) Through letters
- (D) Through video calls

Correct Answer: (C) Through letters

Solution:

Step 1: Locate the relevant information in the passage.

The passage states:

“In the past, letters took days or even weeks to reach their destination.”

This sentence directly describes the method of communication used in earlier times.

Step 2: Evaluate Option (A) – Through mobile apps.

Mobile applications are modern communication tools that operate through smartphones and internet connectivity.

Examples include:

- WhatsApp
- Telegram
- Signal

Since the passage contrasts the past with modern communication technologies, mobile apps cannot represent the communication method used in the past.

Therefore, Option (A) is incorrect.

Step 3: Evaluate Option (B) – Through emails.

Emails are a form of electronic communication that require computers, smartphones, and internet access.

The passage mentions emails as a modern method of communication, not as a traditional one.

Therefore, Option (B) is incorrect.

Step 4: Evaluate Option (C) – Through letters.

The passage clearly states that in the past, people relied on letters to communicate.

Letters were physically transported and often required several days or weeks to reach the recipient.

This information exactly matches the statement given in the passage.

Therefore, Option (C) is correct.

Step 5: Evaluate Option (D) – Through video calls.

Video calls are a modern technology that depend on internet connectivity and digital devices.

They were not used as a communication method in the past.

Therefore, Option (D) is incorrect.

Step 6: Determine the correct answer.

The passage explicitly states that communication in the past was carried out through letters.

Thus,

Through letters

Hence, the correct answer is **Option (C)**.

Quick Tip: For factual reading comprehension questions, identify the exact sentence in the passage that relates to the question. Answers directly stated in the passage are usually the most reliable.

5. What is one advantage of modern communication?

- (A) It is slower
- (B) It is more expensive
- (C) It is instant
- (D) It requires travel

Correct Answer: (C) It is instant

Solution:

Step 1: Locate the relevant information in the passage.

The passage states:

“Today, messages can be sent instantly through e-mails and mobile applications.”

The keyword *instantly* highlights a major advantage of modern communication systems.

Step 2: Evaluate Option (A) – It is slower.

Modern communication systems allow messages to be delivered within seconds.

The passage emphasizes speed as a benefit.

Therefore, describing modern communication as slower contradicts the passage.

Hence, Option (A) is incorrect.

Step 3: Evaluate Option (B) – It is more expensive.

The passage does not mention higher costs as an advantage of modern communication.

Furthermore, this option does not represent a benefit.

Therefore, Option (B) is incorrect.

Step 4: Evaluate Option (C) – It is instant.

The passage explicitly states that messages can be sent instantly through modern communication platforms.

This means information can reach another person almost immediately without significant delay.

Therefore, this option directly matches the information given in the passage.

Hence, Option (C) is correct.

Step 5: Evaluate Option (D) – It requires travel.

Modern communication enables people to communicate without physically travelling.

In fact, one of its major benefits is that communication can occur remotely.

Therefore, Option (D) is incorrect.

Step 6: Determine the correct answer.

The passage clearly identifies instant communication as an important advantage of modern technology.

Thus,

It is instant

Hence, the correct answer is **Option (C)**.

Quick Tip: When a passage mentions words such as *faster*, *instant*, *efficient*, or *convenient*, they often indicate advantages. Focus on such keywords while answering comprehension questions.

6. What is one disadvantage of modern communication mentioned in the passage?

- (A) Increased travel
- (B) Reduced face-to-face interaction
- (C) Higher costs
- (D) Lack of technology

Correct Answer: (B) Reduced face-to-face interaction

Solution:

Step 1: Locate the relevant statement in the passage.

The passage states:

“While this has made communication faster and more convenient, it has also reduced face-to-face interactions.”

This sentence directly mentions a disadvantage associated with modern communication.

Step 2: Evaluate Option (A) – Increased travel.

Modern communication technologies enable people to communicate remotely without needing to travel physically.

Therefore, increased travel is not a disadvantage mentioned in the passage.

Hence, Option (A) is incorrect.

Step 3: Evaluate Option (B) – Reduced face-to-face interaction.

The passage explicitly states that modern communication has reduced face-to-face interactions. This means people increasingly communicate through texts, emails, and applications rather than meeting in person.

Since this information is directly stated in the passage, it is the correct answer.

Therefore, Option (B) is correct.

Step 4: Evaluate Option (C) – Higher costs.

The passage does not mention increased expenses or higher costs associated with modern communication.

Therefore, this option is not supported by the passage.

Hence, Option (C) is incorrect.

Step 5: Evaluate Option (D) – Lack of technology.

Modern communication depends heavily on technology.

In fact, the passage discusses how technological advancements have transformed communication.

Therefore, lack of technology cannot be considered a disadvantage mentioned in the passage.

Hence, Option (D) is incorrect.

Step 6: Determine the correct answer.

The passage clearly identifies reduced face-to-face interaction as a drawback of modern communication.

Thus,

Reduced face-to-face interaction

Hence, the correct answer is **Option (B)**.

Quick Tip: When a passage contains words such as *however*, *but*, *although*, or *while*, pay special attention to the information that follows, as it often introduces a limitation, drawback, or contrasting viewpoint.

7. OBFUSCATE nearly means:

- (a) Illuminate
 - (b) Confound
 - (c) Explicate
 - (d) Muddle
- (A) (a) and (b) are correct
(B) (b) and (c) are correct
(C) (b) and (d) are correct
(D) (a) and (c) are correct

Correct Answer: (C) (b) and (d) are correct

Solution:

Step 1: Analyze word (a) – Illuminate.

The word **Illuminate** means:

- To shed light on
- To clarify
- To make something easier to understand

Example:

“The teacher’s explanation illuminated the difficult concept.”

Since illuminate means to make something clear, it is opposite in meaning to obfuscate. Therefore, (a) is incorrect.

Step 2: Analyze word (b) – Confound.

The word **Confound** means:

- To confuse
- To bewilder
- To make difficult to understand

Example:

“The complicated instructions confounded the participants.”

This meaning closely matches the meaning of obfuscate. Therefore, (b) is correct.

Step 3: Analyze word (c) – Explicate.

The word **Explicate** means:

- To explain
- To interpret
- To clarify in detail

Example:

“The professor explicated the theory thoroughly.”

Since explicate means to make something clear, it is opposite in meaning to obfuscate. Therefore, (c) is incorrect.

Step 4: Analyze word (d) – Muddle.

The word **Muddle** means:

- To confuse
- To mix up
- To make unclear

Example:

“The contradictory statements muddled the issue.”

This meaning is very close to the meaning of obfuscate.
Therefore, (d) is correct.

Step 5: Determine the correct combination.

We found that:

(b) Confound

and

(d) Muddle

are the words that closely match the meaning of obfuscate.
Therefore,

(b) and (d)

form the correct combination.

Hence, the correct answer is **Option (C)**.

Quick Tip: To solve synonym questions quickly, first identify whether the target word carries a positive, negative, or neutral meaning. Then eliminate options with the opposite tone before making the final selection.

8. Choose the antonyms of LOQUACIOUS.

(a) Garrulous

- (b) Voluble
- (c) Reticent
- (d) Taciturn

- (A) (a) and (b) are correct
- (B) (b) and (c) are correct
- (C) (c) and (d) are correct
- (D) (d) and (a) are correct

Correct Answer: (C) (c) and (d) are correct

Solution:

Step 1: Analyze word (a) – Garrulous.

Garrulous means excessively talkative, especially about trivial matters.

This meaning is similar to loquacious.

Therefore, (a) is not an antonym.

Step 2: Analyze word (b) – Voluble.

Voluble refers to someone who speaks fluently, easily, and at length.

This is also similar to loquacious.

Therefore, (b) is not an antonym.

Step 3: Analyze word (c) – Reticent.

Reticent means quiet, reserved, and unwilling to speak much.

This meaning is opposite to loquacious.

Therefore, (c) is correct.

Step 4: Analyze word (d) – Taciturn.

Taciturn refers to a person who is habitually silent and speaks very little.

This is also opposite to loquacious.

Therefore, (d) is correct.

Step 5: Determine the correct combination.

The antonyms of loquacious are:

(c) Reticent

and

(d) Taciturn

Thus, the correct combination is:

(c) and (d)

Hence, the correct answer is **Option (C)**.

Quick Tip: Remember the vocabulary group: *Loquacious, Garrulous, and Voluble* all relate to excessive talking, whereas *Reticent* and *Taciturn* describe people who are quiet and reserved.

9. Choose the correct meaning of the phrase “a blessing in disguise”.

- (A) Hidden danger
- (B) A very obvious problem
- (C) A happy occasion
- (D) Something that seems bad but turns out to be good

Correct Answer: (D) Something that seems bad but turns out to be good

Solution:

Step 1: Understand the meaning of the idiom.

The phrase consists of two important ideas:

- A **blessing** means something beneficial or fortunate.
- A **disguise** means something hidden behind a different appearance.

Therefore, the idiom suggests that a beneficial outcome is hidden behind an apparently negative situation.

Step 2: Evaluate Option (A) – Hidden danger.

A hidden danger refers to something that appears safe but later causes harm.

This meaning is opposite to the idiom.

Therefore, Option (A) is incorrect.

Step 3: Evaluate Option (B) – A very obvious problem.

An obvious problem is simply a difficulty that is clearly visible.

The idiom refers to an unexpected positive outcome rather than an obvious problem.

Therefore, Option (B) is incorrect.

Step 4: Evaluate Option (C) – A happy occasion.

A happy occasion is openly joyful from the beginning.

However, the idiom specifically refers to a situation that initially appears bad before revealing its positive side.

Therefore, Option (C) is incorrect.

Step 5: Evaluate Option (D) – Something that seems bad but turns out to be good.

This option perfectly captures the meaning of the idiom.

A situation may initially seem disappointing, unfortunate, or harmful, but later prove beneficial.

For example:

“Losing that job was a blessing in disguise because it led her to a much better career opportunity.”

Therefore, Option (D) is correct.

Step 6: Determine the correct answer.

The idiom “**a blessing in disguise**” means:

Something that seems bad but turns out to be good

Hence, the correct answer is **Option (D)**.

Quick Tip: Many idioms have meanings that are very different from the literal meanings of their individual words. Always focus on the established figurative meaning of the complete phrase.

10. Arrange the sentences in the correct order.

- (A) The teacher appreciated her efforts.
- (B) She worked hard to complete the project on time.
- (C) Meena was assigned a project in the class.
- (D) She presented it confidently before everyone.

- (A) C B D A
- (B) B C D A
- (C) C D B A
- (D) B D C A

Correct Answer: (A) C B D A

Solution:

Step 1: Identify the introductory sentence.

Sentence (C) states:

“Meena was assigned a project in the class.”

This sentence introduces the main character, Meena, and establishes the topic of discussion. The other sentences contain pronouns such as “She” and “her,” which refer back to Meena. Therefore, sentence (C) must be the opening sentence.

Step 2: Identify the next logical action.

After receiving a project, the natural next step is to work on it.

Sentence (B) states:

“She worked hard to complete the project on time.”

The pronoun “She” refers to Meena introduced in sentence (C).
Therefore,

$$C \rightarrow B$$

is the logical progression.

Step 3: Identify what happens after completing the project.

Once the project is completed, it is reasonable that Meena would present it.

Sentence (D) states:

“She presented it confidently before everyone.”

The word “it” refers to the completed project mentioned in sentence (B).

Thus,

$$C \rightarrow B \rightarrow D$$

forms a coherent sequence.

Step 4: Identify the concluding sentence.

Sentence (A) states:

“The teacher appreciated her efforts.”

The appreciation comes naturally after Meena presents her work.

Therefore, sentence (A) should conclude the sequence.

This gives:

$$C \rightarrow B \rightarrow D \rightarrow A$$

Step 5: Verify the complete flow.

The final arrangement reads:

1. Meena was assigned a project in the class.
2. She worked hard to complete the project on time.
3. She presented it confidently before everyone.
4. The teacher appreciated her efforts.

This sequence creates a logical and grammatically connected narrative.

Step 6: Determine the correct answer.

The correct order is:

$$C \rightarrow B \rightarrow D \rightarrow A$$

Hence, the correct answer is **Option (A)**.

Quick Tip: In sentence rearrangement questions, first identify the sentence that introduces the main person, place, or idea. Sentences containing pronouns such as *he, she, they, it, his, her, or their* usually appear after the introductory sentence.

11. Primary classification of programming languages are

- (a) Machine language
 - (b) Assembly language
 - (c) High level language
 - (d) Pseudocode and Algorithms
- (A) Only (c) and (d) are correct
(B) Only (a) and (b) are correct
(C) Only (a), (b) and (c) are correct
(D) Only (a) and (d) are correct

Correct Answer: (C) Only (a), (b) and (c) are correct

Solution:

Step 1: Examine Statement (a) – Machine Language.

Machine Language is the lowest-level programming language and consists entirely of binary digits (0s and 1s).

Characteristics include:

- Directly understood by the CPU.
- No translator is required.

- Hardware dependent.
- Difficult for humans to read and write.

Since Machine Language is one of the fundamental classifications of programming languages, statement (a) is correct.

Step 2: Examine Statement (b) – Assembly Language.

Assembly Language was developed to simplify programming in Machine Language.

Characteristics include:

- Uses mnemonic codes such as ADD, MOV, and SUB.
- Easier to understand than binary code.
- Requires an assembler to convert instructions into machine code.
- Still closely related to hardware architecture.

Therefore, Assembly Language is also a primary classification of programming language.

Hence, statement (b) is correct.

Step 3: Examine Statement (c) – High Level Language.

High-Level Languages are designed to be user-friendly and independent of specific hardware architectures.

Examples include:

- C
- C++
- Java
- Python
- Pascal

Characteristics include:

- English-like syntax.
- Easy to learn and maintain.

- Portable across different systems.
- Require a compiler or interpreter.

Therefore, statement (c) is also correct.

Step 4: Examine Statement (d) – Pseudocode and Algorithms.

An Algorithm is a logical sequence of steps used to solve a problem.

Pseudocode is an informal representation of an algorithm written in structured English-like statements.

Important points:

- They are planning tools.
- They help programmers design solutions.
- They are not executable by a computer.
- They do not follow strict programming language syntax.

Therefore, they are not classified as programming languages.

Hence, statement (d) is incorrect.

Step 5: Determine the correct combination.

The correct classifications are:

(a), (b), (c)

while

(d)

is not a programming language classification.

Conclusion:

Only Machine Language, Assembly Language, and High-Level Language are primary classifications of programming languages.

Therefore,

Only (a), (b) and (c) are correct

Hence, the correct answer is **Option (C)**.

Quick Tip: If a language can be translated and executed by a computer through hardware, an assembler, compiler, or interpreter, it is considered a programming language. Algorithms and pseudocode are only planning tools and cannot be executed directly.

12. Match the following with respect to connections between processor and memory.

List - I (Registers)	List - II (Usage)
(a) IR	(i) Keeps track of execution of a program
(b) MAR	(ii) Holds the instruction that is currently being executed
(c) MDR	(iii) Data to be written into or read out of the addressed location
(d) PC	(iv) Holds the address of the location to be accessed

Codes:

- (A) a - iii, b - iv, c - ii, d - i
(B) a - i, b - ii, c - iv, d - iii
(C) a - ii, b - iv, c - iii, d - i
(D) a - iv, b - ii, c - i, d - iii

Correct Answer: (C) a - ii, b - iv, c - iii, d - i

Solution:

Step 1: Match IR (Instruction Register).

The Instruction Register stores the instruction currently being decoded or executed by the CPU.

During instruction execution:

1. The instruction is fetched from memory.
2. It is loaded into IR.
3. The Control Unit decodes it.
4. Execution begins.

Therefore,

IR → Holds the instruction currently being executed

Hence,

$(a) \rightarrow (ii)$

Step 2: Match MAR (Memory Address Register).

The Memory Address Register stores the address of the memory location that the CPU wants to access.

Whenever data must be read or written:

- The address is first loaded into MAR.
- The address is transmitted through the address bus.

Therefore,

MAR → Holds the address of the location to be accessed

Hence,

$(b) \rightarrow (iv)$

Step 3: Match MDR (Memory Data Register).

The Memory Data Register temporarily stores data being transferred between memory and CPU.

It may contain:

- Data read from memory.
- Data waiting to be written to memory.

Therefore,

MDR → Data to be written into or read out of memory

Hence,

$(c) \rightarrow (iii)$

Step 4: Match PC (Program Counter).

The Program Counter keeps track of the execution sequence of a program.

It stores:

- The address of the next instruction to be fetched.
- The progression of program execution.

Therefore,

PC $\rightarrow$ Keeps track of execution of a program

Hence,

$(d) \rightarrow (i)$

Step 5: Construct the final matching.

(a) IR $\rightarrow$ (ii)

(b) MAR $\rightarrow$ (iv)

(c) MDR $\rightarrow$ (iii)

(d) PC $\rightarrow$ (i)

Conclusion:

The correct matching is:

a - ii, b - iv, c - iii, d - i

Hence, the correct answer is **Option (C)**.

Quick Tip: Remember the keywords: MAR = Address, MDR = Data, IR = Instruction, and PC = Program execution tracking. The register names themselves often reveal their primary function.

13. In $b = 66.6 / a + 12 * n;$, which operation will be performed first?

(A) $66.6 / a$ (B) $12 * n$ (C) $a + 12$ (D) Depends upon the compiler

Correct Answer: (A) $66.6 / a$

Solution:

Step-by-Step Evaluation:

- **Identify the operators present:** The expression contains division (/), multiplication (*), and addition (+).
- **Apply precedence rules:** Division and multiplication must be evaluated before addition because they belong to the multiplicative precedence level.
- **Apply associativity:** Since division and multiplication have equal precedence, the compiler evaluates them from left to right.
- **Determine the first operation:** Reading the expression from left to right, $66.6 / a$ appears before $12 * n$. Therefore, division is performed first.

Conclusion: The first operation executed is $66.6 / a$. Therefore, option (A) is correct.

Quick Tip: Whenever multiplication and division appear together without brackets, evaluate them from left to right because they have equal precedence.

14. Consider the following instruction.

ADD R1, R2, R3

What is the meaning of the above instruction?

