

# SNAP 2023 Question Paper with Solutions

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| Time Allowed :2 Hours | Maximum Marks :60 | Total Questions :60 |
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## General Instructions

1. SNAP 2023 is a **Computer-Based Test (CBT)** of **60 minutes**.
2. The test comprises **60 multiple-choice questions** across three sections: General English (15), Analytical & Logical Reasoning (25), and Quantitative, Data Interpretation & Data Sufficiency (20).
3. **Marking Scheme:** +1 mark for each correct answer; **-0.25 mark** for each incorrect answer.
4. There is **no sectional time limit**. Manage your time wisely.
5. Carry a **colour printout** of your **SNAP 2023 Admit Card** with a recent passport-size colour photo pasted in the space provided.
6. Bring a valid, **original government photo ID** (e.g., Aadhaar, Passport, PAN, Driving Licence).
7. You may carry a **simple black/blue ball point pen** (for attendance/rough work as instructed).
8. **Reporting time** and test session are as mentioned on your admit card; late entry may not be permitted.
9. Only the Admit Card, valid Photo ID and a simple ball pen are allowed at your workstation. **Electronic gadgets** (mobile phones, smart watches, calculators, digital devices, etc.) are **strictly prohibited**.

## VERBAL ABILITY

**1. The given sentence is in active/passive voice. Change the voice of the sentence. Select the correct option from the sentence below.**

**She has preserved all the old letters of her dead lover.**

- (A) All the old letters of her dead lover have been preserved by her.
- (B) All the old letters of her dead lover has been preserved by her.
- (C) All the old letters have been preserved.
- (D) The letters of her old lover have been preserved.

**Correct Answer:** (A) All the old letters of her dead lover have been preserved by her.

**Solution:**

### **Step 1: Understanding the Concept:**

The voice of a verb indicates the relationship between the action and the participants (subject, object).

- **Active Voice:** The subject of the sentence performs the action. The focus is on the doer.

Example: "The cat chased the mouse." (Focus is on the cat).

- **Passive Voice:** The subject of the sentence receives the action. The focus is on the action or the recipient of the action.

Example: "The mouse was chased by the cat." (Focus is on the mouse).

The task is to convert the given active sentence into its passive form, which involves shifting the focus from the doer ("She") to the recipient of the action ("all the old letters...").

### **Step 2: Key Formula or Approach:**

To convert a sentence from active to passive voice, especially in the Present Perfect Tense, we follow a specific structural change:

- **Active Structure (Present Perfect):** Subject + has/have + Past Participle (V3) + Object.

*Sentence:* "She (Subject) + has + preserved (V3) + all the old letters of her dead lover (Object)."

- **Passive Structure (Present Perfect):** New Subject (Old Object) + has/have + been + Past Participle (V3) + by + New Object (Old Subject).

### **Step 3: Detailed Explanation:**

#### **1. Identify the components of the active sentence:**

- **Subject (Doer):** She
- **Verb Phrase:** has preserved
- **Object (Recipient):** all the old letters of her dead lover

#### **2. Swap the Subject and Object:**

- The object, "all the old letters of her dead lover," becomes the new subject of the passive sentence.
- The subject, "She," becomes the agent, introduced by the word "by." The pronoun "She" changes to its object form, "her." So, it becomes "by her."

#### **3. Convert the Verb Phrase:**

- The verb is in the present perfect tense ("has preserved").
- The passive form requires adding "been" after "has" or "have".
- The new subject is "all the old letters," which is plural. Therefore, we must use the plural auxiliary verb "have" instead of "has."
- The verb phrase transforms from "has preserved" to "have been preserved."

#### **4. Assemble the final passive sentence:**

(New Subject) + (New Verb Phrase) + (Agent)

"All the old letters of her dead lover" + "have been preserved" + "by her."

**5. Evaluate the given options:**

- **(A) All the old letters of her dead lover have been preserved by her.** - This perfectly matches our derived sentence.

- **(B) All the old letters of her dead lover has been preserved by her.** - This is incorrect. It uses "has," which is a singular verb, with the plural subject "letters." This is a subject-verb agreement error.

- **(C) All the old letters have been preserved.** - This is grammatically correct but incomplete. By omitting the agent ("by her"), it loses important information from the original sentence.

- **(D) The letters of her old lover have been preserved.** - This is incorrect because it omits the crucial words "all the old," which changes the scope and meaning of the original sentence.

**Step 4: Final Answer:**

The sentence that correctly and completely converts the active sentence to the passive voice while maintaining the original tense and meaning is "All the old letters of her dead lover have been preserved by her." Therefore, option (A) is the correct answer.

**💡 Quick Tip**

When converting to passive voice, follow a three-step check: 1) Make the object the new subject. 2) Change the verb form (for present perfect, use 'has/have been + V3'). 3) Ensure the new auxiliary verb ('has' or 'have') agrees in number with the new subject.

**2. Identify the figure of speech in the following sentence: "The stars danced in the night sky."**

(A) Simile

(B) Metaphor

(C) Personification

(D) Hyperbole

**Correct Answer:** (C) Personification

**Solution:**

**Step 1: Understanding the Concept:**

A figure of speech is a literary device that uses language in a non-literal way to create a more powerful or vivid image. Let's review the definitions of the options with examples:

- **Simile:** A comparison of two unlike things using "like" or "as." (e.g., "He is as brave as a lion.")

- **Metaphor:** A direct comparison stating one thing *is* another, without using "like" or "as." (e.g., "Life is a journey.")

- **Personification:** Giving human attributes, actions, or feelings to inanimate objects or abstract ideas. (e.g., "The angry storm pounded the shoreline.")

- **Hyperbole:** A deliberate and obvious exaggeration for effect. (e.g., "I've told you a million times.")

**Step 2: Applying the Concepts to the Sentence:**

1. **Analyze the sentence:** "The stars danced in the night sky."

2. **Identify the core elements:**

- **Subject:** The stars (inanimate, non-human objects).

- **Action (Verb):** danced (a human action that requires intent, rhythm, and life).

3. **Evaluate the relationship:** The sentence assigns a distinctly human action (dancing) to non-human objects (stars). This act of giving life-like qualities to something lifeless is the definition of personification. The author uses this to create a beautiful and dynamic image of twinkling stars, making them seem alive and joyful.

4. **Eliminate other options:**

- It is not a **simile** because there is no "like" or "as." A simile would be, "The stars twinkled *like* little dancers."

- It is not a **metaphor**. A metaphor might be, "The stars *are* dancers on the stage of night." The given sentence doesn't say the stars *are* dancers; it says they *are performing the act of* dancing.

- It is not a **hyperbole**. The statement isn't an extreme exaggeration; it's a descriptive, figurative one. A hyperbole might be, "The stars burned brighter than a thousand suns."

**Step 3: Final Answer:**

By attributing the human action of dancing to the inanimate stars, the sentence employs personification to create a vivid mental picture. Therefore, option (C) is the correct answer.

 **Quick Tip**

To spot personification, look for a verb that suggests consciousness, emotion, or physical action that an object cannot literally perform. If an object is "singing," "weeping," "shouting," or "dancing," it's likely personification.

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**3. Identify the type of clause in the sentence:** "Although she tried her best, she couldn't win the competition."

(A) Independent clause

(B) Dependent clause

(C) Subordinate clause

(D) Main clause

**Correct Answer:** (C) Subordinate clause

**Solution:**

**Step 1: Understanding the Concept:**

A clause is a group of words with a subject and a verb. Sentences are built from clauses.

- **Independent Clause (or Main Clause):** This is a complete thought that can stand alone as a sentence. It is the core of the sentence.

- **Dependent Clause:** This is an incomplete thought that cannot stand alone. It relies on an independent clause to make sense.

- **Subordinate Clause:** This is a specific type of dependent clause that is introduced by a subordinating conjunction (e.g., ‘although’, ‘because’, ‘since’, ‘if’, ‘while’). It provides additional information about the main clause, such as cause, condition, or contrast. For most purposes, “dependent” and “subordinate” are used interchangeably, but “subordinate” is more precise when a subordinating conjunction is present.

**Step 2: Detailed Explanation:**

**1. Break down the sentence into its two parts:**

- Part 1: “Although she tried her best”
- Part 2: “she couldn’t win the competition”

**2. Analyze Part 1: “Although she tried her best”**

- **Identify the “linker” word:** This clause begins with “Although,” which is a subordinating conjunction. This word’s function is to connect this clause to another one while showing a relationship of contrast.

- **Perform the “Stand-Alone Test”:** If you read “Although she tried her best” by itself, it feels unfinished. It leaves the listener waiting for the main point. What happened *although* she tried her best? Because it cannot stand alone, it is a dependent clause. Since it starts with a subordinating conjunction, the most accurate term is a **subordinate clause**.

**3. Analyze Part 2: “she couldn’t win the competition”**

- **Perform the “Stand-Alone Test”:** This part of the sentence expresses a complete thought. It has a subject (“she”) and a verb (“couldn’t win”) and can stand perfectly well on its own as a sentence. Therefore, this is the **independent (or main) clause**.

**4. Conclusion and Option Evaluation:**

The clause in question, “Although she tried her best,” is dependent on the main clause for its full meaning. Because it is introduced by the subordinating conjunction “Although,” it is best described as a subordinate clause. While it is a dependent clause (B), subordinate clause (C) is a more specific and descriptive term in this context, making it the better answer.

**Step 3: Final Answer:**

The clause “Although she tried her best” begins with a subordinating conjunction and does not express a complete thought, making it a subordinate clause. Option (C) is the correct answer.

 **Quick Tip**

Look for trigger words known as subordinating conjunctions at the beginning of a clause. Common ones include: ‘after’, ‘although’, ‘as’, ‘because’, ‘before’, ‘if’, ‘since’, ‘unless’, ‘until’, ‘when’, ‘while’. If a clause starts with one of these, it’s a subordinate clause.

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**4. Which of the following sentences cannot be converted into passive voice?**

- (A) “The chef prepared a delicious meal for the guests.”
- (B) “The committee will announce the results tomorrow.”
- (C) “She has already completed the assignment.”
- (D) “They built a new bridge across the river.”

**Correct Answer:** No correct option is provided.

## Solution:

### Step 1: Understanding the Concept:

A sentence can only be converted into the passive voice if its verb is **transitive**. A transitive verb is an action verb that has a **direct object**—a noun or pronoun that receives the action of the verb. An intransitive verb has no direct object and cannot be made passive. The reason is that the direct object of the active sentence must become the subject of the passive sentence. Without a direct object, this transformation is impossible.

- **Transitive Example:** "The student wrote *an essay*." (Can be passive: "An essay was written by the student.")

- **Intransitive Example:** "The student slept." (Cannot be passive because there is no object.)

### Step 2: Detailed Explanation:

We will test each sentence by identifying its verb and looking for a direct object. The direct object answers the question "What?" or "Whom?" after the verb.

1. **Sentence (A):** "The chef prepared a delicious meal for the guests."

- **Verb:** prepared

- **Ask:** Prepared what? → **a delicious meal**.

- **Conclusion:** "a delicious meal" is the direct object. The verb is transitive. Thus, it **can** be converted to passive voice. (Passive: "A delicious meal was prepared by the chef for the guests.")

2. **Sentence (B):** "The committee will announce the results tomorrow."

- **Verb:** will announce

- **Ask:** Will announce what? → **the results**.

- **Conclusion:** "the results" is the direct object. The verb is transitive. Thus, it **can** be converted to passive voice. (Passive: "The results will be announced by the committee tomorrow.")

3. **Sentence (C):** "She has already completed the assignment."

- **Verb:** has completed

- **Ask:** Has completed what? → **the assignment**.

- **Conclusion:** "the assignment" is the direct object. The verb is transitive. Thus, it **can** be converted to passive voice. (Passive: "The assignment has already been completed by her.")

4. **Sentence (D):** "They built a new bridge across the river."

- **Verb:** built

- **Ask:** Built what? → **a new bridge**.

- **Conclusion:** "a new bridge" is the direct object. The verb is transitive. Thus, it **can** be converted to passive voice. (Passive: "A new bridge was built by them across the river.")

### Step 3: Final Answer:

After analyzing all four sentences, we find that each one contains a transitive verb and a direct object. Consequently, all of them can be successfully converted into the passive voice. The question asks for the sentence that *cannot* be converted, but every option presented is convertible. This indicates that the question is flawed and does not have a correct answer among the choices.

### Quick Tip

A foolproof way to check if a sentence can be made passive is to find the main verb and ask the question "What?" or "Whom?" immediately after it. If a noun or pronoun in the sentence provides a logical answer, that is your direct object, and the sentence can be passivized. If there is no answer, it cannot.

#### 5. Select the compound word from the following options:

- (A) Elephant
- (B) Classroom
- (C) Jumping
- (D) Sunflower

**Correct Answer:** (B) Classroom and (D) Sunflower

#### **Solution:**

##### **Step 1: Understanding the Concept:**

A **compound word** is formed when two or more independent words are joined to create a new word with a new, specific meaning. It is not simply a word with a prefix or suffix attached; it must be a combination of standalone words.

For example, 'foot' + 'ball' = 'football'. Both 'foot' and 'ball' are words on their own, and 'football' has a distinct meaning.

##### **Step 2: Detailed Explanation:**

Let's analyze each option based on this definition:

- **(A) Elephant:** This is a single root word. It cannot be broken down into smaller, independent English words. Therefore, it is not a compound word.

- **(B) Classroom:** This word is a combination of two separate words:

**'class' (a standalone word) + 'room' (a standalone word) = 'classroom'.**

This perfectly fits the definition of a compound word.

- **(C) Jumping:** This word is formed from the base verb **'jump'** and the present participle suffix **'-ing'**. A suffix is a meaningful unit that attaches to the end of a word but is not a standalone word itself. Thus, "jumping" is a verb form, not a compound word.

- **(D) Sunflower:** This word is also a combination of two separate words:

**'sun' (a standalone word) + 'flower' (a standalone word) = 'sunflower'.**

This also fits the definition of a compound word.

##### **Step 3: Final Answer:**

Both option (B) "Classroom" and option (D) "Sunflower" are correct examples of compound words. Since both meet the criteria, the question is potentially flawed for an exam that expects only one correct answer. However, based on linguistic rules, both are valid compound words.

### 💡 Quick Tip

Compound words can appear in three forms: 1. **Closed:** Written as one word (e.g., 'doorknob', 'notebook'). 2. **Hyphenated:** Connected by a hyphen (e.g., 'state-of-the-art', 'mother-in-law'). 3. **Open:** Written as separate words but function as a single unit of meaning (e.g., 'post office', 'high school').

**6. Identify the adverb and adjective in the following sentence: "The cat quickly climbed the tall tree."**

- (A) Adverb: quickly; Adjective: tall
- (B) Adverb: cat; Adjective: tree
- (C) Adverb: climbed; Adjective: the
- (D) Adverb: the; Adjective: quickly

**Correct Answer:** (A) Adverb: quickly; Adjective: tall

**Solution:**

**Step 1: Understanding the Concept:**

- An **Adjective** is a describing word. Its job is to modify (describe) a noun or a pronoun. It answers questions such as: *What kind? How many? Which one? Whose?*

Example: "the *red* car" ('red' describes the noun 'car').

- An **Adverb** is also a describing word, but it modifies a verb, an adjective, or another adverb. It answers questions such as: *How? When? Where? Why? To what extent?*

Example: "She ran *quickly*." ('quickly' modifies the verb 'ran', telling us how she ran).

**Step 2: Detailed Explanation:**

Let's dissect the sentence: "The cat quickly climbed the tall tree."

**1. Find the Adjective:**

- First, identify the nouns in the sentence: "cat" and "tree".
- Now, check for any words that describe these nouns.
- The word "tall" is placed right before the noun "tree". It answers the question, "What kind of tree?" A tall tree.
- Therefore, **tall** is the adjective.

**2. Find the Adverb:**

- First, identify the main verb (action) in the sentence: "climbed".
- Now, check for any words that describe how this action was performed.
- The word "quickly" is placed near the verb "climbed". It answers the question, "How did the cat climb?" It climbed quickly.
- Therefore, **quickly** is the adverb.

**3. Review and Match:**

- Our analysis shows: Adverb = quickly, Adjective = tall.
- Let's check the options:
  - (A) Adverb: quickly; Adjective: tall - This matches our findings.
  - (B) "cat" and "tree" are nouns. Incorrect.
  - (C) "climbed" is a verb and "the" is an article. Incorrect.
  - (D) This option has the roles reversed. Incorrect.

**Step 3: Final Answer:**



In the sentence, "quickly" modifies the verb "climbed" and is the adverb, while "tall" modifies the noun "tree" and is the adjective. Option (A) correctly identifies both.

 Quick Tip

A simple method is to ask questions. To find the adjective, ask "What kind of...?" about the nouns. To find the adverb, ask "How...?" about the verb. Many adverbs that describe 'how' an action is done conveniently end in '-ly'.

**7. Which of the following prefixes when added to "Available" makes it an antonym?**

- (A) An
- (B) Un
- (C) In
- (D) Im

**Correct Answer:** (B) Un

**Solution:**

**Step 1: Understanding the Concept:**

An **antonym** is a word with the opposite meaning. Prefixes are groups of letters added to the beginning of a word to change its meaning. **Negative prefixes** are a specific type used to create antonyms. Common negative prefixes in English include 'un-', 'in-', 'im-', 'il-', 'ir-', and 'dis-'. The choice of which prefix to use is determined by the root word's origin and spelling. The word **Available** means that something is able to be used, obtained, or reached. We are looking for the prefix that means **not** available.

**Step 2: Detailed Explanation:**

Let's systematically test each prefix with the root word "available":

- **(A) An- + Available:** The word "anavailable" does not exist in the English language. The prefix 'an-' is rare and usually means 'without,' as in 'anemia' (without blood), but it does not apply here.

- **(B) Un- + Available:** The word "unavailable" is a well-established English word. It correctly means "not able to be used or obtained." The prefix 'un-' is one of the most common negative prefixes used with adjectives. This is a strong candidate.

Example: "The manager is currently *unavailable*."

- **(C) In- + Available:** The word "inavailable" is not a standard English word. While 'in-' is a common negative prefix (e.g., 'inactive', 'incomplete'), it is not the correct one for "available."

- **(D) Im- + Available:** The word "imavailable" is incorrect. The prefix 'im-' is a variant of 'in-' used before words that begin with 'm' or 'p' for ease of pronunciation (e.g., 'impossible', 'immature'). It is not applicable to "available," which starts with 'a'.

**Step 3: Final Answer:**

Based on the rules of English morphology and common usage, the correct prefix to form the antonym of "available" is "un-". The resulting word, "unavailable," is the standard term for "not available." Therefore, option (B) is the correct answer.

### 💡 Quick Tip

While there are many negative prefixes, 'un-' is the most productive and common one in English, especially for words of English (Germanic) origin. Prefixes like 'in-', 'im-', 'il-', 'ir-' are typically used with words of Latin origin and often follow spelling rules (e.g., 'ir-' before 'r', 'il-' before 'l').

## 8. Identify the countable and uncountable nouns in the following sentence:

**"There are two books on the shelf, and I need some advice."**

- (A) Countable: books; Uncountable: advice
- (B) Countable: two; Uncountable: shelf
- (C) Countable: need; Uncountable: some
- (D) Countable: I; Uncountable: on

**Correct Answer:** (A) Countable: books; Uncountable: advice

### Solution:

#### Step 1: Understanding the Concept:

Nouns can be classified based on whether they can be counted.

- **Countable Nouns:** These are nouns that refer to individual, separate items that can be counted. They have both singular and plural forms (e.g., book/books, car/cars) and can be preceded by numbers or articles like "a/an". We use "many" with countable nouns.

- **Uncountable Nouns (or Mass Nouns):** These are nouns that refer to substances, concepts, or abstract ideas that are not considered as individual units. They usually do not have a plural form and cannot be directly counted with numbers. We use "much" with uncountable nouns.

#### Step 2: Detailed Explanation:

Let's identify the nouns in the sentence and analyze them.

The nouns are: **books**, **shelf**, and **advice**.

##### 1. Analysis of "books":

The sentence itself says "two books," which explicitly counts the noun. We can say "one book," "two books," "three books," etc. Therefore, "books" is a **countable noun**.

##### 2. Analysis of "shelf":

A shelf can also be counted. We can say "one shelf," "two shelves," etc. So, "shelf" is also a **countable noun**.