(A) Add the contents of registers R1 and R2 and place the sum in R3 (B) Add the contents of registers R1, R2 and R3 and place the sum in another register (C) Add the contents of registers R2 and R3

and place the sum in R1 (D) Instruction is invalid

Correct Answer: (C) Add the contents of registers R2 and R3 and place the sum in R1

Solution:

Step-by-Step Analysis:

- **Identify the opcode:** The opcode is ADD, which performs arithmetic addition.
- **Identify the destination register:** The first register listed is R1. This is where the result will be stored.
- **Identify the source registers:** The second and third registers are R2 and R3. Their contents are used as operands.
- **Perform the operation:** The instruction can be represented as:

$$R1 \leftarrow R2 + R3$$

Thus, the contents of R2 and R3 are added and the result is stored in R1.

Conclusion: The instruction adds the contents of registers **R2** and **R3** and places the result in **R1**. Therefore, option **(C)** is correct.

Quick Tip: In most three-address instruction formats, remember: Destination Register $\leftarrow$ Source Register 1 + Source Register 2.

15. What is the meaning of 16×8 organization with respect to memory chip?

(A) 8 words of 16 bits each (B) 16 bits $\times$ 8 bits (C) 16 words of 8 bits each (D) 16 words of 8 bytes each

Correct Answer: (C) 16 words of 8 bits each

Solution:

Step-by-Step Evaluation:

- **Interpret the first value:** The number 16 indicates that there are 16 addressable memory words.
- **Interpret the second value:** The number 8 indicates that each word stores 8 bits.
- **Combine the interpretation:** Therefore, the memory chip contains 16 separate memory locations, each capable of storing 8 bits.

Conclusion: A memory organization of 16×8 means **16 words of 8 bits each**. Hence, option (C) is correct.

Quick Tip: For memory organization written as $M \times N$, remember: M represents the number of memory locations and N represents the number of bits stored in each location.

16. Reservation clerks for Airlines and Hotels check availability for given request and make reservation. These type of users are categorised into _____ with respect to database applications.

(A) Casual end users (B) Parametric end users (C) Sophisticated end users (D) Standalone users

Correct Answer: (B) Parametric end users

Solution:

Step-by-Step Analysis:

- **Parametric End Users:** These users repeatedly execute predefined database transactions using forms, menus, and standard interfaces. Examples include bank tellers, reservation clerks, and data-entry operators.
- **Casual End Users:** These users access the database occasionally and may issue different

queries whenever needed.

- **Sophisticated End Users:** These users possess advanced knowledge of database systems and often develop complex queries or applications.
- **Standalone Users:** These users maintain personal databases using ready-made software packages.
- **Evaluate the given scenario:** Reservation clerks repeatedly perform tasks such as checking availability, making reservations, and updating booking information through predefined interfaces.

Conclusion: Since reservation clerks perform repetitive transactions through fixed database forms and screens, they are classified as **Parametric End Users**. Therefore, option **(B)** is correct.

Quick Tip: If a user repeatedly performs the same database operation using predefined menus or forms, that user is generally classified as a Parametric (Naive) End User.

17. The _____ data model which makes it possible to organize data in a collection of records with fixed structure.

- (A) Relational Data Model
- (B) Network Data Model
- (C) Hierarchical Data Model
- (D) Object Data Model

Correct Answer: (A) Relational Data Model

Solution:

Step 1: Understanding the meaning of “collection of records with fixed structure”.

The question emphasizes that the data is organized as a collection of records and that each

record follows a fixed structure. A fixed structure means that all records contain the same set of fields or attributes.

For example, in a student table:

Roll No.	Name	Class	Marks
----------	------	-------	-------

every student record must contain these same columns. The structure remains identical for all records.

Step 2: Identifying the data model that uses fixed-format records.

The Relational Data Model stores data in tables (relations). Each row represents a record, while each column represents an attribute.

Since the schema defines the columns beforehand, every record must conform to the same structure. Therefore, the relational model naturally satisfies the requirement of maintaining records with a fixed structure.

Step 3: Eliminating the other options.

- The **Network Data Model** focuses on relationships between records rather than fixed tabular structures.
- The **Hierarchical Data Model** organizes records in a parent-child tree structure and is not specifically defined by fixed tabular records.
- The **Object Data Model** stores data as objects and is based on object-oriented concepts rather than fixed relational records.

Therefore, the model that specifically organizes data into records having a fixed structure is the **Relational Data Model**.

Hence, the correct answer is:

Relational Data Model

Quick Tip: Whenever a question mentions tables, rows, columns, tuples, relations, or records having a fixed structure, the answer is generally the **Relational Data Model**.

18. _____ language is used to define the logical, external and physical schemas and access

authorizations.

- (A) Data Manipulation Language (DML)
- (B) Data Definition Language (DDL)
- (C) Logical Definition Language (LDL)
- (D) Data-Driven Language (DDL)

Correct Answer: (B) Data Definition Language (DDL)

Solution:

Step 1: Understanding the role of schemas in a database.

A schema is the overall design or blueprint of a database.

Database systems generally deal with:

- Physical Schema
- Logical (Conceptual) Schema
- External Schema

These schemas describe how data is stored, organized, and presented to users.

Step 2: Determining which language defines schemas.

The language responsible for creating and defining database structures is Data Definition Language (DDL).

Examples of DDL commands include:

CREATE, ALTER, DROP, TRUNCATE

These commands establish the structure of the database and therefore define schemas.

Step 3: Understanding access authorization.

Access authorization refers to permissions and privileges granted to users.

Database systems use definition-related commands and authorization mechanisms to establish who can access various database objects.

Thus, schema definition and authorization management are associated with DDL-related database administration functions.

Step 4: Eliminating incorrect options.

- DML works with data, not schema definitions.
- LDL is not a standard database language.
- Data-Driven Language is not a recognized schema-definition language.

Therefore, the language used to define logical, external, and physical schemas along with access authorizations is:

Data Definition Language (DDL)

Quick Tip: Remember: **DDL defines the structure**, while **DML manipulates the data**. If the question asks about creating tables, schemas, or database design, think of **DDL**.

19. Arrange the given list of memories as per the size.

- (a) Cache memory
 - (b) Registers
 - (c) Secondary memory
 - (d) Primary memory
-
- (A) (b), (a), (d), (c)
 - (B) (b), (a), (c), (d)
 - (C) (a), (b), (c), (d)
 - (D) (d), (b), (a), (c)

Correct Answer: (A) (b), (a), (d), (c)

Solution:

Step 1: Analyzing Registers.

Registers are located directly inside the CPU and are the fastest memory units available.

Their storage capacity is extremely small, usually measured in bytes.
Hence, registers have the smallest size.

Registers = Smallest Capacity

Step 2: Analyzing Cache Memory.

Cache memory stores frequently used instructions and data close to the CPU.
Its capacity is larger than registers but much smaller than main memory.

Registers < Cache Memory

Step 3: Analyzing Primary Memory.

Primary memory (RAM) stores currently running programs and active data.
Modern computers usually have RAM capacities ranging from several gigabytes to hundreds of gigabytes.
Thus,

Cache Memory < Primary Memory

Step 4: Analyzing Secondary Memory.

Secondary memory includes SSDs, HDDs, and other permanent storage devices.
Its capacity is significantly larger than RAM and is usually measured in gigabytes or terabytes.
Therefore,

Primary Memory < Secondary Memory

Step 5: Writing the complete order.

Combining all comparisons:

Registers < Cache Memory < Primary Memory < Secondary Memory

Using the given labels:

$(b) < (a) < (d) < (c)$

Hence, the correct arrangement is:

(b), (a), (d), (c)

Quick Tip: The increasing order of memory size is always:

Registers → Cache → RAM → Secondary Storage

The larger the memory, the slower it generally becomes.

20. The control unit of a computer is designed to go through an instruction cycle that is divided into following phases.

- (a) Fetch the instruction from memory
- (b) Decode the instruction
- (c) Execute the instruction
- (A) Only (b) and (c) are correct
- (B) Only (c) is correct
- (C) Only (a) is correct
- (D) (a), (b) and (c) are correct

Correct Answer: (D) (a), (b) and (c) are correct

Solution:

Step 1: Understanding the Fetch Phase.

The first step is fetching the instruction from memory.

The Program Counter (PC) stores the address of the next instruction to be executed.

The Control Unit reads this instruction from memory and places it into the Instruction Register (IR).

Therefore, statement (a) is correct.

Fetch Phase

Step 2: Understanding the Decode Phase.

After the instruction is fetched, the Control Unit interprets its meaning.

The opcode is analyzed so that the processor can determine what operation is required.

This process is called decoding.

Therefore, statement (b) is correct.

Decode Phase

Step 3: Understanding the Execute Phase.

Once the instruction has been decoded, the processor performs the required operation.

The Arithmetic Logic Unit (ALU) or other functional units carry out the task.

This phase is called execution.

Therefore, statement (c) is correct.

Execute Phase

Step 4: Determining the final answer.

Since fetching, decoding, and execution are all mandatory phases of the instruction cycle,

(a), (b), (c)

are all correct.

Hence, the correct answer is:

(D) (a), (b) and (c) are correct

Quick Tip: The instruction cycle can always be remembered as:

Fetch → Decode → Execute

Every CPU instruction must pass through these three fundamental stages.

21. Full form of WAMP is _____ with respect to web applications.

- (A) Windows, Apache, MySQL and PHP
- (B) Word, Adobe, MySQL and PHP
- (C) Windows, Apache, Mainstream and Program
- (D) Windows, Adobe, MySQL and PHP

Correct Answer: (A) Windows, Apache, MySQL and PHP

Solution:

Step 1: Understanding the acronym WAMP

The acronym WAMP is formed from the first letter of each software component included in the stack.

$W = \text{Windows}$

Windows serves as the operating system platform on which the entire stack runs.

$A = \text{Apache}$

Apache is a popular open-source web server responsible for handling HTTP requests and serving web pages to users.

$M = \text{MySQL}$

MySQL is a Relational Database Management System (RDBMS) used for storing and managing application data.

$P = \text{PHP}$

PHP is a server-side scripting language used for generating dynamic web content and interacting with databases.

Step 2: Examining each option.

- **Option (A):** Windows, Apache, MySQL and PHP — All four components are correct.
- **Option (B):** Word and Adobe are not components of the WAMP stack.
- **Option (C):** Mainstream and Program are not recognized technologies in the WAMP

acronym.

- **Option (D):** Adobe incorrectly replaces Apache.

Step 3: Selecting the correct answer.

Since WAMP officially stands for:

Windows, Apache, MySQL and PHP

the correct option is:

(A)

Quick Tip: Remember the common web development stacks:

WAMP = Windows + Apache + MySQL + PHP

LAMP = Linux + Apache + MySQL + PHP

MAMP = macOS + Apache + MySQL + PHP

Only the operating system changes while the remaining components usually remain the same.

22. Which of the following are valid hexadecimal numbers?

- (i) 1A3F
 - (ii) 29GF
 - (iii) FF12
 - (iv) 7BHE
-
- (A) (i), (ii) and (iv)
 - (B) (i), (ii) and (iii)
 - (C) (i) and (iii)
 - (D) (i), (iii) and (iv)

Correct Answer: (C) (i) and (iii)

Solution:

Step 1: Checking number (i): 1A3F

The characters present are:

1, A, 3, F

All of these belong to the valid hexadecimal set.

Therefore,

1A3F

is a valid hexadecimal number.

Step 2: Checking number (ii): 29GF

The characters present are:

2, 9, G, F

The letter G does not belong to the hexadecimal digit set.

Therefore,

29GF

is not a valid hexadecimal number.

Step 3: Checking number (iii): FF12

The characters present are:

F, F, 1, 2

All characters belong to the hexadecimal digit set.

Therefore,

FF12

is a valid hexadecimal number.

Step 4: Checking number (iv): 7BHE

The characters present are:

7, B, H, E

The letter H is not allowed in hexadecimal notation.

Therefore,

7BHE

is not a valid hexadecimal number.

Step 5: Writing the final result.

Valid hexadecimal numbers are:

(i) and (iii)

Hence, the correct option is:

(C) (i) and (iii)

Quick Tip: A hexadecimal number can contain only:

0 – 9 and A – F

If you find letters such as G, H, I, J, etc., the number is immediately invalid.

23. The decimal number 25_{10} is represented in binary as _____.

(A) 1 1 0 0 1

(B) 1 0 1 0 1

(C) 1 1 1 0 0

(D) 1 0 0 1 1

Correct Answer: (A) 1 1 0 0 1

Solution:

Step 1: Perform repeated division by 2.

$$25 \div 2 = 12$$

Remainder:

1

$$12 \div 2 = 6$$

Remainder:

0

$$6 \div 2 = 3$$

Remainder:

0

$$3 \div 2 = 1$$

Remainder:

1

$$1 \div 2 = 0$$

Remainder:

1

Step 2: Write remainders in reverse order.

Reading from bottom to top:

1 1 0 0 1

Therefore,

$$25_{10} = 11001_2$$

Step 3: Verification using powers of 2.

$$11001_2$$

$$= (1 \times 2^4) + (1 \times 2^3) + (0 \times 2^2) + (0 \times 2^1) + (1 \times 2^0)$$

$$= 16 + 8 + 0 + 0 + 1$$

$$= 25$$

Hence, the conversion is correct.

$$11001_2$$

Quick Tip: To verify a binary number quickly, multiply each bit by its corresponding power of 2 and add the results. If the sum equals the original decimal number, the conversion is correct.

24. Arrange the following steps in correct order to binary:

- (i) Repeat division until becomes 0
- (ii) Divide the number by 2
- (iii) Write the remainder
- (iv) Write the remainder in reverse order

- (A) (i) $\rightarrow$ (ii) $\rightarrow$ (iii) $\rightarrow$ (iv)
(B) (ii) $\rightarrow$ (iii) $\rightarrow$ (i) $\rightarrow$ (iv)
(C) (iii) $\rightarrow$ (i) $\rightarrow$ (iv) $\rightarrow$ (ii)
(D) (iv) $\rightarrow$ (ii) $\rightarrow$ (iii) $\rightarrow$ (i)

Correct Answer: (B) (ii) $\rightarrow$ (iii) $\rightarrow$ (i) $\rightarrow$ (iv)

Solution:

Step 1: Identify the first operation.

The process begins by dividing the decimal number by 2.

Therefore, the first step is:

(ii)

Step 2: Record the remainder.

After every division, the remainder must be noted because it becomes part of the binary representation.

Therefore, the second step is:

(iii)

Step 3: Continue the process.

The quotient obtained from the division is again divided by 2.

This procedure is repeated until the quotient becomes zero.

Therefore, the third step is:

(i)

Step 4: Construct the binary number.

The remainders are generated from least significant bit to most significant bit.

To obtain the final binary number, the remainders are written in reverse order.

Therefore, the final step is:

(iv)

Step 5: Write the complete sequence.

Hence, the correct order is:

$$(ii) \rightarrow (iii) \rightarrow (i) \rightarrow (iv)$$

Therefore, the correct answer is:

(B)

Quick Tip: For decimal-to-binary conversion always remember:

Divide $\rightarrow$ Write Remainder $\rightarrow$ Repeat $\rightarrow$ Reverse

This simple sequence helps in solving conversion questions quickly.

25. Match the Characters in List-I with their correct ASCII Property in List-II.

List - I	List - II
(a) 'A'	(i) ASCII 32 (Decimal)
(b) 'a'	(ii) ASCII 48 (Decimal)
(c) '0' (Zero)	(iii) ASCII 65 (Decimal)
(d) ' ' (Space)	(iv) ASCII differ from (i) by 32

(A) a - i, b - iii, c - iv, d - ii

(B) a - i, b - iv, c - iii, d - ii

(C) a - iii, b - iv, c - i, d - ii

(D) a - iii, b - iv, c - ii, d - i

Correct Answer: (D) a - iii, b - iv, c - ii, d - i

Solution:

Step 1: Match character 'A'.

The ASCII value of capital A is:

65

Therefore,

$a \rightarrow (iii)$

Step 2: Match character 'a'.

The ASCII value of lowercase a is:

97

Since

$$97 - 65 = 32$$

it differs from uppercase A by 32.

Therefore,

$b \rightarrow (iv)$

Step 3: Match character '0'.

The ASCII value of zero is:

48

Therefore,

$c \rightarrow (ii)$

Step 4: Match the space character.

The ASCII value of a blank space is:

32

Therefore,

$d \rightarrow (i)$

Step 5: Write the complete matching.

$$a \rightarrow iii$$

$$b \rightarrow iv$$

$$c \rightarrow ii$$

$$d \rightarrow i$$

Hence, the correct option is:

$$(D) a - iii, b - iv, c - ii, d - i$$

Quick Tip: Memorize these three important ASCII values:

$$\text{Space} = 32, \quad 'O' = 48, \quad 'A' = 65$$

Also remember that lowercase letters are always 32 greater than their corresponding uppercase letters.

26. A floating point number typically consists of

- (i) Sign bit
 - (ii) Parity bit
 - (iii) Mantissa (Significand)
 - (iv) Exponent
- (A) (i), (ii) and (iv)
(B) (i), (iii) and (iv)
(C) (ii), (iii) and (iv)
(D) (i), (ii) and (iii)

Correct Answer: (B) (i), (iii) and (iv)

Solution:

Step 1: Analyzing the Sign Bit.

The sign bit determines whether the number is positive or negative.

$0 \Rightarrow$ Positive Number

$1 \Rightarrow$ Negative Number

Since every floating-point number requires a sign indicator, the sign bit is an essential component.

Therefore,

(i) is correct.

Step 2: Analyzing the Parity Bit.

A parity bit is primarily used for error detection during data transmission and memory operations.

Its purpose is to detect accidental changes in stored or transmitted bits.

A parity bit is not part of the mathematical representation of a floating-point number.

Therefore,

(ii) is incorrect.

Step 3: Analyzing the Mantissa (Significand).

The mantissa contains the significant digits of the number and determines the precision of the representation.

For example, in scientific notation:

$$6.25 \times 10^3$$

the value 6.25 represents the significand or mantissa.

Thus, the mantissa is a mandatory component of floating-point representation.

Therefore,

(iii) is correct.

Step 4: Analyzing the Exponent.

The exponent determines the scale or magnitude of the number.

It specifies how many positions the decimal or binary point should effectively move.

Without the exponent field, very large and very small numbers could not be represented efficiently.

Therefore,

(iv) is correct.

Step 5: Determining the correct combination.

The valid components are:

(i), (iii), (iv)

Hence, the correct answer is:

(B) (i), (iii) and (iv)

Quick Tip: Remember the three basic parts of a floating-point number:

Sign Bit + Exponent + Mantissa

A parity bit is used for error detection and is not a component of floating-point representation.