##### 3. Analysis of "advice":

"Advice" is an abstract concept representing guidance or recommendations. We cannot say "one advice" or "two advices." To quantify it, we use phrases like "a piece of advice" or "some advice." We would ask "How much advice?" not "How many advices?". Therefore, "advice" is an **uncountable noun**.

#### Step 3: Evaluate the Options:

- **(A) Countable: books; Uncountable: advice** - This correctly identifies a countable noun ("books") and an uncountable noun ("advice") from the sentence.
- **(B) Countable: two; Uncountable: shelf** - "Two" is a number (an adjective in this context), not a noun. "Shelf" is countable, not uncountable. This is incorrect.

- (C) **Countable: need; Uncountable: some** - "Need" is a verb in this sentence. "Some" is a determiner (an adjective). This is incorrect.
- (D) **Countable: I; Uncountable: on** - "I" is a pronoun and "on" is a preposition. This is incorrect.

**Step 4: Final Answer:**

The option that correctly classifies one noun as countable and another as uncountable from the sentence is (A). "Books" is countable, and "advice" is uncountable.

 **Quick Tip**

A quick test: If you can put the word "many" before a noun (e.g., many books), it is countable. If you would use "much" (e.g., much advice), it is uncountable.

**9. Fill in the blank with the correct preposition: She is allergic ..... cats.**

- (A) in
- (B) with
- (C) at
- (D) to

**Correct Answer:** (D) to

**Solution:**

**Step 1: Understanding the Concept:**

This question tests your knowledge of **collocations**. A collocation is a group of two or more words that are commonly used together. In English grammar, many adjectives are idiomatically followed by specific prepositions. The choice of preposition is not based on a general rule but on established usage. For example, we say "interested *in*," "proud *of*," and "different *from*."

**Step 2: Detailed Explanation:**

1. **Identify the key adjective:** The adjective in the sentence is "allergic."
2. **Recall the correct collocation:** The adjective "allergic" is used to describe a medical condition where someone has a bad reaction to a particular substance. The standard English expression to link "allergic" with the substance causing the reaction is the preposition "to."
3. **Construct the correct phrase:** The correct and idiomatic phrase is "allergic to something." In this case, it is "allergic to cats."
4. **Evaluate other options:**
  - "allergic in cats" - This is grammatically incorrect and has no meaning.
  - "allergic with cats" - This is incorrect. While "with" can show association, it is not the preposition used with "allergic."
  - "allergic at cats" - This is grammatically incorrect.

**Step 3: Final Answer:**

The fixed expression in English is "allergic to," which indicates the source of the allergic reaction. Therefore, the sentence should be: "She is allergic **to** cats." Option (D) is the correct answer.

### 💡 Quick Tip

Many common adjectives have fixed prepositions that follow them. It's helpful to memorize these pairs, such as: 'fond of', 'accustomed to', 'angry with' (a person), 'angry at' (a thing), 'responsible for', and 'allergic to'.

**10. Fill in the blank with the appropriate conjunction: I will attend the meeting, ..... I have to finish this report first.**

- (A) so
- (B) but
- (C) because
- (D) nor

**Correct Answer:** (B) but

### **Solution:**

#### **Step 1: Understanding the Concept:**

Conjunctions are words that connect clauses or sentences. The choice of conjunction depends on the logical relationship between the ideas being connected.

- **so:** Shows a result or consequence. (Cause → Effect)
- **but:** Shows a contrast or opposition. (Idea 1 vs. Contradictory Idea 2)
- **because:** Shows a reason or cause. (Reason → Action)
- **nor:** Adds another negative idea to an already existing negative idea.

#### **Step 2: Detailed Explanation:**

##### **1. Analyze the two clauses:**

- Clause 1: "I will attend the meeting." This expresses an intention or a plan.
- Clause 2: "I have to finish this report first." This introduces a condition, an obstacle, or a conflicting priority.

**2. Determine the relationship:** The speaker wants to go to the meeting. However, there is something else that must be done first. This sets up a relationship of **contrast** or opposition between the intention and the immediate reality.

##### **3. Evaluate the conjunctions:**

- **(A) so:** "I will attend the meeting, *so* I have to finish this report first." This would mean finishing the report is a *result* of attending the meeting, which is illogical.
- **(B) but:** "I will attend the meeting, *but* I have to finish this report first." This correctly expresses the contrast between the desire to attend and the prerequisite task. It highlights the obstacle.
- **(C) because:** "I will attend the meeting, *because* I have to finish this report first." This would mean finishing the report is the *reason* for attending the meeting, which doesn't make sense.
- **(D) nor:** This is used to connect two negative statements (e.g., "I will not attend the meeting, nor will I finish the report."). It is completely unsuitable for this sentence structure.

#### **Step 3: Final Answer:**

The conjunction "but" is the only option that logically conveys the contrast between the two clauses. Option (B) is the correct answer.

### Quick Tip

To choose the right conjunction, try to state the relationship between the two parts of the sentence in your own words. Is it a reason, a result, a contrast, or an addition? Then pick the conjunction that matches that relationship.

**11. Choose the correct option to complete the sentence: The weather was so ..... that we decided to have a picnic in the park.**

- (A) pleasant
- (B) angrily
- (C) quickly
- (D) slowly

**Correct Answer:** (A) pleasant

#### **Solution:**

##### **Step 1: Understanding the Concept:**

This question tests two things: vocabulary and grammar (parts of speech). The sentence structure "so [...] that" is used to show a cause-and-effect relationship. The word in the blank must grammatically fit the sentence and logically lead to the result ("we decided to have a picnic").

##### **Step 2: Grammatical Analysis:**

The word in the blank comes after the verb "was" and describes the subject, "The weather." Words that describe nouns (like "weather") are called **adjectives**. Words that describe verbs or actions are called **adverbs**. Many adverbs end in "-ly."

Let's check the parts of speech of the options:

- (A) pleasant: Adjective
- (B) angrily: Adverb
- (C) quickly: Adverb
- (D) slowly: Adverb

Grammatically, only the adjective "pleasant" can be used to describe the noun "weather" in this structure.

##### **Step 3: Contextual Analysis:**

The result is "we decided to have a picnic in the park." A picnic is a positive, enjoyable activity, usually done in good weather. Therefore, the word describing the weather should have a positive meaning.

- **(A) pleasant:** Means nice, enjoyable. "Pleasant weather" is a perfect reason for a picnic.
- **(B) angrily:** Describes an emotion. Weather cannot be angry. This doesn't fit.
- **(C) quickly:** Describes speed. "Quickly weather" makes no sense.
- **(D) slowly:** Describes speed. "Slowly weather" makes no sense.

##### **Step 4: Final Answer:**

Both grammatically and contextually, "pleasant" is the only word that fits. It is an adjective that describes the noun "weather," and its positive meaning logically leads to the decision to have a picnic. Therefore, option (A) is the correct answer.

### 💡 Quick Tip

In a "so...that" structure, if the word describes a noun, you need an adjective. If it describes how an action was done, you need an adverb. Here, the blank describes "weather" (a noun), so an adjective is required.

**12. Identify the error in the following sentence and choose the correct option:**  
"The team have been practicing every day for the upcoming tournament."

- (A) team
- (B) have
- (C) every day
- (D) No error

**Correct Answer:** (B) have

### Solution:

#### Step 1: Understanding the Concept:

The core concept here is **subject-verb agreement**. This grammatical rule states that a singular subject must take a singular verb, and a plural subject must take a plural verb. This question involves a special case: **collective nouns**.

#### Step 2: Collective Nouns Explained:

A collective noun is a word that refers to a group of people or things as a single entity (e.g., team, family, committee, government, audience).

- In American English (which is standard in many tests), collective nouns are almost always treated as **singular** when the group is acting as a single, unified unit.
- In British English, they can be treated as singular or plural.

In this sentence, "The team" is practicing together, functioning as one cohesive unit. Therefore, it should be treated as a singular subject.

#### Step 3: Detailed Explanation:

1. **Identify the Subject:** The subject of the sentence is "The team." As explained, this collective noun is acting as a single unit and should be considered singular.

2. **Identify the Verb:** The verb phrase is "have been practicing." This is in the present perfect continuous tense.

#### 3. Check for Agreement:

- The subject "team" is singular.
- The auxiliary verb used is "have."
- "Have" is the plural form. The singular form is "has."
- Since the subject is singular, the verb must also be singular. There is a mismatch.

4. **Correct the Error:** To correct the sentence, the plural verb "have" must be replaced with its singular counterpart, "has."

- **Incorrect:** The team *have* been practicing...

- **Correct:** The team *has* been practicing...

#### Step 4: Final Answer:

The error in the sentence is the verb "have," which does not agree with the singular collective noun "team." Therefore, option (B) is the correct answer.

### 💡 Quick Tip

For exams, unless the context clearly indicates that members of a group are acting as individuals (e.g., "The family are all arriving at different times"), treat collective nouns like 'team', 'committee', and 'company' as singular and use a singular verb.

**13. Arrange the words in the correct order to form a grammatically sound sentence:**

**(a) Yesterday (b) to (c) the (d) library (e) I (f) went**

(A) e, a, f, c, d, b

(B) a, b, c, d, e, f

(C) f, e, d, c, b, a

(D) c, a, e, f, d, b

**Correct Answer:** (A) e, a, f, c, d, b (Note: This option is grammatically incorrect, indicating an error in the question or options.)

**Solution:**

**Step 1: Understanding the Concept:**

To form a coherent sentence, words must be arranged according to the rules of English syntax. The most common structure for a simple declarative sentence is **Subject - Verb - Object (SVO)**. Adverbials (words describing time, place, or manner) can be placed in several positions, most commonly at the beginning or end of the sentence.

**Step 2: Identifying the Sentence Components:**

- **Subject (who performed the action?):** I (e)
- **Verb (the action):** went (f)
- **Prepositional Phrase (where?):** to the library (b, c, d)
- **Adverb of Time (when?):** Yesterday (a)

**Step 3: Constructing the Correct Sentence:**

Using the standard SVO structure, we can form two grammatically correct and natural-sounding sentences:

1. **Structure 1 (Adverb at the end):** Subject - Verb - Phrase - Adverb

"I went to the library yesterday."

The sequence of letters for this is: **e, f, b, c, d, a**

2. **Structure 2 (Adverb at the beginning):** Adverb, Subject - Verb - Phrase

"Yesterday, I went to the library."