27. Arrange the steps to find two's complement of a binary number:

- (i) Take 1's complement
- (ii) Write the binary number
- (iii) Add 1
- (iv) Obtain final result

- (A) (iv) $\rightarrow$ (i) $\rightarrow$ (iii) $\rightarrow$ (ii)
(B) (ii) $\rightarrow$ (iii) $\rightarrow$ (i) $\rightarrow$ (iv)
(C) (ii) $\rightarrow$ (i) $\rightarrow$ (iii) $\rightarrow$ (iv)
(D) (i) $\rightarrow$ (ii) $\rightarrow$ (iii) $\rightarrow$ (iv)

Correct Answer: (C) (ii) $\rightarrow$ (i) $\rightarrow$ (iii) $\rightarrow$ (iv)

Solution:

Step 1: Write the original binary number.

Before performing any operation, the given binary number must be written.

This corresponds to:

(ii)

Step 2: Find the 1's complement.

The next step is to invert every bit.

0 $\rightarrow$ 1

1 $\rightarrow$ 0

This operation produces the 1's complement.

This corresponds to:

(i)

Step 3: Add 1 to the result.

After obtaining the 1's complement, add binary 1.

This converts the 1's complement into the 2's complement.

This corresponds to:

(iii)

Step 4: Obtain the final result.

The binary number obtained after addition is the required two's complement.

This corresponds to:

(iv)

Step 5: Writing the correct sequence.

Thus, the complete order is:

(ii) $\rightarrow$ (i) $\rightarrow$ (iii) $\rightarrow$ (iv)

Hence, the correct answer is:

(C)

Quick Tip: To find a two's complement quickly:

1. Write the binary number.
2. Invert all bits.
3. Add 1.

This shortcut always produces the correct two's complement representation.

28. The result of $101_2 \times 10_2$ is _____.

- (A) 1010_2
- (B) 1000_2
- (C) 1110_2
- (D) 1100_2

Correct Answer: (A) 1010_2

Solution:

Step 1: Perform binary multiplication directly.

Given:

$$101_2 \times 10_2$$

Since

$$10_2 = 2_{10}$$

multiplying by 10_2 is equivalent to shifting the number one position to the left.

$$101_2 \rightarrow 1010_2$$

Thus,

$$101_2 \times 10_2 = 1010_2$$

Step 2: Verification using decimal conversion.

Convert 101_2 to decimal:

$$101_2 = 1(2^2) + 0(2^1) + 1(2^0)$$

$$= 4 + 0 + 1$$

$$= 5_{10}$$

Convert 10_2 to decimal:

$$10_2 = 2_{10}$$

Multiply:

$$5 \times 2 = 10$$

Convert 10_{10} back to binary:

$$10_{10} = 1010_2$$

The answer is verified.

Hence,

$$1010_2$$

Quick Tip: Multiplying a binary number by:

$$10_2$$

simply shifts the number one bit to the left.

Similarly,

$$100_2$$

shifts by two positions and

$$1000_2$$

shifts by three positions.

29. Match the binary operations in List-I with correct results in List-II.

List - I

(a) $1 + 1$

(b) $10 - 1$

(c) 1×0

(d) $11 \div 1$

List - II

(i) 1

(ii) 10

(iii) 11

(iv) 0

(A) a - ii, b - i, c - iv, d - iii

(B) a - iii, b - ii, c - iv, d - i

(C) a - ii, b - iii, c - i, d - iv

(D) a - i, b - v, c - ii, d - iii

Correct Answer: (A) a - ii, b - i, c - iv, d - iii

Solution:

Step 1: Evaluate (a) $1 + 1$.

In binary:

$$1 + 1 = 10_2$$

Thus,

$$a \rightarrow ii$$

Step 2: Evaluate (b) $10 - 1$.

Convert to decimal:

$$10_2 = 2_{10}$$

$$2 - 1 = 1$$

Therefore,

$$10_2 - 1_2 = 1_2$$

Thus,

$$b \rightarrow i$$

Step 3: Evaluate (c) 1×0 .

Any number multiplied by zero gives zero.

$$1 \times 0 = 0$$

Thus,

$$c \rightarrow iv$$

Step 4: Evaluate (d) $11 \div 1$.

Any number divided by one remains unchanged.

$$11 \div 1 = 11$$

Thus,

$$d \rightarrow iii$$

Step 5: Writing the final matching.

$$a \rightarrow ii$$

$$b \rightarrow i$$

$$c \rightarrow iv$$

$$d \rightarrow iii$$

Hence, the correct option is:

(A)

Quick Tip: Memorize these important binary arithmetic facts:

$$1 + 1 = 10$$

$$1 \times 0 = 0$$

$$N \div 1 = N$$

These simple rules help solve many binary arithmetic questions instantly.

30. Which scheduling algorithm works on the principles of time slices?

- (A) FCFS
- (B) Round Robin
- (C) SJF
- (D) Priority Scheduling

Correct Answer: (B) Round Robin

Solution:

Step 1: Understanding FCFS Scheduling.

FCFS stands for First-Come First-Served.

Processes are executed strictly in the order in which they arrive.

Once a process gets the CPU, it continues execution until completion or blocking.

No time slices are used.

Therefore, FCFS is incorrect.

Step 2: Understanding Round Robin Scheduling.

Round Robin scheduling is specifically designed for time-sharing systems.

Each process receives a fixed time quantum.

After the quantum expires:

- The running process is interrupted.
- It is moved to the end of the ready queue.
- The next process receives CPU time.

This cyclic allocation continues until all processes finish execution.

Therefore, Round Robin directly operates on the principle of time slices.

Step 3: Understanding SJF Scheduling.

Shortest Job First selects the process having the smallest CPU burst time.

Its selection criterion is execution time, not time quantum.

Therefore, SJF is incorrect.

Step 4: Understanding Priority Scheduling.

Priority Scheduling allocates the CPU according to process priority values.

The process with the highest priority executes first.

Its primary criterion is priority, not time slices.

Therefore, Priority Scheduling is incorrect.

Step 5: Determining the final answer.

Among all the given scheduling algorithms, only Round Robin uses a fixed time quantum for process execution.

Hence, the correct answer is:

Round Robin

or

(B)

Quick Tip: Whenever a question mentions **time slice**, **time quantum**, or **time-sharing systems**, immediately think of **Round Robin Scheduling**. It is the scheduling algorithm most closely associated with fair CPU sharing among multiple processes.

31. Which of the following are the characteristics of Real Time Operating Systems (RTOS)?

- (i) Deterministic response
 - (ii) High latency allowed
 - (iii) Strict timing constraints
 - (iv) Used in embedded systems
- (A) (i) and (iii) only
- (B) (i), (iii) and (iv) only
- (C) (ii) and (iv) only
- (D) (i), (ii) and (iii) only

Correct Answer: (B) (i), (iii) and (iv) only

Solution:

Step 1: Analyzing statement (i) – Deterministic response.

One of the most important features of an RTOS is deterministic behavior. Determinism means that the operating system can guarantee a known maximum response time for handling interrupts, scheduling tasks, and executing critical operations.

Whenever a particular event occurs, the response time remains predictable and bounded rather than varying unpredictably.

Therefore, statement (i) is correct.

Step 2: Analyzing statement (ii) – High latency allowed.

Latency refers to the delay between the occurrence of an event and the system's response to that event.

In real-time systems, latency must be extremely low because delayed responses may lead to incorrect operation or even system failure.

For example:

- Airbag deployment systems require immediate response.
- Industrial robots must react within precise timing limits.
- Medical monitoring devices cannot tolerate excessive delays.

Since RTOS is specifically designed to minimize latency rather than allow high latency, statement (ii) is incorrect.

Step 3: Analyzing statement (iii) – Strict timing constraints.

A defining characteristic of RTOS is the existence of strict timing requirements.

Tasks are often associated with deadlines that must be met. In many real-time applications, producing the correct result after the deadline is considered equivalent to producing an incorrect result.

Examples include:

- Flight control systems
- Missile guidance systems
- Traffic signal controllers
- Cardiac pacemakers

Therefore, statement (iii) is correct.

Step 4: Analyzing statement (iv) – Used in embedded systems.

RTOS is extensively used in embedded systems because embedded devices often interact directly with hardware sensors and actuators that require precise timing.

Examples include:

- Washing machines
- Automotive engine control units
- Smart televisions
- Industrial controllers
- Medical instruments

Hence, statement (iv) is also correct.

Step 5: Identifying the correct combination.

After evaluating all statements:

(i) Deterministic response	✓
(ii) High latency allowed	×
(iii) Strict timing constraints	✓
(iv) Used in embedded systems	✓

Thus, the correct set of characteristics is:

(i), (iii) and (iv)

Therefore, the correct answer is:

Option (B)

Quick Tip: Remember the keyword for RTOS: **Predictability**. An RTOS is designed to provide deterministic behavior, low latency, and guaranteed deadline compliance. Whenever you see terms such as **strict timing**, **deadline**, **embedded systems**, or **deterministic response**, think of a Real Time Operating System.

32.

Arrange the steps in process state transition.

- (i) Running
 - (ii) Ready
 - (iii) New
 - (iv) Waiting
- (A) (i) → (ii) → (iii) → (iv)
- (B) (iii) → (ii) → (i) → (iv)
- (C) (iv) → (i) → (ii) → (iii)
- (D) (ii) → (i) → (iii) → (iv)

Correct Answer: (B) (iii) → (ii) → (i) → (iv)

Solution:

Step 1: Identifying the initial state.

Whenever a user starts a program, the operating system first creates a process and allocates a Process Control Block (PCB).

At this stage, the process enters the **New** state.

Therefore, the first state is:

(iii) New

Step 2: Moving to the Ready state.

After creation, the operating system loads the necessary information into memory and places the process in the ready queue.

The process is now ready to execute but is waiting for CPU allocation.

Thus, the next state is:

(ii) Ready

Step 3: Transitioning to Running state.

The CPU scheduler selects one process from the ready queue and assigns the CPU to it.

The process now starts executing instructions.

Hence, the process enters:

(i) Running

Step 4: Transitioning to Waiting state.

While executing, the process may need to perform an I/O operation such as:

- Reading a file
- Receiving network data
- Waiting for keyboard input

During this period, the process cannot continue execution and enters the Waiting (Blocked) state.

Thus, the next state becomes:

(iv) Waiting

Step 5: Constructing the correct sequence.

Combining all transitions:

New → Ready → Running → Waiting

or

(iii) → (ii) → (i) → (iv)

Hence, the correct answer is:

Option (B)

Quick Tip: A simple way to remember the process lifecycle is:

New → Ready → Running → Waiting

Think of it as: Created → Waiting for CPU → Executing → Waiting for Resource.

33. Match the operating systems in List-I with their correct characteristics in List-II.

List - I	List - II
(a) Batch OS	(i) Immediate response required
(b) Real Time OS	(ii) No user interaction
(c) Time Sharing OS	(iii) Multiuser share CPU
(d) Distributed OS	(iv) Multiple systems connected

Codes:

- (A) a - ii, b - i, c - iii, d - iv
(B) a - ii, b - i, c - iv, d - iii
(C) a - iii, b - iv, c - i, d - ii
(D) a - iii, b - i, c - iv, d - ii

Correct Answer: (A) a - ii, b - i, c - iii, d - iv

Solution:

Step 1: Matching (a) Batch Operating System.

A Batch Operating System executes jobs in groups called batches.

The user submits jobs and does not interact with the computer while the jobs are running.

Characteristics include:

- No direct user interaction
- Jobs processed sequentially
- Suitable for repetitive tasks

Therefore:

Batch OS → No user interaction

Hence:

$$a \rightarrow ii$$

Step 2: Matching (b) Real Time Operating System.

A Real Time Operating System must respond immediately to external events.

Examples include:

- Air traffic control systems
- Industrial automation
- Medical monitoring systems

Thus:

Real Time OS $\rightarrow$ Immediate response required

Hence:

$$b \rightarrow i$$

Step 3: Matching (c) Time Sharing Operating System.

Time-sharing systems divide CPU time among multiple users.

Each user receives a small time quantum, creating the illusion that everyone has dedicated access to the machine.

Therefore:

Time Sharing OS $\rightarrow$ Multiuser share CPU

Hence:

$$c \rightarrow iii$$

Step 4: Matching (d) Distributed Operating System.

A Distributed Operating System manages multiple interconnected computers and presents them as a single unified system.

Characteristics include:

- Resource sharing
- Parallel processing
- Network-based communication

Therefore:

Distributed OS → Multiple systems connected

Hence:

$$d \rightarrow iv$$

Step 5: Writing the final matching.

$$a \rightarrow ii, \quad b \rightarrow i, \quad c \rightarrow iii, \quad d \rightarrow iv$$

This corresponds exactly to:

Option (A)

Quick Tip: Remember these standard associations:

- **Batch OS** → No user interaction
- **RTOS** → Immediate response
- **Time Sharing OS** → Multiple users share CPU
- **Distributed OS** → Multiple interconnected systems

These four matches frequently appear in competitive examinations.

34. In a class exam, Ramya's average mark was 90 per paper. If she had obtained 4 more marks in Maths paper and 20 more marks in Physics paper, then her average per paper would have been 94. How many papers were there in the exam?

- (A) 6
- (B) 8
- (C) 9
- (D) 7

Correct Answer: (A) 6

Solution:

Step 1: Assume the number of papers.

Let the number of papers be:

$$n$$

Given that Ramya's average mark was 90 per paper.

Therefore, the total marks obtained originally are:

$$90n$$

Step 2: Calculate the increase in total marks.

According to the question:

- Additional marks in Mathematics = 4
- Additional marks in Physics = 20

Hence, total additional marks:

$$4 + 20 = 24$$

Therefore, the new total marks become:

$$90n + 24$$

Step 3: Use the new average.

After adding these marks, the average becomes:

$$94$$

Since the number of papers remains unchanged,

$$\text{New Total Marks} = 94n$$

Therefore:

$$94n = 90n + 24$$

Step 4: Solve the equation.

Subtract $90n$ from both sides:

$$94n - 90n = 24$$

$$4n = 24$$

Dividing both sides by 4:

$$n = \frac{24}{4}$$

$$n = 6$$

Step 5: Verification.

Original total marks:

$$90 \times 6 = 540$$

Additional marks:

$$24$$

New total marks:

$$540 + 24 = 564$$

New average:

$$\frac{564}{6} = 94$$

The condition is satisfied perfectly.

Therefore, the number of papers is:

6

Hence, the correct answer is:

Option (A)

Quick Tip: For average-based questions involving extra marks:

$$\text{Number of Items} = \frac{\text{Change in Total Sum}}{\text{Change in Average}}$$

Here,

$$\frac{24}{94 - 90} = \frac{24}{4} = 6$$

This shortcut can solve many average problems within a few seconds.

35. In a two digit number, the digit in the unit's place is equal to the square of the digit in ten's place and the difference between the numbers obtained by interchanging the digits is 54. What is 40% of the original number?

- (A) 23.4
- (B) 15.6
- (C) 37.2
- (D) 39

Correct Answer: (B) 15.6

Solution:

Step 1: Form the equations

Given that the unit's digit is the square of the ten's digit:

$$y = x^2$$

Also, the difference between the interchanged number and the original number is 54:

$$(10y + x) - (10x + y) = 54$$

$$9(y - x) = 54$$

$$y - x = 6$$

Step 2: Solve for the digits

Substituting $y = x^2$:

$$x^2 - x = 6$$

$$x^2 - x - 6 = 0$$

$$(x - 3)(x + 2) = 0$$

Since a digit cannot be negative,

$$x = 3$$

Therefore,

$$y = 3^2 = 9$$

Hence, the original number is:

39

Step 3: Find 40% of the number

$$40\% \text{ of } 39 = \frac{40}{100} \times 39$$

$$= 15.6$$

Therefore, the required value is:

15.6

Quick Tip: For any two-digit number, the difference between the number formed by reversing its digits and the original number is always a multiple of 9:

$$(10y + x) - (10x + y) = 9(y - x)$$

Use this shortcut to solve digit-reversal problems quickly.

36. A set of letters and numbers are arranged in certain order where some of them are missing.

1 _ 7g _ c8 _ _ b

Choose the correct order of appearing in the missing places.

- (A) 3 h a 2
- (B) a h 2 3
- (C) a 3 h 2
- (D) 2 3 h a

Correct Answer: (C) a 3 h 2

Solution:

Step 1: Observe the given pairs

The sequence can be grouped as:

$$(1, _) \quad (7, g) \quad (_, c) \quad (8, _) \quad (_, b)$$

Notice that:

$$7 \leftrightarrow g$$

since g is the 7th letter of the alphabet.

Thus, each number is paired with its corresponding letter.

Step 2: Fill the blanks

- 1 corresponds to a

$$\text{Blank 1} = a$$

- c is the 3rd letter

$$\text{Blank 2} = 3$$

- 8 corresponds to h

$$\text{Blank 3} = h$$

- b is the 2nd letter

$$\text{Blank 4} = 2$$

Step 3: Write the missing terms in order

$$a, 3, h, 2$$

Hence, the correct arrangement is:

$$a\ 3\ h\ 2$$

which corresponds to **Option (C)**.

Quick Tip: In alphanumeric series, always check whether letters correspond to their alphabetical positions:

$$a = 1, b = 2, c = 3, \dots, z = 26$$

Many reasoning questions are based on this simple relationship.

37. In a certain code language, SHORE is written as PELOB, then match the following original letters in List-I that are coded in List-II.

List-I		List-II	
(a)	B	(i)	W
(b)	Z	(ii)	G
(c)	Q	(iii)	N
(d)	J	(iv)	Y

Codes: (A) a - iv, b - i, c - ii, d - iii

(B) a - iv, b - i, c - iii, d - ii

(C) a - iii, b - i, c - ii, d - iv

(D) a - ii, b - iii, c - i, d - iv

Correct Answer: (B) a - iv, b - i, c - iii, d - ii

Solution:

Step 1: Determine the coding rule

Given:

SHORE → PELOB

Let us compare corresponding letters:

Original	<i>S</i>	<i>H</i>	<i>O</i>	<i>R</i>	<i>E</i>
Code	<i>P</i>	<i>E</i>	<i>L</i>	<i>O</i>	<i>B</i>

Converting to alphabetical positions:

$$S(19) \rightarrow P(16)$$

$$H(8) \rightarrow E(5)$$

$$O(15) \rightarrow L(12)$$

$$R(18) \rightarrow O(15)$$

$$E(5) \rightarrow B(2)$$

Each coded letter is obtained by moving **3 positions backward** in the alphabet.

Thus,

$$\text{Code Letter} = \text{Original Letter} - 3$$

Step 2: Apply the rule to List-I

- (a) B

$$B \rightarrow Y$$

(three positions backward with wrap-around)

Hence,

$$a \rightarrow iv$$

- (b) Z

$$Z \rightarrow W$$

Hence,

$$b \rightarrow i$$

- (c) Q

$$Q \rightarrow N$$

Hence,

$$c \rightarrow iii$$

- (d) J

$$J \rightarrow G$$

Hence,

$$d \rightarrow ii$$

Step 3: Final Matching

$$a \rightarrow iv, \quad b \rightarrow i, \quad c \rightarrow iii, \quad d \rightarrow ii$$

This corresponds to **Option (B)**.

Quick Tip: When a coding-decoding problem shows a constant shift between letters, convert the letters into their alphabetical positions and check the difference. Here, every coded letter is obtained by moving three positions backward in the alphabet.

38. No reptiles can fly. All birds can fly.

Which of the following must be true?

- (A) No birds are reptiles
- (B) All reptiles can fly
- (C) All flying creatures are birds
- (D) Some birds are reptiles

Correct Answer: (A) No birds are reptiles

Solution:

Concept:

This is a syllogism problem based on set relationships.

Let:

$$R = \text{Reptiles}, \quad F = \text{Flying creatures}, \quad B = \text{Birds}$$

Given:

$$R \cap F = \emptyset$$

(No reptiles can fly)

and

$$B \subseteq F$$

(All birds can fly)

Since all birds belong to the set of flying creatures and no reptile belongs to the set of flying creatures, birds and reptiles cannot overlap.

$$B \cap R = \emptyset$$

Therefore,

No birds are reptiles

Hence, Option (A) is correct.

Quick Tip: If Set A is completely inside Set B and Set B has no common elements with Set C, then Set A and Set C can never overlap.

39. Which one of the following number is completely divisible by 45?

- (A) 181566
- (B) 331145
- (C) 242865
- (D) 2023550

Correct Answer: (C) 242865

Solution:

Concept:

A number is divisible by 45 if it is divisible by both 5 and 9.

$$45 = 5 \times 9$$

Rules:

- Divisible by 5 $\Rightarrow$ last digit must be 0 or 5.
- Divisible by 9 $\Rightarrow$ sum of digits must be divisible by 9.

Checking Option (C):

242865

Last digit = 5

Therefore, divisible by 5.

Sum of digits:

$$2 + 4 + 2 + 8 + 6 + 5 = 27$$

Since

$$27 \div 9 = 3$$

the number is divisible by 9.

Hence,

242865

is divisible by both 5 and 9.

Therefore, it is divisible by 45.

242865

Hence, Option (C) is correct.

Quick Tip: To test divisibility by 45, simply check divisibility by 5 and 9 separately.

40. A class of 30 students comprises of boys who can play cricket, hockey and/or football. 3 boys play only cricket, 3 boys play only hockey and 2 play only football. 4 boys could play all 3 games, while 11 could play football and cricket and 10 boys could play football and hockey. How many boys played cricket and hockey but not football?

- (A) 1
- (B) 3
- (C) 4
- (D) 5

Correct Answer: (D) 5

Solution:

Concept:

Use a three-set Venn diagram.

Let:

- Cricket = C
- Hockey = H
- Football = F

Given:

$$\text{Only Cricket} = 3$$

$$\text{Only Hockey} = 3$$

$$\text{Only Football} = 2$$

$$C \cap H \cap F = 4$$

Also,

$$|C \cap F| = 11$$

Therefore,

$$(C \cap F \text{ only}) = 11 - 4 = 7$$

Similarly,

$$|H \cap F| = 10$$

Hence,

$$(H \cap F \text{ only}) = 10 - 4 = 6$$

Let

$$x = (C \cap H \text{ only})$$

Since total students are 30,

$$3 + 3 + 2 + 7 + 6 + 4 + x = 30$$

$$25 + x = 30$$

$$x = 5$$

Therefore,

$$5$$

Hence, the number of boys who played cricket and hockey but not football is 5.

Quick Tip: For three-set Venn diagram problems, fill the central intersection first, then subtract it from the pairwise intersections before using the total.

41. Five groups of letters are given. One of these groups is different from the other four. Find the odd one.

YDEUZ, ASHBR, OZPEQ, AXCMF, HLXEF

- (A) YDEUZ
- (B) ASHBR
- (C) OZPEQ
- (D) AXCMF

Correct Answer: (D) AXCMF

Solution:

Step 1: Examine the letter positions.

YDEUZ : 25, 4, 5, 21, 26

ASHBR : 1, 19, 8, 2, 18

OZPEQ : 15, 26, 16, 5, 17

AXCMF : 1, 24, 3, 13, 6

HLXEF : 8, 12, 24, 5, 6

Step 2: Look for consecutive alphabet pairs.

- **YDEUZ:** D(4) and E(5) are consecutive; Y(25) and Z(26) are consecutive.
- **ASHBR:** A(1) and B(2) are consecutive; S(19) and R(18) are consecutive.
- **OZPEQ:** O(15), P(16), and Q(17) occur consecutively.
- **HLXEF:** E(5) and F(6) are consecutive.
- **AXCMF:** A(1), X(24), C(3), M(13), F(6) contain **no pair of consecutive letters**.

Step 3: Identify the odd group.

All the groups except **AXCMF** contain at least one pair of consecutive alphabet letters. Therefore, **AXCMF** is different from the others.

AXCMF

Hence, the correct answer is **Option (D)**.

Quick Tip: In odd-one-out letter-group questions, convert letters into their alphabetical positions and look for common patterns such as consecutive letters, equal gaps, symmetry, or reverse-order relationships. The group that breaks the common pattern is the answer.

42. If 15th August, 2023 was on Tuesday, then on which day of the week would the Independence Day be celebrated in the year 2040?

- (A) Tuesday
- (B) Wednesday
- (C) Thursday
- (D) Friday

Correct Answer: (B) Wednesday

Solution:

Step 1: Calculate the number of years between the two dates.

$$2040 - 2023 = 17 \text{ years}$$

Thus, the period from 15th August 2023 to 15th August 2040 spans 17 years.

Step 2: Count the leap years in this interval.

The leap years occurring before 15th August 2040 are:

$$2024, 2028, 2032, 2036, 2040$$

Hence,

$$\text{Number of leap years} = 5$$

Step 3: Calculate the total odd days.

Every year contributes one odd day, and each leap year contributes one additional odd day.

$$\text{Total Odd Days} = 17 + 5 = 22$$

Now,

$$22 \bmod 7 = 1$$

Therefore, there is a net advancement of 1 day.

Step 4: Determine the required day.

Given:

15th August, 2023 = Tuesday

Adding 1 day:

Tuesday + 1 = Wednesday

Hence, Independence Day in the year 2040 will be celebrated on **Wednesday**.

Quick Tip: For the same date in different years, use the shortcut:

$$\text{Odd Days} = (\text{Year Difference} + \text{Number of Leap Years}) \pmod{7}$$

Then move forward that many days from the given weekday.

43. Consider the following equations I and II.

$$\text{I: } \sqrt{1\frac{9}{16}} = 1\frac{1}{4}$$

$$\text{II: } \sqrt[3]{2744} = 2 \times 7\sqrt{7}$$

- (A) I and II are correct
- (B) I is incorrect, II is correct
- (C) I is correct, II is incorrect
- (D) I and II are incorrect

Correct Answer: (C) I is correct, II is incorrect

Solution:

Step 1: Check Equation I.

Convert the mixed fraction into an improper fraction:

$$1\frac{9}{16} = \frac{16+9}{16} = \frac{25}{16}$$

Taking square root:

$$\sqrt{\frac{25}{16}} = \frac{5}{4}$$

Now,

$$1\frac{1}{4} = \frac{5}{4}$$

Hence,

$$\sqrt{1\frac{9}{16}} = 1\frac{1}{4}$$

Therefore, Equation I is correct.

Step 2: Check Equation II.

$$2744 = 14^3$$

Therefore,

$$\sqrt[3]{2744} = 14$$

But,

$$2 \times 7\sqrt{7} = 14\sqrt{7}$$

Since

$$14 \neq 14\sqrt{7},$$

Equation II is incorrect.

Step 3: Conclusion.

Equation I is correct and Equation II is incorrect.

Option (C)

Quick Tip: Remember the perfect cube:

$$14^3 = 2744$$

This allows you to evaluate $\sqrt[3]{2744}$ instantly.

44. If $A \star B$ means A and B are of the same age, and $A - B$ means B is younger than A , then Himani $\star$ Mahesh – Jay means:

- (A) Himani is younger than Jay
- (B) Mahesh is younger than Jay
- (C) Jay is the youngest
- (D) Jay is the oldest

Correct Answer: (C) Jay is the youngest

Solution:

Step 1: Interpret the first relation.

Himani $\star$ Mahesh

means

$$H = M$$

where H and M denote the ages of Himani and Mahesh respectively.

Step 2: Interpret the second relation.

Mahesh – Jay

means Jay is younger than Mahesh.

$$M > J$$

Step 3: Combine the relations.

Since

$$H = M$$

and

$$M > J,$$

we get

$$H = M > J$$

Thus, Jay is younger than both Himani and Mahesh.

Jay is the youngest

Hence, the correct answer is **Option (C)**.

Quick Tip: Convert coded relations immediately into mathematical symbols such as =, >, and <. This makes the comparison straightforward.

45. If the sum of two numbers is 10 and the difference of their squares is 20, then these numbers are:

- (A) 8 and 2
- (B) 6 and 4
- (C) 7 and 3
- (D) 5 and 5

Correct Answer: (B) 6 and 4

Solution:

Step 1: Form the equations.

Let the numbers be x and y .

Given:

$$x + y = 10$$

and

$$x^2 - y^2 = 20$$

Using the identity:

$$(x - y)(x + y) = 20$$

Substituting $x + y = 10$,

$$10(x - y) = 20$$

$$x - y = 2$$

Step 2: Solve simultaneously.

$$x + y = 10$$

$$x - y = 2$$

Adding,

$$2x = 12$$

$$x = 6$$

Substituting into $x + y = 10$,

$$y = 4$$

Thus, the two numbers are

6 and 4

Hence, the correct answer is **Option (B)**.

Quick Tip: If both $x + y$ and $x^2 - y^2$ are given, first use

$$x^2 - y^2 = (x - y)(x + y)$$

to find $x - y$, then solve the two linear equations.

46. A figure consists of a triangle attached to a square such that the triangle points up. If the figure is rotated 90° clockwise, then where will the triangle point?

- (A) Left
- (B) Right
- (C) Downward
- (D) Upward

Correct Answer: (B) Right

Solution:

Step 1: Identify the initial direction.

The triangle initially points upward.

Direction = Up

Step 2: Apply the rotation.

A 90° clockwise rotation moves the direction one quarter-turn clockwise.

Up $\xrightarrow{90^\circ \text{ clockwise}}$ Right

Step 3: Conclusion.

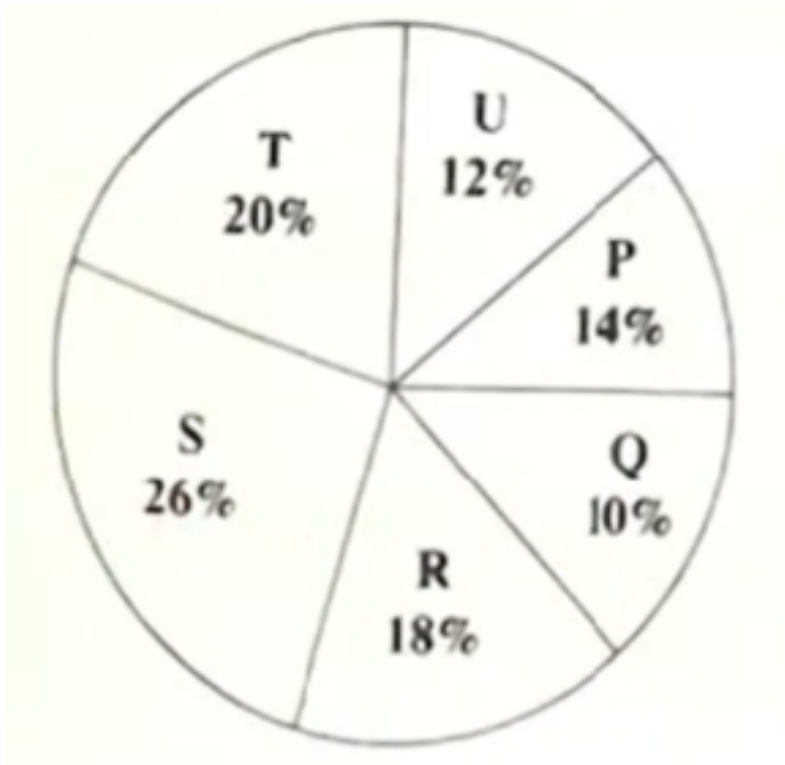
After rotation, the triangle points to the right.

Right

Hence, the correct answer is **Option (B)**.

Quick Tip: Think of a clock face: moving 90° clockwise from 12 o'clock reaches 3 o'clock, which corresponds to the right direction.

47. Distribution of total number of cellular phones sold by six stores in December, 2025 is given in the following pie chart.



What is the central angle corresponding to the total number of cellular phones sold by S?

- (A) 99.2°
- (B) 93.6°
- (C) 105.6°
- (D) 97.4°

Correct Answer: (B) 93.6°

Solution:

Step 1: Identify the percentage share of store S.

From the given pie-chart distribution:

$$T = 20\%, \quad U = 12\%, \quad P = 14\%, \quad Q = 10\%, \quad R = 18\%, \quad S = 26\%$$

Therefore,

$$\text{Percentage corresponding to Store S} = 26\%$$

Step 2: Apply the formula for central angle.

Using

$$\text{Central Angle} = \frac{\text{Percentage}}{100} \times 360^\circ$$

Substituting the value of Store S:

$$\text{Central Angle} = \frac{26}{100} \times 360^\circ$$

$$= 0.26 \times 360^\circ$$

$$= 93.6^\circ$$

Step 3: Verify the result.

Since Store S accounts for 26% of the total sales, its share should be slightly more than one-fourth of the full circle.

One-fourth of a circle is:

$$\frac{360^\circ}{4} = 90^\circ$$

Since 26% is slightly greater than 25%, the angle should be slightly greater than 90° .

Our calculated value is:

$$93.6^\circ$$

which is perfectly reasonable.

Step 4: Select the correct option.

The calculated central angle is

$$93.6^\circ$$

which matches:

Option (B)

Conclusion:

The central angle corresponding to Store S is

$$93.6^\circ$$

Hence, the correct answer is **Option (B)**.

Quick Tip: In pie-chart questions, remember the shortcut:

$$1\% = \frac{360^\circ}{100} = 3.6^\circ$$

Therefore,

$$26\% = 26 \times 3.6^\circ = 93.6^\circ$$

This method is often faster during examinations.

48. A researcher is conducting a statistical study on the students academic performance and life style habits. To ensure the study is scientifically valid, the most appropriate sequence for carrying out data collection, analysis and the following tasks is:

(P) Apply statistical methods to summarise and test relationships in the data

(Q) Design research objects variable sampling plan and data collection instrument

(R) Interpret findings and draw conclusions

(S) Collect responses from selected participants

(T) Class, code and organise the collected raw data

(A) $S \rightarrow T \rightarrow Q \rightarrow P \rightarrow R$

(B) $S \rightarrow T \rightarrow Q \rightarrow R \rightarrow P$

(C) $Q \rightarrow S \rightarrow T \rightarrow P \rightarrow R$

(D) $T \rightarrow Q \rightarrow S \rightarrow P \rightarrow R$

Correct Answer: (C) $Q \rightarrow S \rightarrow T \rightarrow P \rightarrow R$

Solution:

Step 1: Identify the first activity.

Before collecting any information, the researcher must determine:

- The objectives of the study
- The variables to be measured
- The sampling plan
- The data collection instrument

This activity corresponds to:

Q

Therefore, the process must begin with Q.

Step 2: Determine the next stage.

After the research design is prepared, the researcher can approach the selected participants and gather information.

This corresponds to:

S

Thus, **S** follows **Q**.

Step 3: Organise the collected information.

The responses collected from participants are usually in raw form and cannot be analyzed directly.

The data must first be:

- Classified
- Coded
- Organized

This stage corresponds to:

T

Hence, **T** comes after **S**.

Step 4: Apply statistical techniques.

Once the data is organized, statistical tools can be applied to summarize the information and identify relationships among variables.

This activity corresponds to:

P

Thus, **P** follows **T**.

Step 5: Interpret the results.

After statistical analysis has been completed, the researcher interprets the findings and draws meaningful conclusions.

This corresponds to:

R

Hence, **R** must be the final stage.

Step 6: Construct the complete sequence.

Combining all stages:

$$Q \rightarrow S \rightarrow T \rightarrow P \rightarrow R$$

This matches:

Option (C)

Conclusion:

The scientifically correct sequence is:

$$Q \rightarrow S \rightarrow T \rightarrow P \rightarrow R$$

Hence, the correct answer is **Option (C)**.

Quick Tip: Research studies always follow the sequence:

Plan → Collect → Organise → Analyse → Conclude

Remembering this order helps solve such questions quickly.

49. Which of the following statements are correct?

- (a) Startups are innovation-driven businesses and aim at scalability
 - (b) Securities and Exchange Board of India regulates stock markets and protects investors
 - (c) GST is an indirect tax applicable across India and is collected only once at the final stage of the transaction
 - (d) Blinkit operates in quick commerce, which focuses on fast delivery using dark stores
- (A) (a), (b) and (c)
(B) (a), (b) and (d)
(C) (b), (c) and (d)
(D) (c) and (d) only

Correct Answer: (B) (a), (b) and (d)

Solution:

Step 1: Examine Statement (a).

Statement (a):

“Startups are innovation-driven businesses and aim at scalability.”

A startup is generally established around a new idea, innovation, product, or business model with the objective of rapid growth and expansion.

Therefore, Statement (a) is:

Correct

Step 2: Examine Statement (b).

Statement (b):

“Securities and Exchange Board of India regulates stock markets and protects investors.”

SEBI is the statutory regulatory authority responsible for:

- Regulating the securities market
- Protecting investor interests
- Promoting fair market practices

Hence, Statement (b) is:

Correct

Step 3: Examine Statement (c).