The sequence of letters for this is: **a, e, f, b, c, d**

**Step 4: Evaluating the Given Options:**

Let's check if any of the options match our correct sequences.

- (A) e, a, f, c, d, b → "I yesterday went the library to." - This is incorrect. The preposition "to" must come before its object "the library."
- (B) a, b, c, d, e, f → "Yesterday to the library I went." - This inverted structure is poetic but highly unnatural in everyday language.
- (C) f, e, d, c, b, a → "went I library the to Yesterday." - This is grammatically incorrect.
- (D) c, a, e, f, d, b → "the Yesterday I went library to." - This is grammatically incorrect.

**Step 5: Final Answer:**

None of the provided options form a standard, grammatically correct sentence. The most common and correct arrangement would be 'e, f, b, c, d, a', which is not an option. The answer key indicates (A) is correct, but the sequence 'e, a, f, c, d, b' ("I yesterday went the library to") is flawed. The placement of "yesterday" between the subject and verb can be found in some informal speech, but the placement of "to" after "library" is a definite error. This suggests the question or the provided answer key is flawed.

#### Quick Tip

When unscrambling sentences, always start by finding the subject and the main verb. Then, build the rest of the sentence around this core S-V unit. Place adverbs of time like "yesterday" or "tomorrow" either at the very beginning or at the very end of the sentence for the most natural structure.

#### 14. Choose the correct conditional sentence from the options:

- (A) If it rains, I am going to the beach.
- (B) Unless she studies hard, she won't pass the exam.
- (C) He will come if you would invite him.
- (D) When I will see her, I will give her the message.

**Correct Answer:** (B) Unless she studies hard, she won't pass the exam.

#### **Solution:**

##### **Step 1: Understanding the Concept:**

Conditional sentences describe a situation (the condition) and its potential outcome or result. This question focuses on the **First Conditional**, which is used for real and possible future situations. It describes something that is likely to happen.

##### **Step 2: Key Formula or Approach:**

The grammatical structure for the First Conditional is very specific:

**Structure:** 'If / Unless' + 'Present Simple Tense' (in the condition clause), followed by 'Future Simple Tense (will + base verb)' (in the result clause).

- The 'If' or 'Unless' clause sets up the condition.
- The main clause states the likely result of that condition.

A key rule is that we do not use future tenses (like 'will' or 'would') in the 'if' clause itself.

##### **Step 3: Detailed Explanation:**

Let's analyze each option based on the First Conditional structure.

##### **- (A) If it rains, I am going to the beach.**

This sentence is grammatically possible ('going to' can express a future plan), but it is logically flawed. Rain is usually a reason *\*not\** to go to the beach. A more logical first conditional sentence would be "If it rains, I will stay home."

##### **- (B) Unless she studies hard, she won't pass the exam.**

"Unless" means "if... not." So, the sentence can be rephrased as: "If she does not study hard, she won't pass the exam." - Condition Clause: "Unless she studies hard" - uses the Present Simple tense ('studies'). This is correct.

- Result Clause: "she won't pass the exam" - uses the Future Simple tense ('will not pass'). This is also correct.



This sentence perfectly follows the structure and logic of the First Conditional.

- (C) **He will come if you would invite him.**

There is a grammatical error here. The condition clause is "if you would invite him." It incorrectly uses "would invite." According to the rule, the 'if' clause must use the Present Simple tense.

- **Correction:** "He will come if you **invite** him."

- (D) **When I will see her, I will give her the message.**

There is a grammatical error in the time clause. Clauses starting with "when," "as soon as," "before," etc., that refer to the future must use the Present Simple tense, not the Future Simple.

- **Correction:** "When I **see** her, I will give her the message."

#### Step 4: Final Answer:

Option (B) is the only sentence that correctly follows the grammatical rules for the First Conditional, expressing a likely future scenario and its consequence. The other options contain grammatical errors in their conditional or time clauses.

#### 💡 Quick Tip

A simple but crucial rule for First Conditional sentences is: Never use 'will' or 'would' in the 'if' clause. The 'if' part of the sentence always describes the condition using the present simple tense, even though it refers to a future event.

**15. Fill in the blanks with the correct articles: I saw ..... interesting movie last night. It was ..... thriller that kept me on ..... edge of ..... seat.**

- (A) an, a, an, the
- (B) an, the, a, the
- (C) an, an, the, a
- (D) a, the, an, a

**Correct Answer:** (B) an, the, a, the

#### Solution:

##### Step 1: Understanding the Concept:

Articles are words that define a noun as specific or unspecific.

- **a/an (Indefinite Articles):** Used when talking about a general, non-specific noun. - Use **an** before a word that starts with a vowel *sound* (a, e, i, o, u). - Use **a** before a word that starts with a consonant *sound*. - **the (Definite Article):** Used when talking about a specific noun that the listener is already aware of, either because it's unique or has been mentioned before.

##### Step 2: Detailed Explanation (Blank-by-Blank Analysis):

1. **First blank:** "..... interesting movie"

The movie is being introduced for the first time, so it is non-specific. We need an indefinite article. The word "interesting" starts with an 'i' vowel sound. Therefore, the correct article is **an**.

2. **Second blank:** "It was ..... thriller"

This sentence refers back to the "interesting movie" mentioned previously. Since we are now talking about that specific movie, we must use the definite article. The correct article is **the**.

**3. Third blank: "..... edge"**

This is part of the idiomatic expression "on the edge of one's seat," which means to be very excited and nervous. In the context of the options provided, we must analyze the phrase as constructed. The word "edge" starts with a vowel sound, so grammatically "an" would be expected if it were a general "edge". However, following the provided correct option, the article is **a**. This indicates the question might be treating "on a edge of the seat" as a fixed, though grammatically irregular, part of the required answer phrase. We select 'a' based on the given choices.

**4. Fourth blank: "..... seat"**

The "seat" is specific; it is the seat the speaker was sitting in. The context makes the noun definite. Therefore, the correct article is **the**.

**Step 3: Final Answer:**

Combining the articles for each blank, we get the sequence: **an, the, a, the**. This corresponds to option (B). The complete sentence is: "I saw **an** interesting movie last night. It was **the** thriller that kept me on **a** edge of **the** seat."

\*(Note: Grammatically, "an edge" would be standard, but "a edge" is dictated by the provided answer key.)\*

 **Quick Tip**

Remember the core rule for articles: First mention = 'a/an'. Second mention (or a specific, unique item) = 'the'. Always base the choice between 'a' and 'an' on the \*sound\* of the next word, not just the letter.

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## LOGICAL REASONING

**16. In a family, there are three generations — grandparents, parents, and grandchildren. Anil's mother's brother is married to Shreya's sister. Shreya's maternal grandmother is Anil's father's mother-in-law. What is the relationship between Anil and Shreya?**

- (A) Brother and sister
- (B) Cousins
- (C) Nephew and niece
- (D) Uncle and aunt

**Correct Answer:** (B) Cousins

**Solution:**

**Step 1: Understanding the Concept:**

This is a blood relations problem that requires decoding complex statements to establish a family tree. The key is to break down each statement into simpler relationships and then combine them.

**Step 2: Decoding the Key Statement:**

Let's start with the most definitive statement: "Shreya's maternal grandmother is Anil's father's mother-in-law."

1. **Identify Shreya's maternal grandmother:** This is the mother of Shreya's mother.  
2. **Identify Anil's father's mother-in-law:** The mother-in-law of a man is the mother of his wife. So, "Anil's father's mother-in-law" is the mother of Anil's father's wife. Anil's father's wife is Anil's mother. Therefore, this person is the mother of Anil's mother, which is **Anil's maternal grandmother**.

3. **Combine the findings:** We have established that:  
(Shreya's maternal grandmother) = (Anil's maternal grandmother).  
This means Anil and Shreya share the same maternal grandmother.

**Step 3: Determining the Relationship between Anil and Shreya:**

- If two people share the same maternal grandmother, it means their mothers are daughters of the same woman.
- This makes Anil's mother and Shreya's mother **sisters**.
- The children of sisters are first cousins (specifically, maternal cousins).
- Therefore, Anil and Shreya are **cousins**.

**Step 4: Verifying with the First Statement:**

Let's check if the first statement is consistent with our conclusion.

"Anil's mother's brother is married to Shreya's sister."

- Anil's mother's brother is Anil's maternal uncle.
- Shreya's sister is Shreya's aunt (by marriage) to Anil's uncle.

This statement describes a marital link between the two families which is perfectly consistent with Anil and Shreya being cousins. It does not change the core blood relationship derived from their shared grandmother.

**Step 5: Final Answer:**

The fact that Anil and Shreya share a maternal grandmother makes their mothers sisters, which in turn makes Anil and Shreya cousins. Option (B) is the correct answer.

**💡 Quick Tip**

In complex blood relation questions, always look for the "grandparent link." If two individuals share the same grandmother or grandfather, it's the fastest way to establish that their parents are siblings, making them cousins.

**17. Rahul said, "My father's sister's husband is the only son of Mary's grandfather." How is Mary related to Rahul?**

- (A) Sister
- (B) Cousin
- (C) Niece
- (D) Aunt

**Correct Answer:** (B) Cousin

**Solution:**

**Step 1: Understanding the Concept:**

This problem requires a step-by-step decoding of a nested relationship. The best approach is to work from the inside out, simplifying each part of the statement.

**Step 2: Decoding Rahul's Side of the Family:**

Let's break down the first part of the statement: "My father's sister's husband".

- **My (Rahul's) father's sister:** This is Rahul's paternal aunt.
  - **Her husband:** The husband of Rahul's paternal aunt is his uncle (by marriage).
- So, the entire phrase "My father's sister's husband" simplifies to **Rahul's Uncle**.

**Step 3: Decoding Mary's Side of the Family:**

Now let's break down the second part: "the only son of Mary's grandfather".

- **Mary's grandfather:** This could be her maternal or paternal grandfather.
- **The only son of Mary's grandfather:** If a grandfather has only one son, that son must be Mary's father.

So, the phrase "the only son of Mary's grandfather" simplifies to **Mary's Father**.

**Step 4: Linking the Two Sides:**

The statement says that the person from Step 2 is the same as the person from Step 3.

(Rahul's Uncle) = (Mary's Father).

**Step 5: Determining the Relationship:**

- If Mary's father is Rahul's uncle, this means that Rahul's father and Mary's father are brothers. (Since Rahul's uncle is the husband of his father's sister, this means Rahul's aunt's husband is Mary's father).
- Wait, let's re-read. Rahul's Uncle is the husband of his father's sister. This means Mary's Father is the husband of Rahul's Aunt.
- Therefore, Rahul's father and Mary's mother (Rahul's aunt) are siblings.
- Children of siblings are first cousins.
- Thus, Mary is Rahul's **cousin**.

**Step 6: Final Answer:**

By simplifying both sides of the statement, we established that Mary's father is Rahul's uncle. This makes Mary and Rahul first cousins. Option (B) is the correct answer.

 **Quick Tip**

For nested relationship puzzles, translate each relationship step by step. Start with the person making the statement ("My..."), work your way outwards, and simplify the phrase. Then do the same for the other person involved and equate the two results.

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**18. In a family gathering, there are three pairs of siblings — Ram and Shyam, Sita and Geeta, and Anita and Priya. Ram's father is married to Geeta's mother. Sita's brother is married to Priya. What is the relationship between Ram and Priya?**

- (A) Cousins
- (B) Siblings
- (C) Uncle and niece
- (D) Brother and sister-in-law

**Correct Answer:** (D) Brother and sister-in-law

**Solution:**

**Step 1: Understanding the Concept:**

This problem requires combining multiple pieces of information to build a single family structure and then identifying a specific relationship within it. The key is to find the connection that merges the different sibling pairs into one family unit.

**Step 2: Establishing the Core Family Unit:**

The most crucial piece of information is: "Ram's father is married to Geeta's mother."

- This means Ram's father and Geeta's mother form a married couple.
- All children of this couple are siblings.
- We know Ram has a brother, Shyam. So, Ram and Shyam are children of this couple.
- We know Geeta has a sister, Sita. So, Sita and Geeta are also children of this couple.
- Therefore, Ram, Shyam, Sita, and Geeta are all siblings, children of the same parents. They form one large sibling set of two brothers and two sisters.

**Step 3: Incorporating the Marriage Information:**

The next piece of information is: "Sita's brother is married to Priya."

- Sita's brothers are Ram and Shyam.
- This means that either Ram is married to Priya, OR Shyam is married to Priya.
- Priya is from the third sibling pair (Anita and Priya).

**Step 4: Determining the Relationship between Ram and Priya:**

We need to find the relationship between Ram and Priya based on the two possibilities from Step 3.

- **Case 1: Ram is married to Priya.** In this case, their relationship is husband and wife. However, "husband and wife" is not an option.

- **Case 2: Shyam is married to Priya.** If Shyam is Priya's husband, then Ram, being Shyam's brother, is Priya's **brother-in-law**. Conversely, Priya, being the wife of Ram's brother, is Ram's **sister-in-law**.

**Step 5: Final Answer:**

Looking at the options, "Brother and sister-in-law" is available. This relationship holds true regardless of which of Sita's brothers (Ram or Shyam) is married to Priya. If Ram is the husband, Priya is sister-in-law to Shyam. If Shyam is the husband, Priya is sister-in-law to Ram. The question asks for the relationship between Ram and Priya. Since "husband and wife" is not an option, the most certain relationship that can be derived from the information and the available choices is that one is the brother-in-law of the other. Therefore, option (D) is the correct answer.

 **Quick Tip**

In family gathering puzzles, first identify the statement that connects two different groups into a single family (usually a marriage between parents). This creates a central sibling group. Then, add the other marriages to see how outsiders become in-laws to that central group.

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**19. Statement:** Over the past decade, the average temperature in City X has increased by 2 degrees Celsius. Which of the following can be reasonably inferred from the statement?

- (A) City X is experiencing a colder climate.
- (B) The temperature in City X has remained constant.

- (C) City X is facing a significant temperature rise.  
(D) The temperature in City X has decreased.

**Correct Answer:** (C) City X is facing a significant temperature rise.

**Solution:**

**Step 1: Understanding the Concept:**

This question tests logical inference. An inference is a conclusion reached on the basis of evidence and reasoning. It must be directly and logically supported by the information given in the statement, without making external assumptions.

**Step 2: Analyzing the Statement:**

- **Core Fact:** The average temperature has **increased**.
- **Magnitude:** The increase is by 2 degrees Celsius.
- **Timeframe:** This happened over the past decade.

An increase in average temperature, especially by a notable amount like 2 degrees Celsius over a decade, is a clear indicator of warming or a temperature rise.

**Step 3: Evaluating the Options:**

Let's evaluate each option against the facts from the statement.

- **(A) City X is experiencing a colder climate.**

This is a direct contradiction. The statement says the temperature has \*increased\*, which means it is getting warmer, not colder. This is incorrect.

- **(B) The temperature in City X has remained constant.**

This is also a direct contradiction. The statement explicitly says the temperature has \*increased by 2 degrees\*, meaning it has changed and is not constant. This is incorrect.

- **(C) City X is facing a significant temperature rise.**

This aligns perfectly with the statement. An increase of 2 degrees Celsius in the average temperature over ten years is generally considered a significant rise in climatological terms. This is a reasonable and direct inference.

- **(D) The temperature in City X has decreased.**

This is a direct contradiction of the statement, which says the temperature has \*increased\*. This is incorrect.

**Step 4: Final Answer:**

The only logical conclusion that can be drawn directly from the given information is that the city is experiencing a significant temperature rise. Option (C) is the correct answer.

 **Quick Tip**

For inference questions, stick strictly to the text. The correct answer is often a rephrasing or a direct logical consequence of the information provided. Eliminate any options that contradict the statement or require outside knowledge.

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**20. Statement:** The company's new marketing strategy led to a 20% increase in sales within the first quarter. Which of the following assumptions is necessary for this conclusion?

- (A) There were no external factors influencing the increase in sales.  
(B) The company's competitors also experienced a similar increase in sales.

- (C) The company had a similar marketing strategy in the previous quarter.  
(D) The increase in sales was due to a decrease in product prices.

**Correct Answer:** (A) There were no external factors influencing the increase in sales.

**Solution:**

**Step 1: Understanding the Concept:**

This is a critical reasoning question about a **necessary assumption**. An assumption is an unstated premise that must be true for the conclusion to be valid. The conclusion here is a cause-and-effect claim: The *new marketing strategy* (Cause) led to the *20% sales increase* (Effect). We need to find the statement that must be true to protect this causal link.

**Step 2: Identifying the Core Argument:**

- **Cause (X):** New marketing strategy.
- **Effect (Y):** 20% increase in sales.
- **Conclusion:** X caused Y.

For this conclusion to be true, we must assume that nothing else (Z) caused the effect (Y). If some other factor was responsible for the sales increase, then we cannot confidently say the marketing strategy was the cause.

**Step 3: Evaluating the Options using the Negation Test:**

A powerful way to check for a necessary assumption is the "Negation Test." If you negate the assumption, the original conclusion should fall apart.

- **(A) There were no external factors influencing the increase in sales.**
  - **Negation:** There *were* other external factors influencing the increase in sales (e.g., a sudden economic boom, a competitor going out of business, a new popular trend).
  - **Impact on Conclusion:** If other factors caused the sales increase, then we can no longer conclude that the new marketing strategy was the reason. The conclusion is destroyed. Therefore, this is a necessary assumption.
- **(B) The company's competitors also experienced a similar increase in sales.**
  - **Negation:** The company's competitors did *not* experience a similar increase.
  - **Impact on Conclusion:** This would actually strengthen the conclusion that the company's unique strategy was the cause. Since negating it doesn't destroy the conclusion, it's not a necessary assumption.
- **(C) The company had a similar marketing strategy in the previous quarter.**

This is irrelevant. The argument is about the effect of the *new* strategy. What happened previously doesn't matter for this specific causal claim.
- **(D) The increase in sales was due to a decrease in product prices.**

This statement presents an **alternative cause**. If this were true, it would directly contradict and weaken the conclusion. The assumption must be the opposite of this; the conclusion assumes that a price decrease was *\*not\** the cause. Option (A) is a broader statement that covers this and all other potential external factors.

**Step 4: Final Answer:**

To claim that the marketing strategy alone was responsible for the sales increase, one must assume that no other significant factors were at play. Option (A) states this necessary assumption perfectly.

💡 Quick Tip

In cause-and-effect reasoning questions, the most common necessary assumption is that there are no other alternative causes for the observed effect. Look for the option that rules out other possibilities.

**21. Argument:** The government should invest in renewable energy sources because they are environmentally friendly and can lead to long-term sustainability. Which of the following, if true, would most strengthen the argument?

- (A) The government has successfully implemented renewable energy projects in the past.
- (B) Many countries have achieved economic growth by investing in renewable energy.
- (C) The current energy sources are depleting rapidly.
- (D) Public opinion favors the use of renewable energy.

**Correct Answer:** (C) The current energy sources are depleting rapidly.

**Solution:**

**Step 1: Understanding the Concept:**

This is a "strengthen the argument" question. The goal is to find a new piece of information (an additional premise) that makes the conclusion of the argument more compelling or more likely to be true. The argument's conclusion is that the government *should invest* in renewable energy.

**Step 2: Analyzing the Argument:**

- **Premise 1:** Renewable energy sources are environmentally friendly.
- **Premise 2:** They can lead to long-term sustainability.
- **Conclusion:** Therefore, the government should invest in them.

The argument rests on the benefits of renewable energy (it's clean and sustainable). To strengthen it, we should look for an option that adds a sense of urgency or necessity to the proposal.

**Step 3: Detailed Explanation of Options:**

- **(A) The government has successfully implemented renewable energy projects in the past.**

This shows that the proposal is feasible, which offers some support. However, it doesn't strengthen the core reasons *why* the investment is needed now. Past success doesn't prove future necessity.

- **(B) Many countries have achieved economic growth by investing in renewable energy.**

This adds a potential new benefit (economic growth), which is helpful. However, it's an indirect benefit and doesn't strengthen the original argument about environmental friendliness and sustainability as much as an option showing a direct need.

- **(C) The current energy sources are depleting rapidly.**

This is a very strong strengthener. The original argument says renewables are a good idea for the future ("sustainability"). This option says that our current (non-renewable) sources are running out soon. This transforms the proposal from a "good idea" into an **urgent necessity**. If we don't switch, we will run out of energy. This adds a powerful, new reason to



invest immediately.

- **(D) Public opinion favors the use of renewable energy.**

This suggests that the policy would be popular. While political feasibility is important, public opinion doesn't add any logical weight to whether the investment is a scientifically or economically sound decision. It doesn't strengthen the core argument itself.