Statement (c):

“GST is an indirect tax applicable across India and is collected only once at the final stage of the transaction.”

Although GST is an indirect tax applicable throughout India, the statement becomes incorrect because GST is not collected only at the final stage.

GST is a multi-stage tax levied at every stage of value addition. The Input Tax Credit (ITC) mechanism prevents double taxation.

Therefore, Statement (c) is:

Incorrect

Step 4: Examine Statement (d).

Statement (d):

“Blinkit operates in quick commerce, which focuses on fast delivery using dark stores.”

Quick commerce companies maintain local fulfillment centres known as dark stores to enable extremely fast deliveries.

Blinkit is one of the leading quick-commerce companies in India.

Hence, Statement (d) is:

Correct

Step 5: Identify the correct combination.

The correct statements are:

(a), (b), (d)

while Statement (c) is incorrect.

Therefore, the correct option is:

Option (B)

Conclusion:

Statements (a), (b), and (d) are correct, whereas Statement (c) is incorrect.

Hence, the correct answer is:

Option (B)

Quick Tip: GST is a value-added tax collected at multiple stages of the supply chain. Any statement claiming that GST is collected only once at the final stage is incorrect.

50. Which of the following statements about consumer-to-consumer (C2C) e-business model

are correct?

- (a) It involves transactions between two consumers
 - (b) Online platforms like OLX facilitate C2C trade
 - (c) It reduces dependency on traditional retailers
 - (d) Businesses directly supply goods and services to customers in this model
- (A) (a), (b) and (c)
(B) (a) and (b) only
(C) (b), (c) and (d)
(D) (c) and (d) only

Correct Answer: (A) (a), (b) and (c)

Solution:

Step 1: Examine Statement (a).

Statement (a):

“It involves transactions between two consumers.”

This statement accurately describes the fundamental feature of the C2C model. Both the buyer and seller are consumers rather than business organizations.

Therefore,

Statement (a) is Correct

Step 2: Examine Statement (b).

Statement (b):

“Online platforms like OLX facilitate C2C trade.”

OLX is a well-known platform where individuals can directly buy and sell products such as vehicles, furniture, electronics, and household goods.

Hence, OLX is a classic example of a C2C marketplace.

Therefore,

Statement (b) is Correct

Step 3: Examine Statement (c).

Statement (c):

“It reduces dependency on traditional retailers.”

Since consumers can directly purchase products from other consumers, they often bypass traditional retail stores and intermediaries.

Thus, C2C platforms provide an alternative channel for buying and selling goods.

Therefore,

Statement (c) is Correct

Step 4: Examine Statement (d).

Statement (d):

“Businesses directly supply goods and services to customers in this model.”

This statement describes the **Business-to-Consumer (B2C)** model rather than the Consumer-to-Consumer (C2C) model.

In B2C, companies sell directly to end consumers. Examples include Amazon Retail, Flipkart, and company-owned online stores.

Therefore,

Statement (d) is Incorrect

Step 5: Determine the correct combination.

From the above analysis:

(a) = Correct

(b) = Correct

(c) = Correct

(d) = Incorrect

Hence, the correct set of statements is:

(a), (b), and (c)

which corresponds to:

Option (A)

Conclusion:

The C2C e-business model involves transactions between consumers, is facilitated by platforms such as OLX, and reduces reliance on traditional retailers. Therefore, statements (a), (b), and (c) are correct.

Hence, the correct answer is:

Option (A)

Quick Tip: Remember the difference:

B2C = Business → Consumer

C2C = Consumer → Consumer

Whenever businesses directly sell to customers, it is B2C and not C2C.

51. Which is NOT an advantage of writing Business letter?

- (A) It has wide reach
- (B) It can be standalone medium
- (C) It is not cost effective
- (D) It can be reproduced and repeated

Correct Answer: (C) It is not cost effective

Solution:

Step 1: Examine Option (A).

Option (A): *"It has wide reach."*

Business letters can be sent across cities, states, and countries through postal services and electronic communication systems.

Thus, they can reach a large audience.

Hence,

This is an Advantage

Step 2: Examine Option (B).

Option (B): *"It can be standalone medium."*

A business letter generally contains complete information regarding the matter being communicated. The recipient can understand the message without requiring additional explanation.

Therefore,

This is an Advantage

Step 3: Examine Option (D).

Option (D): *"It can be reproduced and repeated."*

Business letters can be photocopied, printed, archived, scanned, and shared with multiple departments whenever required.

Thus,

This is an Advantage

Step 4: Examine Option (C).

Option (C): *"It is not cost effective."*

This statement describes a disadvantage rather than an advantage.

In reality, business letters are generally considered economical and cost-effective forms of communication, especially when compared with meetings, travel, or extensive verbal communication.

Therefore,

This is NOT an Advantage

Step 5: Select the correct answer.

Among the given options, only Option (C) represents a disadvantage rather than an advantage.

Hence,

Option (C)

is the correct answer.

Conclusion:

Business letters have wide reach, can function independently as a communication medium, and can be reproduced whenever necessary. The statement “It is not cost effective” does not represent an advantage.

Therefore, the correct answer is:

Option (C)

Quick Tip: In questions containing words such as **NOT**, **EXCEPT**, or **INCORRECT**, identify the option that does not belong to the group of correct statements before selecting the answer.

52. Arrange the sentences in the correct order.

- (A) The teacher appreciated her efforts
- (B) She worked hard to complete the project on time
- (C) Meena was assigned a project in the class
- (D) She presented it confidently before everyone

- (A) C B D A
- (B) B C D A
- (C) C D B A
- (D) B D C A

Correct Answer: (A) C B D A

Solution:

Step 1: Identify the opening sentence.

Let us examine the sentences:

- (A) begins with “The teacher”
- (B) begins with “She”
- (C) introduces “Meena”
- (D) begins with “She”

The pronoun “She” used in sentences (B) and (D) must refer to someone already introduced.

Sentence (C) introduces the main character, Meena.

Therefore,

Sentence (C) must come first

Step 2: Determine what happens after the project is assigned.

Sentence (C) states:

Meena was assigned a project in the class.

After receiving the project, the natural next step is to work on it.

Sentence (B) states:

She worked hard to complete the project on time.

Thus,

$C \rightarrow B$

Step 3: Identify the next event.

Once the project has been completed, it can be presented.

Sentence (D) states:

She presented it confidently before everyone.

The word “it” refers to the project completed in Sentence (B).

Therefore,

$$C \rightarrow B \rightarrow D$$

Step 4: Determine the concluding sentence.

After Meena presents the project, the teacher evaluates her work.

Sentence (A) states:

The teacher appreciated her efforts.

This naturally serves as the conclusion.

Hence,

$$C \rightarrow B \rightarrow D \rightarrow A$$

Step 5: Match with the options.

The sequence obtained is:

$$C \rightarrow B \rightarrow D \rightarrow A$$

which corresponds to:

Option (A)

Conclusion:

The logical sequence of events is:

$$C \rightarrow B \rightarrow D \rightarrow A$$

Therefore, the correct answer is:

Option (A)

“Meena was assigned a project in the class. She worked hard to complete the project on time. She presented it confidently before everyone. The teacher appreciated her efforts.”

Quick Tip: When arranging sentences, first identify the sentence that introduces the subject. Then place the remaining sentences according to the natural sequence of events and pronoun references.

53. Which of the following is/are true?

- (i) $(a + b)^3 = a^3 + 3a^2b + 3ab^2 + b^3$
- (ii) $(a + b + c)^2 = a^2 + b^2 + c^2 + 2ab + 2bc + 2ca$
- (iii) $(x + a)(x + b) = x^2 + (a + b)x + ab$
- (A) Both (i) and (ii)
- (B) (iii) only
- (C) Both (i) and (iii)
- (D) (i), (ii) and (iii)

Correct Answer: (D) (i), (ii) and (iii)

Solution:

Step 1: Verification of Statement (i)

The given statement is:

$$(a + b)^3 = a^3 + 3a^2b + 3ab^2 + b^3$$

Let us expand the left-hand side.

$$(a + b)^3 = (a + b)(a + b)^2$$

Using the well-known identity:

$$(a + b)^2 = a^2 + 2ab + b^2$$

Substituting:

$$(a + b)^3 = (a + b)(a^2 + 2ab + b^2)$$

Applying distributive multiplication:

$$= (a)(a^2 + 2ab + b^2) + b(a^2 + 2ab + b^2)$$

$$= a^3 + 2a^2b + ab^2 + a^2b + 2ab^2 + b^3$$

Combining like terms:

$$= a^3 + (2a^2b + a^2b) + (ab^2 + 2ab^2) + b^3$$

$$= a^3 + 3a^2b + 3ab^2 + b^3$$

This matches exactly with the right-hand side.

Therefore, statement (i) is **true**.

Step 2: Verification of Statement (ii)

The given statement is:

$$(a + b + c)^2 = a^2 + b^2 + c^2 + 2ab + 2bc + 2ca$$

Expanding directly:

$$(a + b + c)^2 = (a + b + c)(a + b + c)$$

Multiplying term by term:

$$= a(a + b + c) + b(a + b + c) + c(a + b + c)$$

$$= a^2 + ab + ac + ab + b^2 + bc + ac + bc + c^2$$

Grouping similar terms:

$$= a^2 + b^2 + c^2 + 2ab + 2ac + 2bc$$

Rearranging:

$$= a^2 + b^2 + c^2 + 2ab + 2bc + 2ca$$

This is exactly the expression given.

Hence, statement (ii) is **true**.

Step 3: Verification of Statement (iii)

The given statement is:

$$(x + a)(x + b) = x^2 + (a + b)x + ab$$

Expanding the left-hand side:

$$(x + a)(x + b)$$

$$= x(x + b) + a(x + b)$$

$$= x^2 + bx + ax + ab$$

Combining the middle terms:

$$= x^2 + (a + b)x + ab$$

This is identical to the right-hand side.

Therefore, statement (iii) is also **true**.

Step 4: Final Conclusion

All three statements have been verified independently and found to be correct algebraic identities.

Hence,

Statements (i), (ii) and (iii) are all true

Therefore, the correct answer is:

Option (D)

Quick Tip: Some of the most important algebraic identities to remember are:

$$(a + b)^2 = a^2 + 2ab + b^2$$

$$(a - b)^2 = a^2 - 2ab + b^2$$

$$(a + b)^3 = a^3 + 3a^2b + 3ab^2 + b^3$$

$$(a + b + c)^2 = a^2 + b^2 + c^2 + 2ab + 2bc + 2ca$$

Memorizing these standard identities saves significant time in algebraic calculations and competitive examinations.

54. A person has 2 parents, 4 grandparents, 8 great grandparents and so on. What is the number of his ancestors during the 5th generation preceding his own?

- (A) 40
- (B) 124
- (C) 32
- (D) 62

Correct Answer: (C) 32

Solution:

Step 1: Identify the sequence of ancestors generation-wise

The problem states:

$$\text{Parents} = 2$$

$$\text{Grandparents} = 4$$

$$\text{Great-grandparents} = 8$$

Continuing this pattern:

$$2, 4, 8, 16, 32, \dots$$

Clearly, every term is twice the preceding term.

Step 2: Determine the first term and common ratio

The first term is:

$$a = 2$$

The common ratio is:

$$r = \frac{4}{2} = 2$$

Checking with the next pair:

$$r = \frac{8}{4} = 2$$

Thus,

$$a = 2, \quad r = 2$$

Step 3: Find the number of ancestors in the 5th generation

We need the number of ancestors during the 5th generation preceding the person's own generation.

Using:

$$a_n = a r^{n-1}$$

Substituting $a = 2$, $r = 2$, and $n = 5$:

$$a_5 = 2(B)^{5-1}$$

$$a_5 = 2(B)^4$$

$$a_5 = 2 \times 16$$

$$a_5 = 32$$

Therefore, the number of ancestors in the fifth generation is:

$$32$$

Step 4: Verification through direct doubling

Let us verify by listing generation-wise values:

$$1^{\text{st}} \text{ generation} = 2$$

$$2^{\text{nd}} \text{ generation} = 4$$

$$3^{\text{rd}} \text{ generation} = 8$$

$$4^{\text{th}} \text{ generation} = 16$$

$$5^{\text{th}} \text{ generation} = 32$$

The fifth generation indeed contains 32 ancestors.

Step 5: Final Conclusion

The ancestor count follows a geometric progression with common ratio 2. Using either repeated doubling or the GP formula, the number of ancestors in the fifth generation preceding the person's own generation is:

$$32$$

Hence, the correct answer is:

Option (C)

Quick Tip: A common mistake is to calculate the *total* ancestors up to the fifth generation:

$$2 + 4 + 8 + 16 + 32 = 62$$

However, the question asks for the number of ancestors **during the fifth generation only**, not the cumulative total. Therefore, the required answer is 32, not 62.

55. If $A = \begin{bmatrix} 1 & 2 & 4 \\ -1 & 3 & 0 \\ 1 & 2 & 0 \end{bmatrix}$, then the value of determinant of A is:

- (A) -10
- (B) 10
- (C) 20
- (D) -20

Correct Answer: (D) -20

Solution:

Step 1: Expand the determinant along the third column.

The sign pattern for cofactors in a 3×3 determinant is:

$$\begin{bmatrix} + & - & + \\ - & + & - \\ + & - & + \end{bmatrix}$$

The elements of the third column are:

$$4, \quad 0, \quad 0$$

Hence,

$$|A| = 4 \begin{vmatrix} -1 & 3 \\ 1 & 2 \end{vmatrix} - 0 \begin{vmatrix} 1 & 2 \\ 1 & 2 \end{vmatrix} + 0 \begin{vmatrix} 1 & 2 \\ -1 & 3 \end{vmatrix}$$

Since the last two terms are multiplied by zero, they vanish completely.

Therefore,

$$|A| = 4 \begin{vmatrix} -1 & 3 \\ 1 & 2 \end{vmatrix}$$

Step 2: Evaluate the remaining 2×2 determinant.

For a matrix

$$\begin{bmatrix} a & b \\ c & d \end{bmatrix},$$

the determinant is given by

$$ad - bc.$$

Applying this formula:

$$\begin{vmatrix} -1 & 3 \\ 1 & 2 \end{vmatrix} = (-1)(B) - (C)(A)$$

$$= -2 - 3$$

$$= -5$$

Thus,

$$\begin{vmatrix} -1 & 3 \\ 1 & 2 \end{vmatrix} = -5.$$

Step 3: Substitute the value into the expansion.

Using the result obtained above,

$$|A| = 4(-5)$$

$$|A| = -20$$

Step 4: Verify the result.

Since only one non-zero cofactor term contributed to the expansion, the computation is straightforward and free from sign ambiguity.

Thus, the determinant of matrix A is

$$-20$$

Hence, the correct answer is:

$$(D) - 20$$

Quick Tip: Whenever a determinant contains several zero entries, always expand along the row or column having the greatest number of zeros. This minimizes calculations and significantly reduces the possibility of arithmetic mistakes.

56. If $A = \begin{bmatrix} 1 & 2 \\ -1 & 3 \end{bmatrix}$, $B = \begin{bmatrix} -1 & 2 \\ 0 & 4 \end{bmatrix}$, then match the following and choose the correct answer.

List - I

List - II

- | | |
|---------------|---|
| (a) $A + B$ | (i) $\begin{bmatrix} -1 & 10 \\ 1 & 10 \end{bmatrix}$ |
| (b) $A - B$ | (ii) $\begin{bmatrix} 0 & 4 \\ -1 & 7 \end{bmatrix}$ |
| (c) AB | (iii) $\begin{bmatrix} 1 & 4 \\ 0 & 10 \end{bmatrix}$ |
| (d) $2A + B'$ | (iv) $\begin{bmatrix} 2 & 0 \\ -1 & -1 \end{bmatrix}$ |

Codes:

- (A) a - ii, b - iv, c - i, d - iii
 (B) a - iii, b - iv, c - i, d - ii
 (C) a - iii, b - i, c - v, d - ii
 (D) a - ii, b - i, c - iv, d - iii

Correct Answer: (A) a - ii, b - iv, c - i, d - iii

Solution:

Step 1: Find $A + B$.

Add corresponding elements:

$$\begin{aligned}
 A + B &= \begin{bmatrix} 1 + (-1) & 2 + 2 \\ -1 + 0 & 3 + 4 \end{bmatrix} \\
 &= \begin{bmatrix} 0 & 4 \\ -1 & 7 \end{bmatrix}
 \end{aligned}$$

This matches item (ii).

Therefore,

$$a \rightarrow ii$$

Step 2: Find $A - B$.

Subtract corresponding elements:

$$\begin{aligned} A - B &= \begin{bmatrix} 1 - (-1) & 2 - 2 \\ -1 - 0 & 3 - 4 \end{bmatrix} \\ &= \begin{bmatrix} 2 & 0 \\ -1 & -1 \end{bmatrix} \end{aligned}$$

This matches item (iv).

Therefore,

$$b \rightarrow iv$$

Step 3: Find AB .

Using row-by-column multiplication:

$$AB = \begin{bmatrix} 1 & 2 \\ -1 & 3 \end{bmatrix} \begin{bmatrix} -1 & 2 \\ 0 & 4 \end{bmatrix}$$

First row, first column:

$$(A)(-1) + (B)(0) = -1$$

First row, second column:

$$(A)(2) + (B)(4) = 2 + 8 = 10$$

Second row, first column:

$$(-1)(-1) + (C)(0) = 1$$

Second row, second column:

$$(-1)(B) + (C)(D) = -2 + 12 = 10$$

Therefore,

$$AB = \begin{bmatrix} -1 & 10 \\ 1 & 10 \end{bmatrix}$$

This matches item (i).

Hence,

$$c \rightarrow i$$

Step 4: Find $2A + B'$.

First calculate $2A$:

$$2A = \begin{bmatrix} 2 & 4 \\ -2 & 6 \end{bmatrix}$$

Next calculate the transpose of B :

$$B' = \begin{bmatrix} -1 & 0 \\ 2 & 4 \end{bmatrix}$$

Now add them:

$$\begin{aligned} 2A + B' &= \begin{bmatrix} 2 + (-1) & 4 + 0 \\ -2 + 2 & 6 + 4 \end{bmatrix} \\ &= \begin{bmatrix} 1 & 4 \\ 0 & 10 \end{bmatrix} \end{aligned}$$

This matches item (iii).

Hence,

$$d \rightarrow iii$$

Step 5: Compile all matches.

$$a \rightarrow ii$$

$$b \rightarrow iv$$

$$c \rightarrow i$$

$$d \rightarrow iii$$

Therefore,

$$a - ii, b - iv, c - i, d - iii$$

which corresponds to

(A)

Quick Tip: In matching-type matrix questions, compute the easiest expressions first. Matrix addition and subtraction often eliminate most incorrect options before matrix multiplication is even required.

57. Let U be universal set. If A and B are subsets of U , then match the following and choose the correct answer.

List - I

List - II

(a) $A \cup A'$

(i) A

(b) $(A \cup B)'$

(ii) $A' \cup B'$

(c) $(A \cap B)'$

(iii) $A' \cap B'$

(d) $(A')'$

(iv) U

Codes:

(A) a - ii, b - i, c - iv, d - iii

(B) a - ii, b - iii, c - iv, d - i

(C) a - iii, b - iv, c - ii, d - i

(D) a - iv, b - iii, c - ii, d - i

Correct Answer: (D) a - iv, b - iii, c - ii, d - i

Solution:

Step 1: Match (a) $A \cup A'$.

A set together with its complement contains every element of the universal set.

Hence,

$$A \cup A' = U$$

This corresponds to item (iv).

Therefore,

$$a \rightarrow iv$$

Step 2: Match (b) $(A \cup B)'$.

Applying the first De Morgan's Law:

$$(A \cup B)' = A' \cap B'$$

This corresponds to item (iii).

Therefore,

$$b \rightarrow iii$$

Step 3: Match (c) $(A \cap B)'$.

Applying the second De Morgan's Law:

$$(A \cap B)' = A' \cup B'$$

This corresponds to item (ii).

Therefore,

$$c \rightarrow ii$$

Step 4: Match (d) $(A')'$.

Taking complement twice returns the original set.

$$(A')' = A$$

This corresponds to item (i).

Therefore,

$$d \rightarrow i$$

Step 5: Final matching.

$$a \rightarrow iv$$

$$b \rightarrow iii$$

$$c \rightarrow ii$$

$$d \rightarrow i$$

Thus,

$$a - iv, b - iii, c - ii, d - i$$

which matches option

$$(D)$$

Quick Tip: A useful memory trick for De Morgan's Laws is: "Break the bar, change the operation." When the complement sign is distributed, union changes to intersection and intersection changes to union.

58. Let 'U' be universal set. If A and B are subsets of U, then match the following and choose

the correct answer.

List - I	List - II
(a) $A \cup A'$	(i) A
(b) $(A \cup B)'$	(ii) $A' \cup B'$
(c) $(A \cap B)'$	(iii) $A' \cap B'$
(d) $(A')'$	(iv) $\cup$

(A) a - ii, b - i, c - iv, d - iii

(B) a - ii, b - iii, c - iv, d - i

(C) a - iii, b - iv, c - ii, d - i

(D) a - iv, b - iii, c - ii, d - i

Correct Answer: (D) a - iv, b - iii, c - ii, d - i

Solution:

Step 1: Evaluate (a) $A \cup A'$

Every element in the universal set either belongs to A or does not belong to A . Hence their union covers the entire universal set:

$$A \cup A' = U$$

So, (a) matches with (iv).

Step 2: Evaluate (b) $(A \cup B)'$

Using De Morgan's law, the complement of union becomes intersection of complements:

$$(A \cup B)' = A' \cap B'$$

So, (b) matches with (iii).

Step 3: Evaluate (c) $(A \cap B)'$

Using De Morgan's law again, the complement of intersection becomes union of complements:

$$(A \cap B)' = A' \cup B'$$

So, (c) matches with (iii).

Step 4: Evaluate (d) $(A')'$

Applying double complement law:

$$(A')' = A$$

So, (d) matches with (i).

Final Matching:

$$a \rightarrow (iv), \quad b \rightarrow (ii), \quad c \rightarrow (iii), \quad d \rightarrow (i)$$

Thus, the correct option is:

(D)

Quick Tip: De Morgan's Laws are easiest to remember as: "Break the line, change the sign" - Union becomes intersection - Intersection becomes union while keeping complements on each term.

59. In a shop, the cost of 3 pens and 3 pencils is Rs. 9 and the cost of 4 pens and 6 pencils is Rs. 14. The cost of each pencil in Rs. is:

- (A) 1
- (B) 2
- (C) 3
- (D) 4

Correct Answer: (A) 1

Solution:

Step 1: Forming the equations

Let:

$$\text{Cost of one pen} = x, \quad \text{Cost of one pencil} = y$$

From the first condition:

$$3x + 3y = 9 \quad \dots(A)$$

From the second condition:

$$4x + 6y = 14 \quad \dots(B)$$

Step 2: Simplify Equation (A)

Divide equation (A) by 3:

$$x + y = 3 \quad \dots(C)$$

Step 3: Express one variable

From equation (C):

$$x = 3 - y \quad \dots(D)$$

Step 4: Substitute into Equation (B)

Substitute $x = 3 - y$ into equation (B):

$$4(3 - y) + 6y = 14$$

Expanding:

$$12 - 4y + 6y = 14$$

$$12 + 2y = 14$$

$$2y = 2$$

$$y = 1$$

Thus, the cost of each pencil is:

$$1$$

Quick Tip: When two linear equations are given, always try to simplify the smaller equation first. This reduces substitution complexity and minimizes calculation errors in elimination problems.

60. The equation of the line passing through the points $(1, 2)$ and $(-1, 4)$ is:

- (A) $x + y = 3$
- (B) $x + y = 4$
- (C) $2x + y = 4$
- (D) $x + 2y = 3$

Correct Answer: (A) $x + y = 3$

Solution:

Step 1: Find slope

Given points:

$$(1, 2), \quad (-1, 4)$$

$$m = \frac{4 - 2}{-1 - 1} = \frac{2}{-2} = -1$$

Step 2: Use point-slope form

Using point $(1, 2)$:

$$y - 2 = -1(x - 1)$$

$$y - 2 = -x + 1$$

Step 3: Rearrange

$$x + y = 3$$

Thus, the required equation is:

$$x + y = 3$$

Quick Tip: Always verify the final equation by substituting both points. If both satisfy the equation, it is correct.

61. The midpoint of the line joining the points $(2, 4)$ and $(6, -2)$ is:

- (A) $(4, -1)$
- (B) $(4, 1)$
- (C) $(2, 4)$
- (D) $(3, -1)$

Correct Answer: (B) $(4, 1)$

Solution:

Step 1: Apply formula

For $(2, 4)$ and $(6, -2)$:

$$x = \frac{2 + 6}{2} = 4$$

$$y = \frac{4 + (-2)}{2} = 1$$

Final answer:

$(4, 1)$

Quick Tip: Carefully handle negative signs in midpoint problems; most errors occur in adding signed numbers.

62. The point of intersection of the lines $3x + 2y = 6$ and $3x - 2y = -2$ is:

- (A) $(2/3, 2)$
- (B) $(2/3, -2)$
- (C) $(-2/3, 2)$
- (D) $(-2/3, -2)$

Correct Answer: (A) $(2/3, 2)$

Solution:

Step 1: Add equations

$$(3x + 2y) + (3x - 2y) = 6 - 2$$

$$6x = 4 \Rightarrow x = \frac{2}{3}$$

Step 2: Substitute

$$3\left(\frac{2}{3}\right) + 2y = 6$$

$$2 + 2y = 6 \Rightarrow 2y = 4 \Rightarrow y = 2$$

$$\left(\frac{2}{3}, 2\right)$$

Quick Tip: When coefficients of one variable are equal and opposite, addition eliminates the variable instantly.

63. The centre of the circle $(x + 5)^2 + (y - 3)^2 = 36$ is:

- (A) (5, 3)
- (B) (-5, -3)
- (C) (-5, 3)
- (D) (5, -3)

Correct Answer: (C) (-5, 3)

Solution:

Step 1: Compare

$$(x + 5)^2 = (x - (-5))^2$$

$$(y - 3)^2 \Rightarrow k = 3$$

Step 2: Identify center

$$(-5, 3)$$

Quick Tip: To avoid sign mistakes, equate each bracket expression to zero: $x + 5 = 0$, $y - 3 = 0$.

64. The reflection of the point $(4, -13)$ about the line $5x + y + 6 = 0$ is:

- (A) $(-1, -14)$
- (B) $(-5, -14)$
- (C) $(-1, -5)$
- (D) $(-2, -7)$

Correct Answer: (A) $(-1, -14)$

Solution:

Step 1: Identify given values

Given point:

$$(x_1, y_1) = (4, -13)$$

Given line:

$$5x + y + 6 = 0$$

Thus,

$$a = 5, \quad b = 1, \quad c = 6$$

Step 2: Compute substitution expression

We first compute:

$$S = ax_1 + by_1 + c$$

Substituting values:

$$S = 5(D) + 1(-13) + 6$$

$$S = 20 - 13 + 6 = 13$$

This scalar value represents the signed perpendicular influence of the point with respect to the line.

Step 3: Compute denominator

$$a^2 + b^2 = 5^2 + 1^2 = 25 + 1 = 26$$

Step 4: Compute reflected x-coordinate

$$x_2 = 4 - \frac{2 \cdot 5 \cdot 13}{26}$$

$$x_2 = 4 - \frac{130}{26}$$

$$x_2 = 4 - 5 = -1$$

Thus, the x-coordinate of the image point is -1 .

Step 5: Compute reflected y-coordinate

$$y_2 = -13 - \frac{2 \cdot 1 \cdot 13}{26}$$

$$y_2 = -13 - \frac{26}{26}$$

$$y_2 = -13 - 1 = -14$$

Thus, the y-coordinate of the image point is -14 .

Step 6: Final verification reasoning

The midpoint of $(4, -13)$ and $(-1, -14)$ is:

$$\left(\frac{4 + (-1)}{2}, \frac{-13 + (-14)}{2} \right) = \left(\frac{3}{2}, \frac{-27}{2} \right)$$

Substituting into the line:

$$\begin{aligned} 5\left(\frac{3}{2}\right) + \left(\frac{-27}{2}\right) + 6 \\ = \frac{15 - 27 + 12}{2} = 0 \end{aligned}$$

Since the midpoint satisfies the equation of the line, the reflection is confirmed.

Final Answer:

$$(-1, -14)$$

Quick Tip: In reflection problems, always compute $ax_1 + by_1 + c$ first. If this value is large or messy, simplify before substitution to avoid arithmetic errors.

65. The equation of the parabola which is symmetric about the y-axis and passes through the point $(2, -3)$ is:

- (A) $4x^2 = -3y$
- (B) $4x^2 = 3y$
- (C) $3x^2 = 4y$
- (D) $3x^2 = -4y$

Correct Answer: (D) $3x^2 = -4y$

Solution:

Step 1: Substitute the point into general form

Given point:

$$(2, -3)$$

Substitute into $x^2 = ky$:

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

$$4 = -3k$$

Step 2: Solve for constant k

$$k = -\frac{4}{3}$$

This negative value indicates that the parabola opens downward.

Step 3: Form the equation

$$x^2 = -\frac{4}{3}y$$

Multiply throughout by 3 to remove fraction:

$$3x^2 = -4y$$

Step 4: Geometrical interpretation

Since $k < 0$, the parabola opens in the negative y -direction, which is consistent with the given point $(2, -3)$ lying below the x -axis.

Final Answer:

$$3x^2 = -4y$$

Quick Tip: For parabolas symmetric about the y -axis, always assume $x^2 = ky$ unless vertex shift is mentioned.

66. Consider the triangle with vertices $(0, 0)$, $(5, 0)$ and $(2, 3)$. If scaling of 3 units is applied along both x-axis and y-axis, the new coordinates are:

- (A) $(0, 0), (5, 0), (5, 6)$
- (B) $(0, 0), (8, 0), (5, 6)$
- (C) $(0, 0), (2, 0), (-1, 0)$
- (D) $(0, 0), (8, 0), (-1, 0)$

Correct Answer: (B) $(0, 0), (8, 0), (5, 6)$

Solution:

Step 1: Original vertices

$$A(0, 0), \quad B(5, 0), \quad C(2, 3)$$

Step 2: Apply transformation rule

$$x' = x + 3, \quad y' = y + 3$$

Step 3: Transform each vertex

For $A(0, 0)$:

$$A' = (0, 0)$$

For $B(5, 0)$:

$$B' = (5 + 3, 0 + 0) = (8, 0)$$

For $C(2, 3)$:

$$C' = (2 + 3, 3 + 3) = (5, 6)$$

Step 4: Interpretation

The triangle is uniformly shifted in both coordinate directions, preserving shape but changing position.

Final Answer:

$(0, 0), (8, 0), (5, 6)$

Quick Tip: Always apply transformations vertex-by-vertex instead of applying them mentally to the whole shape.

67. Match the postulates in List-I with List-II.

List - I	List - II
(a) Identity law	(i) $A + \bar{A} = 1$ and $A \cdot \bar{A} = 0$
(b) Null law	(ii) $A + A = A$ and $A \cdot A = A$
(c) Complement law	(iii) $A + 0 = A$ and $A \cdot 1 = A$
(d) Idempotent law	(iv) $A + 1 = 1$ and $A \cdot 0 = 0$

- (A) a-iv, b-ii, c-i, d-iii
(B) a-iv, b-iii, c-i, d-ii
(C) a-iii, b-iv, c-i, d-ii
(D) a-iii, b-i, c-ii, d-iv

Correct Answer: (C) a-iii, b-iv, c-i, d-ii

Solution:

Step 1: Identity law

$$A + 0 = A, \quad A \cdot 1 = A \Rightarrow (iii)$$

Step 2: Null law

$$A + 1 = 1, \quad A \cdot 0 = 0 \Rightarrow (iv)$$

Step 3: Complement law

$$A + \bar{A} = 1, \quad A \cdot \bar{A} = 0 \Rightarrow (i)$$

Step 4: Idempotent law

$$A + A = A, \quad A \cdot A = A \Rightarrow (ii)$$

Final Matching

$$a \rightarrow (iii), \quad b \rightarrow (iv), \quad c \rightarrow (i), \quad d \rightarrow (ii)$$

Final Answer:

(C)

Quick Tip: Remember: Identity preserves value, Null forces constant, Complement flips, Idempotent repeats same value.

68. The Boolean function $AB + AC$ is equivalent to:

- (A) $AB + AC + BC$
- (B) $A'BC' + ABC' + A'BC$
- (C) $ABC + A'BC + B'C'$
- (D) $ABC + ABC' + AB'C$

Correct Answer: (D) $ABC + ABC' + AB'C$

Solution:

Step 1: Expand first term

$$AB = AB(C + C')$$

$$= ABC + ABC'$$

Step 2: Expand second term

$$AC = AC(B + B')$$

$$= ABC + AB'C$$

Step 3: Combine terms

$$AB + AC = ABC + ABC' + ABC + AB'C$$

Using idempotent law ($X + X = X$):

$$= ABC + ABC' + AB'C$$

Step 4: Interpretation

The final expression is a canonical SOP form containing all minterms covered by the original expression.

Final Answer:

$$ABC + ABC' + AB'C$$

Quick Tip: Canonical expansion always ensures every term contains all variables using $(X + X')$ multiplication.

69. The Boolean expressions $(AB)' = A' + B'$ and $(A + B)' = A'B'$ represent

- (A) Absorption law
- (B) Distributive law
- (C) De Morgan's law
- (D) Idempotent law

Correct Answer: (C) De Morgan's law

Solution:

Step 1: Analysis of $(AB)' = A' + B'$

The expression $(AB)'$ represents the complement of the AND operation between two variables A and B . According to Boolean logic, when an AND expression is complemented, the result transforms into an OR expression where each variable is individually complemented. This gives:

$$(AB)' = A' + B'$$

This transformation clearly shows that the operation changes from multiplication (AND) to addition (OR) while applying NOT to each variable separately. This is the fundamental statement of De Morgan's First Law.

Step 2: Analysis of $(A + B)' = A'B'$

The expression $(A + B)'$ represents the complement of the OR operation between A and B . According to Boolean rules, when an OR expression is complemented, it becomes an AND expression where each variable is individually complemented:

$$(A + B)' = A'B'$$

This is known as De Morgan's Second Law. It shows that OR changes to AND under complementation, with each variable being negated.

Step 3: Combined interpretation

Both expressions together form the complete set of De Morgan's laws. These laws are essential in switching between NAND-NOR logic implementations and simplifying complex logic circuits in digital electronics.

Thus, the given expressions directly represent De Morgan's laws.

Quick Tip: Remember: "Break the line, change the sign, and complement every variable." AND becomes OR, OR becomes AND under negation.

70. Match List-I with List-II.

List - I	List - II
(a) $\sin(\pi/3)$	(i) $\frac{1}{\sqrt{2}}$
(b) $\sin(\pi/4)$	(ii) $\frac{1}{2}$
(c) $\sin(\pi/6)$	(iii) $\frac{\sqrt{3}}{2}$
(d) $\sin(\pi/2)$	(iv) 1

- (A) a - iii, b - i, c - ii, d - iv
 (B) a - iv, b - ii, c - i, d - iii
 (C) a - iii, b - ii, c - i, d - iv
 (D) a - iv, b - ii, c - iii, d - i

Correct Answer: (A) a - iii, b - i, c - ii, d - iv

Solution:

Step 1: Evaluate $\sin(\pi/3)$

The angle $\frac{\pi}{3}$ corresponds to 60° . In a $30^\circ - 60^\circ - 90^\circ$ triangle, the sine of 60° is:

$$\sin(60^\circ) = \frac{\sqrt{3}}{2}$$

Thus, (a) matches (iii).

Step 2: Evaluate $\sin(\pi/4)$

The angle $\frac{\pi}{4}$ corresponds to 45° . In a $45^\circ - 45^\circ - 90^\circ$ triangle:

$$\sin(45^\circ) = \frac{1}{\sqrt{2}}$$

Thus, (b) matches (i).

Step 3: Evaluate $\sin(\pi/6)$

The angle $\frac{\pi}{6}$ corresponds to 30° . In a $30^\circ - 60^\circ - 90^\circ$ triangle:

$$\sin(30^\circ) = \frac{1}{2}$$

Thus, (c) matches (ii).

Step 4: Evaluate $\sin(\pi/2)$

The angle $\frac{\pi}{2}$ corresponds to 90° . On the unit circle:

$$\sin(90^\circ) = 1$$

Thus, (d) matches (iv).