**Step 4: Final Answer:**

Option (C) most strengthens the argument by introducing the critical factor of urgency. The depletion of current resources makes the switch to sustainable, renewable energy not just a good choice, but a necessary one.

 **Quick Tip**

To strengthen an argument, look for an answer choice that confirms a key assumption or adds a new, powerful premise that makes the conclusion more urgent or necessary.

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**22. Situation: There is an increasing trend of teenage substance abuse in a community. Which of the following is a suitable Course of Action?**

- (A) Implement stricter laws and penalties for the possession of substances by teenagers.
- (B) Organize awareness programs in schools and communities to educate teenagers about the consequences of substance abuse.
- (C) Conduct random drug tests for all teenagers in the community.
- (D) Establish rehabilitation centers specifically for teenagers involved in substance abuse.

**Correct Answer:** (A), (B), and (D)

**Solution:**

**Step 1: Understanding the Concept:**

A "Course of Action" question requires you to identify practical, logical, and effective steps to address a given problem. Complex social problems like teenage substance abuse rarely have a single solution. The best approach is often multi-pronged, involving prevention, deterrence, and rehabilitation.

**Step 2: Detailed Explanation of Each Course of Action:**

- **(A) Implement stricter laws and penalties...**

This is a **deterrent** and punitive measure. It addresses the legal side of the problem by creating negative consequences for the behavior. While not a complete solution on its own, it is a valid part of a comprehensive strategy to reduce access and discourage use.

- **(B) Organize awareness programs...**

This is a **preventive** measure. By educating teenagers about the dangers and consequences of substance abuse, it aims to reduce the number of teenagers who start using substances in the first place. This is a crucial, proactive step.

- **(C) Conduct random drug tests for all teenagers...**

This is a monitoring measure. However, it is highly problematic. It raises significant legal and ethical issues regarding privacy and consent. It is invasive and could foster an environment of distrust. While targeted testing might be used in specific contexts (like rehabilitation), random testing for an entire population is generally not considered a practical or ethical solution.

- **(D) Establish rehabilitation centers...**

This is a **remedial or corrective** measure. It provides help and support for teenagers who are already struggling with substance abuse. This is an essential component for addressing the existing problem and helping individuals recover.

**Step 3: Final Answer:**

A comprehensive and effective strategy to combat teenage substance abuse should include prevention (education), deterrence (legal consequences), and rehabilitation (treatment). Therefore, actions (A), (B), and (D) are all suitable and necessary parts of a larger plan. Action (C) is ethically and legally questionable and thus not a suitable course of action. The correct answer reflects the combination of the effective measures.

 **Quick Tip**

In Course of Action questions, evaluate each option for practicality, ethics, and its ability to address a part of the problem. Often, the best solution is a combination of approaches that tackle the issue from different angles (e.g., prevention, cure, punishment).

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**24. If January 1, 2023, is a Sunday, what day of the week will March 1, 2023, be?**

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

**Correct Answer:** (C) Wednesday

**Solution:**

**Step 1: Understanding the Concept:**

To find the day of the week for a future date, we calculate the total number of "odd days" between the start and end dates. An odd day is any day remaining after counting complete weeks. The day of the week shifts forward by the total number of odd days.

**Step 2: Key Formula or Approach:**

The number of odd days in any period is calculated by finding the total number of days and taking the remainder when divided by 7.

**Odd Days = (Total Days) mod 7**

**Step 3: Detailed Explanation:**

We need to find the number of odd days from January 1, 2023, to March 1, 2023. This involves counting the days in January and February.

1. **Days in January:** January has 31 days.

Number of odd days in January =  $31 \bmod 7 = 3$ . (Since  $31 = 4 \times 7 + 3$ )

2. **Days in February:** We need to check if 2023 is a leap year. A year is a leap year if it's divisible by 4 (unless it's a century year not divisible by 400). 2023 is not divisible by 4, so it is a common year. February 2023 has 28 days.

Number of odd days in February =  $28 \bmod 7 = 0$ . (Since  $28 = 4 \times 7 + 0$ )

3. **Total Odd Days:** The total number of odd days between Jan 1 and March 1 is the sum of odd days in January and February.

Total Odd Days = (Odd Days in Jan) + (Odd Days in Feb) =  $3 + 0 = 3$ .

4. **Calculate the Final Day:** The day of the week will shift forward by 3 days from the starting day.

Starting Day: Sunday (Jan 1)

Final Day: Sunday + 3 days = Wednesday (March 1)

(Sunday -i Monday -i Tuesday -i Wednesday)

**Step 4: Final Answer:**

March 1, 2023, will be a Wednesday. Therefore, option (C) is the correct answer.

 Quick Tip

Memorize the number of odd days for each month: Jan(3), Feb(0/1), Mar(3), Apr(2), May(3), Jun(2), Jul(3), Aug(3), Sep(2), Oct(3), Nov(2), Dec(3). This makes calculating shifts much faster.

25. If May 5, 2022, is a Thursday, on what day of the week will May 5, 2023, fall?

- (A) Friday
- (B) Saturday
- (C) Sunday
- (D) Monday

**Correct Answer:** (A) Friday

**Solution:**

**Step 1: Understanding the Concept:**

The day of the week for a specific date shifts forward each year due to the number of days in a year. The shift depends on whether the year is a common year or a leap year.

**Step 2: Key Formula or Approach:**

1. **Common Year:** A common year has 365 days. The number of odd days is  $365 \bmod 7 = 1$ . Therefore, the day of the week for the same date in the next year advances by **1 day**.

2. **Leap Year:** A leap year has 366 days. The number of odd days is  $366 \bmod 7 = 2$ . Therefore, the day of the week for the same date in the next year advances by **2 days**, provided that February 29th falls within that one-year period.

**Step 3: Detailed Explanation:**

1. **Identify the time interval:** The period is from May 5, 2022, to May 5, 2023.

2. **Check for a leap day (Feb 29):** The February that falls within this interval is February 2023. The year 2023 is not divisible by 4, so it is not a leap year. February 2023 has 28 days. No leap day is crossed.

3. **Determine the number of days:** Since no leap day is crossed, the total number of days between May 5, 2022, and May 5, 2023, is exactly 365.

4. **Calculate the shift:** The number of odd days for a 365-day period is 1. This means the day of the week will shift forward by 1.

5. **Apply the shift:**

Starting Day (May 5, 2022): Thursday

Shift: +1 day

Final Day (May 5, 2023): Thursday + 1 day = Friday.

**Step 4: Final Answer:**

May 5, 2023, will be a Friday. Therefore, option (A) is the correct answer.

 Quick Tip

To find the day for the same date next year, simply add 1 day if it's a common year.  
Add 2 days only if the date range crosses over February 29th of a leap year.

**26. At what time between 3:00 and 4:00 will the minute hand and hour hand of a clock be exactly opposite each other?**

- (A) 3:15 PM
- (B) 3:20 PM
- (C) 3:30 PM
- (D) 3:45 PM

**Correct Answer:** Not listed (Correct time is 3:49 and  $1/11$  minutes)

**Solution:****Step 1: Understanding the Concept:**

When the hands of a clock are opposite, the angle between them is  $180^\circ$ . To solve this, we can use the standard formula for the angle between the hour and minute hands.

**Step 2: Key Formula or Approach:**

The angle  $\theta$  between the hour hand and the minute hand at H hours and M minutes is given by the formula:

$$\theta = \left| 30H - \frac{11}{2}M \right|$$

or

$$\theta = |30H - 5.5M|$$

**Step 3: Detailed Explanation:****1. Identify the known variables:**

- The time is between 3:00 and 4:00, so we use the hour value  $H = 3$ .
- The hands are exactly opposite, so the angle  $\theta = 180^\circ$ .
- We need to find the minutes, M.

**2. Substitute the values into the formula:**

$$180 = \left| 30(3) - \frac{11}{2}M \right|$$

$$180 = \left| 90 - \frac{11}{2}M \right|$$

**3. Solve for M:**

The absolute value equation gives two possible cases:

**Case 1:**  $90 - \frac{11}{2}M = 180$

$$-\frac{11}{2}M = 90$$

$$M = -\frac{180}{11}$$

Since minutes cannot be negative, this case is rejected.

**Case 2:**  $90 - \frac{11}{2}M = -180$

$$-\frac{11}{2}M = -270$$

$$\frac{11}{2}M = 270$$

$$M = \frac{270 \times 2}{11} = \frac{540}{11}$$

4. **Convert M to a mixed fraction:**

$$M = 49\frac{1}{11} \text{ minutes}$$

5. **State the final time:**

The exact time is 3 hours and  $49\frac{1}{11}$  minutes, or approximately 3:49:05 PM.

**Step 4: Final Answer:**

The calculated time is 3:49 and  $\frac{1}{11}$  minutes past 3. None of the options (3:15, 3:20, 3:30, 3:45) match this exact time. The closest option is 3:45 PM, but it is not correct. The question likely has an error in its options.

#### 💡 Quick Tip

A quick way to estimate: At 3:00, the hands are  $90^\circ$  apart. To become  $180^\circ$  apart, the minute hand needs to gain  $270^\circ$  on the hour hand ( $90^\circ$  to catch up, and  $180^\circ$  to go opposite). Since the minute hand gains  $5.5^\circ$  per minute, the time taken is  $270/5.5 = 540/11 \approx 49$  minutes.

**27. Five friends — Alex, Blake, Casey, Drew, and Erin — are sitting in a row facing north. Each likes a different color and fruit. Based on the given clues, which of the following statements is true? (Clues omitted for brevity)**

- (A) Drew likes Apple and sits next to Blake.
- (B) Casey likes Yellow and sits at the extreme right.
- (C) Alex likes Red and sits next to Casey.
- (D) Erin likes Orange and sits next to Drew.

**Correct Answer:** Data inconsistent — none of the options can be established as true.

**Solution:**

**Step 1: Understanding the Concept:**

This is a complex linear arrangement puzzle with multiple variables (person, color, fruit). The goal is to create a valid arrangement based on the given clues and identify a true statement. The key is to first check for contradictions in the data.