Step 5: Final Matching

Combining all results:

$$(a, b, c, d) = (iii, i, ii, iv)$$

Hence, option (A) is correct.

Quick Tip: Use the pattern:

$$\sqrt{0/4}, \sqrt{1/4}, \sqrt{2/4}, \sqrt{3/4}, \sqrt{4/4}$$

to quickly recall sine values of $0^\circ, 30^\circ, 45^\circ, 60^\circ, 90^\circ$.

71. The general solution of $2 \cos \theta - \sqrt{3} = 0$ is

(A) $\theta = n\pi + (-1)^n \frac{\pi}{6}$

(B) $\theta = 2n\pi \pm \frac{\pi}{6}$

(C) $\theta = 2n\pi \pm \frac{\pi}{3}$

(D) $\theta = n\pi + (-1)^n \frac{\pi}{3}$

Correct Answer: (B) $\theta = 2n\pi \pm \frac{\pi}{6}$

Solution:

Step 1: Simplifying the given equation

We are given:

$$2 \cos \theta - \sqrt{3} = 0$$

First, isolate the trigonometric term:

$$2 \cos \theta = \sqrt{3}$$

Now divide both sides by 2:

$$\cos \theta = \frac{\sqrt{3}}{2}$$

Step 2: Finding principal value

We know from standard trigonometric values that:

$$\cos\left(\frac{\pi}{6}\right) = \frac{\sqrt{3}}{2}$$

Thus, the principal solution angle is:

$$\theta = \frac{\pi}{6}$$

Step 3: Applying general solution of cosine

For cosine equations, the general solution formula is:

$$\theta = 2n\pi \pm \alpha$$

where α is the principal angle.

Substituting $\alpha = \frac{\pi}{6}$:

$$\theta = 2n\pi \pm \frac{\pi}{6}$$

Step 4: Final interpretation

This represents all angles where cosine equals $\frac{\sqrt{3}}{2}$, including both symmetric positions in the unit circle.

Thus, the correct answer is option (B).

Quick Tip: Remember:

- $\cos \theta = \cos \alpha \Rightarrow \theta = 2n\pi \pm \alpha$
- $\sin \theta = \sin \alpha \Rightarrow \theta = n\pi + (-1)^n \alpha$

72. In a right angled isosceles triangle $\triangle ABC$, right angle at C , if side $a = 2$, then sides b and c are respectively

- (A) $2\sqrt{2}, 2$
- (B) $\sqrt{2}, 2$
- (C) $2, \sqrt{2}$
- (D) $2, 2\sqrt{2}$

Correct Answer: (D) $2, 2\sqrt{2}$

Solution:

Step 1: Understanding triangle properties

Since the triangle is right-angled at C , side c is the hypotenuse. In a right-angled isosceles triangle, the two perpendicular sides are equal:

$$a = b$$

Given:

$$a = 2 \Rightarrow b = 2$$

Step 2: Applying Pythagoras theorem

For a right-angled triangle:

$$c^2 = a^2 + b^2$$

Substituting values:

$$c^2 = 2^2 + 2^2 = 4 + 4 = 8$$

$$c = \sqrt{8} = 2\sqrt{2}$$

Step 3: Final answer arrangement

The question asks for (b, c) respectively:

$$b = 2, \quad c = 2\sqrt{2}$$

Thus, option (D) is correct.

Quick Tip: In a right isosceles triangle:

$$\text{Sides ratio} = 1 : 1 : \sqrt{2}$$

So if one leg is x , hypotenuse is always $x\sqrt{2}$.

73. The value of $\tan^{-1}(A) + \cos^{-1}\left(-\frac{1}{2}\right) + \sin^{-1}\left(-\frac{1}{2}\right)$ is

- (A) $\frac{\pi}{4}$
- (B) $\frac{\pi}{2}$
- (C) $\frac{3\pi}{4}$
- (D) $\frac{3\pi}{2}$

Correct Answer: (C) $\frac{3\pi}{4}$

Solution:

Step 1: Evaluate $\tan^{-1}(A)$

We know that:

$$\tan\left(\frac{\pi}{4}\right) = 1$$

Therefore,

$$\tan^{-1}(A) = \frac{\pi}{4}$$

Step 2: Evaluate $\cos^{-1}\left(-\frac{1}{2}\right)$

We know:

$$\cos\left(\frac{\pi}{3}\right) = \frac{1}{2}$$

Since cosine is negative, the angle lies in the second quadrant:

$$\cos^{-1}\left(-\frac{1}{2}\right) = \frac{2\pi}{3}$$

Step 3: Evaluate $\sin^{-1}\left(-\frac{1}{2}\right)$

We know:

$$\sin\left(\frac{\pi}{6}\right) = \frac{1}{2}$$

Since sine is negative, principal value lies in fourth quadrant:

$$\sin^{-1}\left(-\frac{1}{2}\right) = -\frac{\pi}{6}$$

Step 4: Add all values

$$E = \frac{\pi}{4} + \frac{2\pi}{3} - \frac{\pi}{6}$$

Taking LCM = 12:

$$E = \frac{3\pi}{12} + \frac{8\pi}{12} - \frac{2\pi}{12}$$

$$E = \frac{9\pi}{12} = \frac{3\pi}{4}$$

Thus, the final answer is $\frac{3\pi}{4}$.

Quick Tip: Remember:

- $\tan^{-1}(A) = \frac{\pi}{4}$
- $\cos^{-1}(-x)$ lies in second quadrant
- $\sin^{-1}(-x)$ lies in fourth quadrant

74. Two dice are thrown and the sum of the numbers which come up is noted. Among the following events: A: sum is even, B: sum is multiple of 3, C: sum is less than 4, D: sum is greater than 11. Which pair of events are mutually exclusive?

- (A) A and B
- (B) A and C
- (C) C and D
- (D) B and D

Correct Answer: (C) C and D

Solution:

Step 1: Define each event clearly

We list all possible sums for each event:

Event A (even sum):

$$\{2, 4, 6, 8, 10, 12\}$$

Event B (multiple of 3):

$$\{3, 6, 9, 12\}$$

Event C (sum less than 4):

$$\{2, 3\}$$

Event D (sum greater than 11):

$$\{12\}$$

Step 2: Check intersections

We check each option:

(A and B):

$$\{2, 4, 6, 8, 10, 12\} \cap \{3, 6, 9, 12\} = \{6, 12\} \neq \emptyset$$

(B and D):

$$\{3, 6, 9, 12\} \cap \{12\} = \{12\} \neq \emptyset$$

(A and C):

$$\{2, 4, 6, 8, 10, 12\} \cap \{2, 3\} = \{2\} \neq \emptyset$$

(C and D):

$$\{2, 3\} \cap \{12\} = \emptyset$$

Thus, only C and D are mutually exclusive.

Quick Tip: Two events are mutually exclusive when no outcome is common between them. If even one outcome matches, they are not mutually exclusive.

75. Two students A and B appear for an exam. Probability that A passes is 0.05, B passes is 0.10, and both pass is 0.02. Find probability that neither passes.

- (A) 0.87
- (B) 0.98
- (C) 1
- (D) 0.11

Correct Answer: (A) 0.87

Solution:

Step 1: Write the given probabilities.

$$P(A) = 0.05, \quad P(B) = 0.10, \quad P(A \cap B) = 0.02.$$

Step 2: Find the probability that at least one student passes.

Using

$$P(A \cup B) = P(A) + P(B) - P(A \cap B),$$

we get

$$P(A \cup B) = 0.05 + 0.10 - 0.02.$$

$$P(A \cup B) = 0.13.$$

Step 3: Find the probability that neither student passes.

$$P(\text{Neither}) = 1 - P(A \cup B).$$

$$P(\text{Neither}) = 1 - 0.13.$$

$$P(\text{Neither}) = 0.87.$$

Conclusion:

$$0.87$$

Hence, the probability that neither student passes is 0.87.

Quick Tip: Whenever a question asks for the probability that none of the given events occur, first find the probability that at least one event occurs and then use

$$P(\text{None}) = 1 - P(\text{At least one}).$$

76. The probability of selecting a man from a crowd containing 20 men and 33 women is

- (A) $\frac{20}{33}$
- (B) $\frac{33}{20}$
- (C) $\frac{20}{53}$
- (D) $\frac{33}{53}$

Correct Answer: (C) $\frac{20}{53}$

Solution:

Step 1: Find the total number of people.

The crowd contains

20

men and

33

women.

Therefore,

$$\text{Total people} = 20 + 33 = 53.$$

Step 2: Find the favourable outcomes.

The event is selecting a man.

Hence,

$$\text{Favourable outcomes} = 20.$$

Step 3: Apply the probability formula.

$$P(\text{Selecting a man}) = \frac{20}{53}.$$

Step 4: Match with the options.

The obtained probability is

$$\frac{20}{53},$$

which corresponds to Option (C).

Conclusion:

$$\frac{20}{53}$$

Quick Tip: For a random selection problem,

$$P(E) = \frac{\text{Favourable Outcomes}}{\text{Total Outcomes}}.$$

Always include every member of the group in the denominator.

77. Three cards are drawn successively without replacement from a pack of 52 well shuffled cards. What is the probability that first two cards are kings and the third card drawn is an ace?

- (A) $\frac{4}{52}$
- (B) $\frac{3}{51}$
- (C) $\frac{4}{50}$
- (D) $\frac{2}{5525}$

Correct Answer: (D) $\frac{2}{5525}$

Solution:

Step 1: Find the probability that the first card is a king.

$$P(K_1) = \frac{4}{52}.$$

Step 2: Find the probability that the second card is also a king.

After one king is removed,

$$P(K_2|K_1) = \frac{3}{51}.$$

Step 3: Find the probability that the third card is an ace.

After two kings have been removed, there are still four aces among fifty cards.

$$P(A_3|K_1 \cap K_2) = \frac{4}{50}.$$

Step 4: Multiply the probabilities.

$$P = \frac{4}{52} \times \frac{3}{51} \times \frac{4}{50}.$$

$$= \frac{1}{13} \times \frac{1}{17} \times \frac{2}{25}.$$

$$= \frac{2}{13 \times 17 \times 25}.$$

$$= \frac{2}{5525}.$$

Conclusion:

$$\frac{2}{5525}$$

Quick Tip: For draws without replacement, update both the numerator and denominator after every draw because the sample space changes.

78. A man is known to speak truth 3 out of 4 times. He throws a die and reports that it is a six. Find the probability that it is actually six.

- (A) $\frac{1}{8}$
- (B) $\frac{2}{8}$
- (C) $\frac{3}{8}$
- (D) $\frac{1}{2}$

Correct Answer: (C) $\frac{3}{8}$

Solution:

Step 1: Find the prior probabilities.

Since the die is fair,

$$P(E) = \frac{1}{6}, \quad P(E') = \frac{5}{6}.$$

Step 2: Find the truth and lie probabilities.

The man speaks truth with probability

$$\frac{3}{4}.$$

Hence,

$$P(A|E) = \frac{3}{4}.$$

Therefore,

$$P(A|E') = \frac{1}{4}.$$

Step 3: Apply Bayes' Theorem.

$$\begin{aligned}
 P(E|A) &= \frac{\frac{1}{6} \cdot \frac{3}{4}}{\frac{1}{6} \cdot \frac{3}{4} + \frac{5}{6} \cdot \frac{1}{4}} \\
 &= \frac{\frac{3}{24}}{\frac{3}{24} + \frac{5}{24}} \\
 &= \frac{3}{8}
 \end{aligned}$$

Conclusion:

$$\frac{3}{8}$$

Quick Tip: Whenever information is reported by a person whose statements may be true or false, Bayes' Theorem is usually the correct approach.

79. The variance of 25 observations is 6. If each observation is multiplied by 3, then the new variance of the resulting observations is

- (A) 56
- (B) 50
- (C) 54
- (D) 36

Correct Answer: (C) 54

Solution:

Step 1: Identify the given values.

$$\text{Old Variance} = 6, \quad k = 3.$$

Step 2: Apply the variance transformation formula.

$$\text{New Variance} = 3^2 \times 6.$$

$$= 9 \times 6.$$

$$= 54.$$

Conclusion:

$$54$$

Quick Tip: Adding or subtracting a constant does not change variance. Multiplying by k changes variance by a factor of k^2 .

80. A committee of two persons is selected from two men and two women. What is the probability that the committee will have one man?

- (A) $\frac{1}{3}$
- (B) $\frac{2}{3}$
- (C) 1
- (D) $\frac{4}{3}$

Correct Answer: (B) $\frac{2}{3}$

Solution:

Step 1: Find the total number of committees.

There are

$$2 + 2 = 4$$

people.

The number of ways to choose a committee of two persons is

$${}^4C_2 = \frac{4!}{2!2!} = 6.$$

Thus,

$$n(S) = 6.$$

Step 2: Find the number of favourable committees.

The committee must contain exactly one man.

Choose

1

man from

2

men:

$${}^2C_1 = 2.$$

Choose

1

woman from

2

women:

$${}^2C_1 = 2.$$

Therefore,

$$n(E) = {}^2C_1 \times {}^2C_1 = 2 \times 2 = 4.$$

Step 3: Compute the probability.

$$P(E) = \frac{4}{6} = \frac{2}{3}.$$

Conclusion:

Hence, the probability that the committee contains exactly one man is

$$\frac{2}{3}.$$

Quick Tip: For committee-selection problems, use combinations because the order of selection is irrelevant. Always count favourable committees and total committees separately before computing probability.

81. The Boolean expressions

$$(AB)' = A' + B'$$

and

$$(A + B)' = A'B'$$

represent

- (A) Absorption law
- (B) Distributive law
- (C) De Morgan's law
- (D) Idempotent law

Correct Answer: (C) De Morgan's law

Solution:

Step 1: Examine the first Boolean expression.

The first expression is

$$(AB)' = A' + B'.$$

This states that the complement of the AND operation equals the OR operation of the individual

complements.

In words,

$$\text{NOT}(A \text{ AND } B) = (\text{NOT } A) \text{ OR } (\text{NOT } B).$$

Step 2: Examine the second Boolean expression.

The second expression is

$$(A + B)' = A'B'.$$

This states that the complement of the OR operation equals the AND operation of the individual complements.

In words,

$$\text{NOT}(A \text{ OR } B) = (\text{NOT } A) \text{ AND } (\text{NOT } B).$$

Step 3: Identify the Boolean law represented.

Both identities together form the pair of statements known as De Morgan's Laws.

These laws are widely used for simplifying logical circuits and converting between NAND and NOR implementations.

Conclusion:

Therefore, the given Boolean expressions represent

De Morgan's Law.

Quick Tip: Remember De Morgan's Laws:

$$(AB)' = A' + B'$$

and

$$(A + B)' = A'B'.$$

A useful memory trick is:

When the complement enters the bracket, the operation changes from AND to OR or from OR to AND.

82. Match List-I with List-II.

Match List-I with List-II.	
List - I	List - II
(a) $\sin (\pi/3)$	(i) $\frac{1}{\sqrt{2}}$
(b) $\sin (\pi/4)$	(ii) $\frac{1}{2}$
(c) $\sin (\pi/6)$	(iii) $\frac{\sqrt{3}}{2}$
(d) $\sin (\pi/2)$	(iv) 1

Codes:

- (A) a - iii, b - i, c - ii, d - iv
- (B) a - iv, b - ii, c - i, d - iii
- (C) a - iii, b - ii, c - i, d - iv
- (D) a - iv, b - ii, c - iii, d - i

Correct Answer: (A) a - iii, b - i, c - ii, d - iv

Solution:

Step 1: Evaluate $\sin(\pi/3)$.

$$\sin\left(\frac{\pi}{3}\right) = \sin 60^\circ = \frac{\sqrt{3}}{2}.$$

Thus,

$$(a) \rightarrow (iii).$$

Step 2: Evaluate $\sin(\pi/4)$.

$$\sin\left(\frac{\pi}{4}\right) = \sin 45^\circ = \frac{1}{\sqrt{2}}.$$

Thus,

$$(b) \rightarrow (i).$$

Step 3: Evaluate $\sin(\pi/6)$.

$$\sin\left(\frac{\pi}{6}\right) = \sin 30^\circ = \frac{1}{2}.$$

Thus,

$$(c) \rightarrow (ii).$$

Step 4: Evaluate $\sin(\pi/2)$.

$$\sin\left(\frac{\pi}{2}\right) = \sin 90^\circ = 1.$$

Thus,

$$(d) \rightarrow (iv).$$

Conclusion:

The correct matching is

$$a - iii, \quad b - i, \quad c - ii, \quad d - iv.$$

Hence the correct option is

(A).

Quick Tip: The four most important sine values are

$$\sin 0^\circ = 0, \quad \sin 30^\circ = \frac{1}{2}, \quad \sin 45^\circ = \frac{1}{\sqrt{2}}, \quad \sin 60^\circ = \frac{\sqrt{3}}{2}, \quad \sin 90^\circ = 1.$$

These values appear frequently in competitive examinations.

83. The general solution of

$$2 \cos \theta - \sqrt{3} = 0$$

is

(A) $\theta = n\pi + (-1)^n \frac{\pi}{6}, n \in \mathbb{Z}$

(B) $\theta = 2n\pi \pm \frac{\pi}{6}, n \in \mathbb{Z}$

(C) $\theta = 2n\pi \pm \frac{\pi}{3}, n \in \mathbb{Z}$

(D) $\theta = n\pi + (-1)^n \frac{\pi}{3}, n \in \mathbb{Z}$

Correct Answer: (B) $\theta = 2n\pi \pm \frac{\pi}{6}, n \in \mathbb{Z}$

Solution:

Step 1: Simplify the equation.

Given,

$$2 \cos \theta - \sqrt{3} = 0.$$

Adding $\sqrt{3}$ to both sides gives

$$2 \cos \theta = \sqrt{3}.$$

Dividing by 2,

$$\cos \theta = \frac{\sqrt{3}}{2}.$$

Step 2: Find the principal angle.

We know that

$$\cos \frac{\pi}{6} = \frac{\sqrt{3}}{2}.$$

Therefore,

$$\alpha = \frac{\pi}{6}.$$

Step 3: Write the general solution.