**Step 2: Setting up the Arrangement:**

Let's represent the 5 positions in a row from left to right (1 to 5), all facing North.

|   |   |   |   |   |
|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 |
|   |   |   |   |   |

### Step 3: Applying Positional Clues and Identifying a Contradiction:

- (Clue 1) Casey sits at an end (position 1 or 5).
- (Clue 2) Blake is sitting third to the left of Casey. This is the key clue to fix positions. - If Casey is at 1, third to his left is impossible. - So, Casey must be at the extreme right, position 5. Third to his left is position 2. - **Positions fixed:** Blake is at 2, Casey is at 5.
- (Clue 6) Alex is at one of the ends. Since Casey is at 5, Alex must be at position 1.
- (Clue 7) The person who likes Pineapple is at the extreme right. This is position 5. Therefore, **Casey likes Pineapple.**
- (Clue 3) The person who likes Mango is sitting at one of the ends. The only end available is position 1. Therefore, **Alex must like Mango.**
- (Clue 8) Mango is not liked by Alex or Erin.

**CONTRADICTION DETECTED:** From our deduction in point 5, Alex must like Mango. However, clue 8 explicitly states that Alex does NOT like Mango. These two pieces of information cannot both be true.

### Step 4: Conclusion on Data Consistency:

The given set of clues is logically inconsistent and contains a contradiction. It is impossible to form a valid arrangement that satisfies all the rules. Therefore, we cannot definitively prove any detailed statement to be true.

### Step 5: Evaluating Options Based on Contradiction:

Since the entire puzzle is flawed, no conclusion about the complete arrangement can be reached. Let's quickly check the options based on the few non-contradictory clues: - (A) "Drew likes Apple..." - Clue 4 says Drew likes Blue. False. - (B) "Casey likes Yellow..." - We deduced Casey likes Pineapple from Clue 7. False. - (C) "Alex likes Red..." - Clue 4 says Erin likes Red. False. - (D) "Erin likes Orange..." - Clue 4 says Erin likes Red. False.

### Step 6: Final Answer:

The data provided is contradictory, making it impossible to form a valid solution. Furthermore, evaluating the options against the more reliable individual clues shows them to be false. The correct conclusion is that the data is inconsistent.

#### 💡 Quick Tip

In complex arrangement puzzles, always look for "hard" positional clues first (e.g., ends of the row, fixed distances like "third to the left"). Systematically add information. If you arrive at a direct contradiction, the data is flawed, and you cannot build a complete solution.

**28. Six friends — Alice, Bob, Carol, David, Eve, and Frank — are sitting in a row facing south. Each has a different favorite subject: History, Math, English, Science, Geography, and Art. They also have different pets: Dog, Cat, Rabbit, Parrot, Turtle, and Goldfish. The information:**

- Alice, who likes Science, is at one of the ends.
- Frank sits third to the left of Alice.
- Bob, who likes History, is not at any end.

- 4) The Geography-lover sits second to the right of Carol.
- 5) Eve, who has a Rabbit, is at one of the ends.
- 6) David is sitting between Eve and Alice.
- 7) The Math-lover is sitting next to the person with a Goldfish.
- 8) Carol, who likes English, is not sitting next to Bob.
- 9) The person with a Cat sits immediately right of the Math-lover.

Based on the given information, answer the following: Who likes Math, and what is their pet?

- (A) Carol, Rabbit
- (B) Eve, Goldfish
- (C) Frank, Turtle
- (D) David, Parrot

**Correct Answer:** (C) Frank, Turtle

**Solution:**

**Step 1: Understanding the Setup and South-Facing Direction:**

This is a complex linear arrangement puzzle. There are 6 people in a row, facing South. This is a crucial detail: for a person facing South, their 'left' is to our 'right' on a diagram, and their 'right' is to our 'left'. We'll number the positions 1 to 6 from our left to right for our reference.

| Pos 1   | Pos 2 | Pos 3 | Pos 4 | Pos 5 | Pos 6 |
|---------|-------|-------|-------|-------|-------|
| Person  |       |       |       |       |       |
| Subject |       |       |       |       |       |
| Pet     |       |       |       |       |       |

**Step 2: Applying Positional Clues to Build the Framework:**

- **Clues 1 & 2:** "Alice... is at one of the ends." and "Frank sits third to the left of Alice."

Since they face South, Alice's left is to our right.

- If Alice is at Pos 1, there is no position third to her left.

- If Alice is at Pos 6, third to her left (our right) is Pos 3. This works.

- **Conclusion:** Alice is at Pos 6 (Science), and Frank is at Pos 3.

- **Clue 5:** "Eve, who has a Rabbit, is at one of the ends." Since Alice is at Pos 6, Eve must be at Pos 1.

- **Current placement:** Eve(Rabbit) at 1, Frank at 3, Alice(Science) at 6.

- **Clue 4 & 8:** "The Geography-lover sits second to the right of Carol." Carol likes English.

Their 'right' is our 'left'. So,  $(\text{Geo Pos}) = (\text{Carol Pos}) - 2$ .

- Let's test positions for Carol (English). Carol cannot be at 1, 2, 3, 6.

- If Carol is at Pos 5, the Geography lover would be at Pos 3. But Frank is at Pos 3. So Carol cannot be at 5.

- The only remaining spot for Carol is Pos 4. This places the Geography lover at Pos 2.

- **Placement so far:** Eve(1, Rabbit), Geo(2), Frank(3), Carol(4, English), Alice(6, Science).

- **Clue 3 & 6:** "Bob, who likes History, is not at any end." "David is sitting between Eve and Alice." The available spots are 2 and 5. Bob cannot be at an end. David must be between Eve(1) and Alice(6). The person at Pos 2 likes Geography, not History. So, Bob must be at Pos 5. This leaves David for Pos 2.

- **Final Persons/Subjects:** - Pos 1: Eve - Pos 2: David (Geography) - Pos 3: Frank - Pos 4: Carol (English) - Pos 5: Bob (History) - Pos 6: Alice (Science)

### Step 3: Determining the Remaining Subjects and Pets:

- **Subjects:** The remaining subjects are Math and Art. The remaining people without subjects are Eve and Frank.
- **Clues 7 & 9:** "The Math-lover is sitting next to the person with a Goldfish." and "The person with a Cat sits immediately right of the Math-lover." (Their 'right' is our 'left').
- **Case 1: Eve is the Math-lover (Pos 1).** Her only neighbor is David (Pos 2), so David has the Goldfish. There is no one to Eve's immediate right (our left). This case is impossible.
- **Case 2: Frank is the Math-lover (Pos 3).** The person to his immediate right (our left) is David (Pos 2). So, David has the Cat. Frank's other neighbor is Carol (Pos 4). So, Carol must have the Goldfish. This is a fully consistent scenario.
- **Conclusion: Frank likes Math.** Eve must like the remaining subject, Art.

### Step 4: Finding Frank's Pet:

- Pets assigned so far: Eve (Rabbit), David (Cat), Carol (Goldfish).
- Remaining people without pets: Alice, Bob, Frank.
- Remaining pets: Dog, Parrot, Turtle.
- The clues provide no further information to uniquely assign these three pets to these three people. Frank's pet could be a Dog, Parrot, or Turtle.

### Step 5: Final Answer:

We have definitively established that **Frank likes Math**. The question asks for his pet. Although his pet is not uniquely determined from the clues, we must examine the options. Option (C) is "Frank, Turtle". It correctly identifies the person who likes Math (Frank). Since none of the other options name the correct person, and this option provides a possible pet for him, it is the only viable choice.

#### 💡 Quick Tip

For puzzles where a direction is specified (North/South), immediately establish the left/right convention for your diagram. Systematically use "hard" clues (ends, fixed distances) to build a skeleton, then use logical deduction and case-checking to fill in the details.

### 29. Consider the following alphanumeric series with powers:

$A^1, C^3, E^5, G^7, \dots, I^9, K^{11}, M^{13}, \dots$ . Based on the observed pattern, complete the series by selecting the correct options:

- (A)  $N^{15}, P^{17}$
- (B)  $H^9, J^{11}$
- (C)  $Q^{15}, S^{17}$
- (D)  $I^9, K^{11}$

**Correct Answer:** Not listed among the options (The correct continuation is  $O^{15}, Q^{17}$ )

### Solution:

#### Step 1: Understanding the Concept:

This is an alphanumeric series question where we need to identify two separate patterns: one for the letters (the base) and one for the numbers (the exponent). The series appears to have some missing or misplaced terms, so we must identify the core underlying logic.



**Step 2: Analyzing the Pattern of the Letters:**

The letters in the series are A, C, E, G, I, K, M...

Let's examine their positions in the alphabet:

A is the 1st letter.

C is the 3rd letter. (+2 from A)

E is the 5th letter. (+2 from C)

G is the 7th letter. (+2 from E)

The pattern for the letters is to advance by two positions in the alphabet for each subsequent term.

Following this pattern from M (13th letter):

- The next letter is M (+2) → O (15th letter).
- The letter after that is O (+2) → Q (17th letter).

**Step 3: Analyzing the Pattern of the Exponents:**

The exponents in the series are 1, 3, 5, 7, 9, 11, 13...

This is a simple arithmetic progression of consecutive odd numbers, starting with 1.

The pattern is clear. The exponent of each term is simply its alphabetical position.

**Step 4: Combining the Patterns to Continue the Series:**

Based on the two consistent patterns, the series should be:

$A^1, C^3, E^5, G^7, I^9, K^{11}, M^{13}, \dots$

The next terms must be:

- 15th letter (O) with exponent 15 →  $O^{15}$ .
- 17th letter (Q) with exponent 17 →  $Q^{17}$ .

**Step 5: Final Answer and Analysis of Options:**

The logical continuation of the series is  $O^{15}$  and  $Q^{17}$ . Let's compare this with the given options:

- (A)  $N^{15}, P^{17}$  - Incorrect letters.
  - (B)  $H^9, J^{11}$  - Incorrect letters and exponents.
  - (C)  $Q^{15}, S^{17}$  - Incorrect letters.
  - (D)  $I^9, K^{11}$  - These are already correct terms within the series, not the missing ones after M.
- None of the provided options correctly complete the series. Therefore, the answer is not listed.

**💡 Quick Tip**

In alphanumeric series, always analyze the letter and number patterns separately. For letters, check for constant skips (e.g., +2, +3) or patterns like vowels/consonants. For numbers, check for arithmetic or geometric progressions, squares, cubes, or a relationship to the letter's position.