Using

$$\theta = 2n\pi \pm \alpha,$$

we obtain

$$\theta = 2n\pi \pm \frac{\pi}{6}, \quad n \in \mathbb{Z}.$$

Conclusion:

Hence,

$$\theta = 2n\pi \pm \frac{\pi}{6}, \quad n \in \mathbb{Z}.$$

Quick Tip: Remember:

$$\cos \theta = \cos \alpha \Rightarrow \theta = 2n\pi \pm \alpha.$$

$$\sin \theta = \sin \alpha \Rightarrow \theta = n\pi + (-1)^n \alpha.$$

Students often interchange these two formulas.

84. In a right angled isosceles triangle $\triangle ABC$, right angle at C , if side $a = 2$, then sides b and c are respectively

- (A) $2\sqrt{2}, 2$
- (B) $\sqrt{2}, 2$
- (C) $2, \sqrt{2}$
- (D) $2, 2\sqrt{2}$

Correct Answer: (D) $2, 2\sqrt{2}$

Solution:

Step 1: Use the property of an isosceles right triangle.

Since the triangle is isosceles and right-angled at C ,

$$a = b.$$

Given,

$$a = 2.$$

Therefore,

$$b = 2.$$

Step 2: Apply the Pythagorean theorem.

For a right triangle,

$$c^2 = a^2 + b^2.$$

Substituting $a = 2$ and $b = 2$,

$$c^2 = 2^2 + 2^2.$$

$$c^2 = 4 + 4 = 8.$$

Step 3: Calculate the hypotenuse.

Taking square roots on both sides,

$$c = \sqrt{8} = \sqrt{4 \times 2} = 2\sqrt{2}.$$

Step 4: Write the values of b and c .

We obtained

$$b = 2$$

and

$$c = 2\sqrt{2}.$$

Conclusion:

Hence, the values of b and c respectively are

$$2, 2\sqrt{2}.$$

Therefore, the correct option is

$$(D).$$

Quick Tip: In a $45^\circ - 45^\circ - 90^\circ$ triangle,

$$\text{Hypotenuse} = (\text{Leg})\sqrt{2}.$$

If each equal side is a , then the hypotenuse is always $a\sqrt{2}$.

85.

$$\tan^{-1}(1) + \cos^{-1}\left(-\frac{1}{2}\right) + \sin^{-1}\left(-\frac{1}{2}\right) =$$

(A) $\frac{\pi}{4}$

(B) $\frac{\pi}{2}$

(C) $\frac{3\pi}{4}$

(D) $\frac{3\pi}{2}$

Correct Answer: (C) $\frac{3\pi}{4}$

Solution:

Step 1: Apply the inverse trigonometric identity.

Using

$$\sin^{-1}(x) + \cos^{-1}(x) = \frac{\pi}{2},$$

with

$$x = -\frac{1}{2},$$

we obtain

$$\cos^{-1}\left(-\frac{1}{2}\right) + \sin^{-1}\left(-\frac{1}{2}\right) = \frac{\pi}{2}.$$

Step 2: Evaluate $\tan^{-1}(1)$.

We know that

$$\tan\left(\frac{\pi}{4}\right) = 1.$$

Therefore,

$$\tan^{-1}(1) = \frac{\pi}{4}.$$

Step 3: Add the obtained values.

$$\frac{\pi}{4} + \frac{\pi}{2} = \frac{\pi}{4} + \frac{2\pi}{4} = \frac{3\pi}{4}.$$

Step 4: Verification.

$$\cos^{-1}\left(-\frac{1}{2}\right) = \frac{2\pi}{3}, \quad \sin^{-1}\left(-\frac{1}{2}\right) = -\frac{\pi}{6}.$$

Hence,

$$\frac{2\pi}{3} - \frac{\pi}{6} = \frac{\pi}{2},$$

which confirms the result.

Conclusion:

Therefore,

$$\tan^{-1}(1) + \cos^{-1}\left(-\frac{1}{2}\right) + \sin^{-1}\left(-\frac{1}{2}\right) = \frac{3\pi}{4}.$$

Hence, the correct option is

(C).

Quick Tip: Always remember:

$$\sin^{-1}(x) + \cos^{-1}(x) = \frac{\pi}{2}.$$

This identity frequently appears in objective questions involving inverse trigonometric functions.

86. Two dice are thrown and the sum of the numbers which come up on the dice is noted. Among the following events:

- A: The sum is even.
- B: The sum is a multiple of 3.
- C: The sum is less than 4.
- D: The sum is greater than 11.

Which pair of events are mutually exclusive?

- (A) A and B
- (B) A and C
- (C) C and D
- (D) B and D

Correct Answer: (C) C and D

Solution:

Step 1: Determine the possible sums obtained from two dice.

When two dice are thrown, the smallest possible sum is

$$1 + 1 = 2,$$

and the largest possible sum is

$$6 + 6 = 12.$$

Hence the possible sums are

$$\{2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12\}.$$

Step 2: Write the outcomes corresponding to each event.

Event A:

$$A = \{2, 4, 6, 8, 10, 12\}.$$

Event B:

$$B = \{3, 6, 9, 12\}.$$

Event C:

$$C = \{2, 3\}.$$

Event D:

$$D = \{12\}.$$

Step 3: Check option (A): A and B.

$$A \cap B = \{6, 12\}.$$

Hence they are not mutually exclusive.

Step 4: Check option (B): A and C.

$$A \cap C = \{2\}.$$

Hence they are not mutually exclusive.

Step 5: Check option (C): C and D.

$$C = \{2, 3\}, \quad D = \{12\}.$$

$$C \cap D = \emptyset.$$

Therefore, these events are mutually exclusive.

Step 6: Check option (D): B and D.

$$B \cap D = \{12\}.$$

Hence they are not mutually exclusive.

Therefore,

C and D

is the correct answer.

Quick Tip: To test whether two events are mutually exclusive, find their intersection.

If

$$A \cap B = \emptyset,$$

then the events are mutually exclusive.

87. The average of 5 numbers is 27. If one number is excluded, the average becomes 25. The excluded number is:

- (A) 30
- (B) 35
- (C) 45

(D) 25

Correct Answer: (B) 35

Solution:

Step 1: Calculate the sum of the 5 numbers.

$$27 \times 5 = 135.$$

Step 2: Calculate the sum of the remaining 4 numbers.

$$25 \times 4 = 100.$$

Step 3: Find the excluded number.

$$135 - 100 = 35.$$

Therefore,

$$35$$

is the excluded number.

Quick Tip: Whenever average and number of observations are given, first convert them into total sums using

$$\text{Sum} = \text{Average} \times \text{Number of Observations}.$$

Then compare the sums to obtain the missing value.

88. If the mean of the distribution is 5, then the value of P is:

x_i	2	4	6	P	10
f_i	3	2	1	4	2

(A) 7

- (B) 5
(C) 8
(D) 4

Correct Answer: (B) 5

Solution:

Step 1: Calculate $\sum f_i x_i$.

$$\sum f_i x_i = (3 \times 2) + (2 \times 4) + (1 \times 6) + (4 \times P) + (2 \times 10)$$

$$= 6 + 8 + 6 + 4P + 20 = 40 + 4P.$$

Step 2: Calculate total frequency.

$$\sum f_i = 3 + 2 + 1 + 4 + 2 = 12.$$

Step 3: Use the given mean.

$$5 = \frac{40 + 4P}{12}.$$

$$60 = 40 + 4P.$$

$$20 = 4P.$$

$$P = 5.$$

Therefore,

$$P = 5.$$

Quick Tip: For a discrete frequency distribution,

$$\bar{x} = \frac{\sum f_i x_i}{\sum f_i}.$$

First compute $\sum f_i x_i$, then substitute the given mean to find the unknown value.

89. The arithmetic mean of $1, 2, 3, \dots, n$ is:

- (A) $\frac{n+1}{2}$
- (B) $\frac{n-1}{2}$
- (C) $\frac{n}{2}$
- (D) $\frac{2n+1}{2}$

Correct Answer: (A) $\frac{n+1}{2}$

Solution:

Step 1: Find the sum of the first n natural numbers.

$$S_n = 1 + 2 + 3 + \dots + n = \frac{n(n+1)}{2}.$$

Step 2: Apply the mean formula.

Since there are n numbers,

$$\text{Mean} = \frac{S_n}{n} = \frac{\frac{n(n+1)}{2}}{n}.$$

Cancelling n ,

$$\text{Mean} = \frac{n+1}{2}.$$

Conclusion:

$$\frac{n+1}{2}$$

Hence, the correct answer is Option (A).

Quick Tip: For any arithmetic progression,

$$\text{Mean} = \frac{\text{First Term} + \text{Last Term}}{2}.$$

Thus,

$$\frac{1+n}{2} = \frac{n+1}{2}.$$

90. The algebraic sum of the deviations of a set of n values from their arithmetic mean is:

- (A) n
- (B) 0
- (C) $2n$
- (D) None of these

Correct Answer: (B) 0

Solution:

Step 1: Write the sum of deviations.

$$\sum_{i=1}^n (x_i - \bar{x}).$$

Step 2: Separate the summation.

$$\sum_{i=1}^n x_i - \sum_{i=1}^n \bar{x}.$$

Since $\bar{x}$ is constant,

$$\sum_{i=1}^n \bar{x} = n\bar{x}.$$

Therefore,

$$\sum_{i=1}^n (x_i - \bar{x}) = \sum_{i=1}^n x_i - n\bar{x}.$$

Step 3: Use the definition of mean.

Since

$$\bar{x} = \frac{\sum x_i}{n},$$

we have

$$n\bar{x} = \sum x_i.$$

Hence,

$$\sum_{i=1}^n (x_i - \bar{x}) = \sum x_i - \sum x_i = 0.$$

Conclusion:

$$0$$

Hence, the algebraic sum of deviations from the arithmetic mean is always zero.

Quick Tip: Remember the important identity:

$$\sum (x - \bar{x}) = 0.$$

This property is one of the most important properties of the arithmetic mean.

91. If the first quartile is 142 and the semi-interquartile range is 18, then the third quartile is:

- (A) 160
- (B) 124
- (C) 178
- (D) 151

Correct Answer: (C) 178

Solution:

Step 1: Use the given information.

Given,

$$Q_1 = 142$$

and

$$\frac{Q_3 - Q_1}{2} = 18.$$

Therefore,

$$\frac{Q_3 - 142}{2} = 18.$$

Step 2: Solve for Q_3 .

Multiplying by 2,

$$Q_3 - 142 = 36.$$

Adding 142 to both sides,

$$Q_3 = 178.$$

Conclusion:

$$178$$

Hence, the correct answer is Option (C).

Quick Tip: Use

$$Q_3 = Q_1 + 2(\text{Quartile Deviation}).$$

Thus,

$$Q_3 = 142 + 2(18) = 178.$$

92. The average of squared deviations from mean is called:

- (A) Mean Deviation
- (B) Variance
- (C) Standard Deviation
- (D) Coefficient of Variation

Correct Answer: (B) Variance

Solution:

Step 1: Determine the quantity described in the question.

A deviation from the mean is

$$x_i - \bar{x}.$$

Its square is

$$(x_i - \bar{x})^2.$$

Taking the average of all such squared deviations gives

$$\frac{1}{n} \sum_{i=1}^n (x_i - \bar{x})^2.$$

Step 2: Identify the statistical term.

The above expression is exactly the definition of variance.

Conclusion:

Variance

Hence, the correct answer is Option (B).

Quick Tip: Variance is measured in squared units.

Standard deviation is the positive square root of variance:

$$\sigma = \sqrt{\sigma^2}.$$

93. The relation between mean, median and mode for a moderately asymmetrical distribution is:

- (A) $\text{Mode} = 3\text{Median} - 2\text{Mean}$
- (B) $\text{Mode} = 3\text{Mean} - 2\text{Median}$
- (C) $\text{Median} = 3\text{Mode} - 2\text{Mean}$
- (D) $\text{Mean} = 3\text{Median} - 2\text{Mode}$

Correct Answer: (A) $\text{Mode} = 3\text{Median} - 2\text{Mean}$

Solution:

Step 1: Expand the right-hand side.

$$\text{Mean} - \text{Mode} = 3\text{Mean} - 3\text{Median}.$$

Step 2: Rearrange the equation.

$$-\text{Mode} = 2\text{Mean} - 3\text{Median}.$$

Multiplying by -1 ,

$$\text{Mode} = 3\text{Median} - 2\text{Mean}.$$

Conclusion:

$$\text{Mode} = 3\text{Median} - 2\text{Mean}$$

Hence, the correct answer is Option (A).

Quick Tip: Remember Karl Pearson's empirical relation:

$$\text{Mode} = 3\text{Median} - 2\text{Mean}.$$

It is valid for moderately skewed distributions.

94. If an event cannot occur, then its probability is:

- (A) 1
- (B) $\frac{4}{3}$
- (C) $\frac{1}{2}$
- (D) 0

Correct Answer: (D) 0

Solution:

Step 1: Identify the type of event.

The event described in the question cannot occur.

Therefore, it is an impossible event.

Step 2: Apply the probability rule.

For an impossible event,

$$P(\emptyset) = 0.$$

Hence,

$$P(E) = 0.$$

Conclusion:

$$0$$

Hence, the correct answer is Option (D).

Quick Tip: A certain event has probability 1, while an impossible event has probability 0.

95. An experiment succeeds twice as often as it fails. The probability of success in the next trial is:

- (A) $\frac{1}{3}$

- (B) $\frac{2}{3}$
(C) 1
(D) 0

Correct Answer: (B) $\frac{2}{3}$

Solution:

Step 1: Translate the given condition.

The experiment succeeds twice as often as it fails.

Therefore,

$$p = 2q.$$

Step 2: Use the complementary relation.

Substituting $p = 2q$ into

$$p + q = 1,$$

we obtain

$$2q + q = 1.$$

$$3q = 1.$$

$$q = \frac{1}{3}.$$

Step 3: Find the probability of success.

$$p = 2q = 2\left(\frac{1}{3}\right) = \frac{2}{3}.$$

Conclusion:

$$\frac{2}{3}$$

Hence, the correct answer is Option (B).

Quick Tip: If the ratio of success to failure is $m : n$, then

$$P(\text{Success}) = \frac{m}{m+n}.$$

For ratio 2 : 1,

$$P(\text{Success}) = \frac{2}{3}.$$

96. If $P(A) = 0.8$, $P(B) = 0.5$ and $P(B|A) = 0.4$, then the value of $P(A|B)$ is:

- (A) 0.32
- (B) 0.64
- (C) 0.16
- (D) 0.25

Correct Answer: (B) 0.64

Solution:

Step 1: Find $P(A \cap B)$.

Given,

$$P(A) = 0.8, \quad P(B|A) = 0.4.$$

Therefore,

$$P(A \cap B) = 0.8 \times 0.4 = 0.32.$$

Step 2: Calculate $P(A|B)$.

Using

$$P(A|B) = \frac{P(A \cap B)}{P(B)},$$

we get

$$P(A|B) = \frac{0.32}{0.5} = 0.64.$$

Conclusion:

$$0.64$$

Hence, the correct answer is Option (B).

Quick Tip: A useful relation is

$$P(A|B) = \frac{P(A)P(B|A)}{P(B)}.$$

This is the basic form used in Bayes' theorem.

97. If the mode of a distribution is 18 and the mean is 24, then the median is:

- (A) 18
- (B) 24
- (C) 22
- (D) 21

Correct Answer: (C) 22

Solution:

Step 1: Write the empirical relation.

$$\text{Mode} = 3(\text{Median}) - 2(\text{Mean}).$$

Given

$$\text{Mode} = 18, \quad \text{Mean} = 24.$$

Substituting the values,

$$18 = 3(\text{Median}) - 2(24).$$

Step 2: Simplify the equation.

$$18 = 3(\text{Median}) - 48.$$

Adding 48 to both sides,

$$66 = 3(\text{Median}).$$

Step 3: Find the median.

$$\text{Median} = \frac{66}{3} = 22.$$

Conclusion:

22

Hence, the correct answer is Option (C).

Quick Tip: Remember Karl Pearson's empirical relation:

$$\text{Mode} = 3\text{Median} - 2\text{Mean}.$$

It is applicable for moderately skewed distributions.

98. The range of the data 12, 25, 15, 18, 35, 11, 45, 33, 22, 10 is:

- (A) 10
- (B) 45
- (C) 35
- (D) 11

Correct Answer: (C) 35

Solution:

Step 1: Identify the maximum value.

Given data:

12, 25, 15, 18, 35, 11, 45, 33, 22, 10.

The largest value is

45.

Step 2: Identify the minimum value.

The smallest value is

10.

Step 3: Calculate the range.

$$\text{Range} = 45 - 10 = 35.$$

Conclusion:

35

Hence, the correct answer is Option (C).

Quick Tip: Range depends only on the largest and smallest observations. Intermediate values do not affect the range.

99. The standard deviation of a distribution is 5. If each observation is increased by 2, then the new standard deviation will be:

- (A) 5
- (B) 7
- (C) 3

(D) 10

Correct Answer: (A) 5

Solution:

Step 1: Determine the given information.

Original standard deviation:

$$\sigma = 5.$$

Each observation is increased by

$$2.$$

Step 2: Apply the property of standard deviation.

Since adding a constant does not affect dispersion,

$$\text{New Standard Deviation} = \text{Old Standard Deviation}.$$

Therefore,

$$\sigma_{\text{new}} = 5.$$

Conclusion:

$$5$$

Hence, the correct answer is Option (A).

Quick Tip: Adding or subtracting a constant changes only the mean.

Multiplying every observation by a constant k changes the standard deviation to

$$|k|\sigma.$$

100. For a symmetrical distribution:

- (A) Mean > Median > Mode
- (B) Mean < Median < Mode
- (C) Mean = Median = Mode
- (D) None of these

Correct Answer: (C) Mean = Median = Mode

Solution:

Step 1: Understand the position of the mean.

The arithmetic mean lies at the balancing point of the distribution.

Step 2: Understand the position of the median.

The median divides the distribution into two equal halves.

In a symmetrical distribution, this point coincides with the center.

Step 3: Understand the position of the mode.

The mode is the value with maximum frequency.

For a symmetrical distribution, the peak occurs exactly at the center.

Step 4: Compare all three measures.

Since all three occupy the same central position,

$$\text{Mean} = \text{Median} = \text{Mode}.$$

Hence Option (C) is correct.

Conclusion:

$$\text{Mean} = \text{Median} = \text{Mode}$$

Therefore, the correct answer is Option (C).

Quick Tip: For distributions:

Symmetric $\Rightarrow$ Mean = Median = Mode

Positively Skewed $\Rightarrow$ Mean > Median > Mode

Negatively Skewed $\Rightarrow$ Mean < Median < Mode