**30. Given the statements: 1. All cats are animals. 2. Some animals are playful.**

**Conclusions: I. Some playful creatures are cats. II. All cats are playful.**

**Select the correct conclusions:**

- (A) Only Conclusion I follows.
- (B) Only Conclusion II follows.
- (C) Both Conclusions I and II follow.
- (D) Neither Conclusion I nor II follows.

**Correct Answer:** (D) Neither Conclusion I nor II follows.

**Solution:**

**Step 1: Understanding the Concept:**

This is a syllogism problem, which tests logical deduction based on given statements (premises). A conclusion is valid only if it is necessarily true in all possible scenarios that can be derived from the premises. We can use Venn diagrams to visualize the relationships between the categories.

**Step 2: Visualizing the Statements:**

1. **Statement 1: "All cats are animals."** This means the set of all 'Cats' is a subset of the set of 'Animals'. In a Venn diagram, the 'Cats' circle is completely inside the 'Animals' circle.
2. **Statement 2: "Some animals are playful."** This means there is an overlap between the set of 'Animals' and the set of 'Playful creatures'. The 'Playful' circle must intersect with the 'Animals' circle.

**Step 3: Detailed Explanation and Evaluation of Conclusions:**

The key point is that the overlap between 'Animals' and 'Playful' is not defined in relation to 'Cats'. There are two possible scenarios that fit the statements:

- **Scenario 1:** The playful animals mentioned are not cats (e.g., they are dogs, dolphins, etc.). In this case, the 'Playful' circle overlaps with the 'Animals' circle but does NOT overlap with the 'Cats' circle.
- **Scenario 2:** Some of the playful animals mentioned are cats. In this case, the 'Playful' circle overlaps with both the 'Animals' circle and the 'Cats' circle.

Now let's test the conclusions against these possibilities:

- **Conclusion I: "Some playful creatures are cats."**

This conclusion is true only in Scenario 2. However, it is false in Scenario 1. Since a conclusion must be true in *all* possible scenarios to be valid, this conclusion does not necessarily follow.

- **Conclusion II: "All cats are playful."**

This would mean the 'Cats' circle is completely inside the 'Playful' circle. Neither of the statements provides information to support this. Statement 2 only says "some" animals are playful, which cannot be extrapolated to "all cats." This conclusion is not supported.

**Step 4: Final Answer:**

Since neither Conclusion I nor Conclusion II is guaranteed to be true based on the given statements, the correct option is that neither follows.

 **Quick Tip**

In syllogisms, a conclusion is valid only if it's a logical certainty. If you can imagine even one scenario consistent with the premises where the conclusion is false, then the conclusion does not follow.

**31. Given the statements: 1. All smartphones are devices. 2. Some devices are expensive.**

**Conclusions: I. Some expensive things are smartphones. II. All smartphones are expensive.**

**Select the correct conclusions:**

- (A) Only Conclusion I follows.

- (B) Only Conclusion II follows.  
(C) Both Conclusions I and II follow.  
(D) Neither Conclusion I nor II follows.

**Correct Answer:** (D) Neither Conclusion I nor II follows.

**Solution:**

**Step 1: Understanding the Concept:**

This is a logical deduction problem based on two premises. The validity of the conclusions depends on whether they are a necessary consequence of the premises. This problem is structurally identical to the previous one and can be solved using the same logic.

**Step 2: Visualizing the Statements:**

1. **Statement 1: "All smartphones are devices."** This establishes that the category 'Smartphones' is entirely contained within the larger category 'Devices'.
2. **Statement 2: "Some devices are expensive."** This means there is an intersection between the category 'Devices' and the category 'Expensive things'. It does not specify which devices are expensive.

**Step 3: Detailed Explanation and Evaluation of Conclusions:**

The critical point is that the "expensive" characteristic applies to "some devices," but we do not know if this group of expensive devices includes smartphones. For example, the expensive devices could be laptops, smartwatches, or tablets, all of which are devices but not smartphones.

**- Conclusion I: "Some expensive things are smartphones."**

This conclusion assumes that the group of 'expensive devices' must overlap with the 'smartphones' subgroup. This is a possibility, but not a certainty. The expensive devices could be exclusively non-smartphone devices. Since this conclusion is not guaranteed, it does not logically follow.

**- Conclusion II: "All smartphones are expensive."**

This is a much stronger claim. The statements provide no information to support it. Statement 2 only says "some" devices are expensive, which cannot be used to conclude that "all" of a specific type of device (smartphones) are expensive. This conclusion does not follow.

**Step 4: Final Answer:**

Neither conclusion can be definitively proven from the given statements. There is no necessary logical link between 'smartphones' and 'expensive' based on the premises.

**💡 Quick Tip**

Be careful with the word "some." It means "at least one" and does not imply "all." Also, when a property is applied to a general set (like devices), it does not automatically apply to a specific subset (like smartphones) unless explicitly stated.

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**32. Consider the following information:**

**Set A: Animals that can fly**

**Set B: Birds**

**Set C: Animals that live in water**

Using Venn diagrams, represent the relationships between these sets and answer the question. Which region(s) in the Venn diagram represents animals that can fly and also live in water?

- (A) Region A
- (B) Region B
- (C) Regions A and B
- (D) Regions B and C

**Correct Answer:** Not listed among the options.

**Solution:**

**Step 1: Understanding the Concept:**

Venn diagrams use overlapping circles to show the logical relationships between sets. The question asks to identify a region that represents the combination of two properties. The word "and" is a key indicator of the required logical operation.

**Step 2: Translating the Requirement into Set Notation:**

- "Animals that can fly" corresponds to **Set A**.
- "Animals that live in water" corresponds to **Set C**.
- The phrase "and also" signifies a logical **intersection**. An intersection includes only the elements that are present in *both* sets.
- Therefore, the question is asking for the region that represents the intersection of Set A and Set C, which is written as  $A \cap C$ .

**Step 3: Analyzing the Options:**

Let's evaluate what each option represents in set theory:

- **(A) Region A:** This represents ALL animals that can fly, including those that do not live in water (like a bat or a robin). This is too broad.
- **(B) Region B:** This represents ALL birds, including non-flying birds (like an ostrich) and birds that don't live in water. This is incorrect.
- **(C) Regions A and B:** This phrasing could mean  $A \cup B$  (the union, "A or B") or  $A \cap B$  (the intersection, "A and B"). Neither represents "fly and live in water."
- **(D) Regions B and C:** This would most likely represent the intersection  $B \cap C$ , meaning "birds that live in water" (like a penguin or a duck). This is not the same as all animals that can fly and live in water (it excludes non-birds like flying fish).

**Step 4: Final Answer:**

The correct representation for "animals that can fly and also live in water" is the intersection of Set A and Set C ( $A \cap C$ ). Since this specific intersection is not provided as an option, the question is flawed or the intended answer is not listed.

 **Quick Tip**

In Venn diagram problems, translate verbal descriptions into set operations. Remember these keywords: - **AND** means **Intersection** ( $\cap$ ): The overlapping region. - **OR** means **Union** ( $\cup$ ): All regions of the sets combined. - **NOT** means **Complement**: Everything outside the set. - **ONLY** means you must subtract the overlapping parts.

**33. Arrange the following words in lexicographical (dictionary) order from highest to lowest:**

**1. Elephant 2. Banana 3. Apple 4. Cherry**

- (A) Elephant, Cherry, Banana, Apple
- (B) Elephant, Cherry, Apple, Banana
- (C) Cherry, Elephant, Banana, Apple
- (D) Cherry, Elephant, Apple, Banana

**Correct Answer:** (A) Elephant, Cherry, Banana, Apple

**Solution:**

**Step 1: Understanding Lexicographical Order:**

Lexicographical order is the standard alphabetical order used in dictionaries. The question asks for the order from "highest to lowest," which means reverse alphabetical order (from Z to A).

**Step 2: Arranging in Ascending (A-Z) Order:**

First, let's arrange the words in standard dictionary order by comparing their first letters.

- Apple
- Banana
- Cherry
- Elephant

The correct ascending (A to Z) order is: Apple, Banana, Cherry, Elephant.

**Step 3: Reversing for Descending (Z-A) Order:**

To get the order from "highest to lowest," we simply reverse the ascending list we just created.

- Ascending: Apple, Banana, Cherry, Elephant
- Descending: **Elephant, Cherry, Banana, Apple**

**Step 4: Final Answer:**

The correct descending lexicographical order is Elephant, Cherry, Banana, Apple. This matches option (A).

 **Quick Tip**

To avoid confusion with "highest to lowest," simply find the normal (A-Z) alphabetical order first. Then, reverse that entire list to get the descending (Z-A) order.

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**34. Arrange the following words in lexicographical (dictionary) order from highest to lowest:**

**1. Sunflower 2. Rainbow 3. Mountain 4. Ocean**

- (A) Sunflower, Ocean, Rainbow, Mountain
- (B) Ocean, Rainbow, Sunflower, Mountain
- (C) Sunflower, Rainbow, Mountain, Ocean
- (D) Rainbow, Sunflower, Ocean, Mountain

**Correct Answer:** Logically correct answer is (C) Sunflower, Rainbow, Mountain, Ocean (re-evaluation based on a common error pattern) or more precisely 'Sunflower, Rainbow, Ocean, Mountain' which is not listed.

**Solution:**

**Step 1: Understanding Lexicographical Order:**

Lexicographical order refers to alphabetical order. The instruction "from highest to lowest" requires arranging the words in reverse alphabetical order (Z to A).

**Step 2: Arranging in Ascending (A-Z) Order:**

We compare the words based on their first letter to establish the standard dictionary order.

- Mountain (M)
- Ocean (O)
- Rainbow (R)
- Sunflower (S)

The correct ascending (A to Z) order is: Mountain, Ocean, Rainbow, Sunflower.

**Step 3: Reversing for Descending (Z-A) Order:**

To get the order from "highest to lowest," we reverse the ascending list. The first letters in reverse alphabetical order are S, R, O, M.

- Descending Order: **Sunflower, Rainbow, Ocean, Mountain.**

**Step 4: Final Answer and Analysis of Options:**

The logically derived correct answer is 'Sunflower, Rainbow, Ocean, Mountain'. However, this exact sequence is not available in the options. Let's re-examine the options. Option (A) is 'Sunflower, Ocean, Rainbow, Mountain', which incorrectly places Ocean before Rainbow. Option (C) is 'Sunflower, Rainbow, Mountain, Ocean', which incorrectly places Mountain before Ocean.

This indicates a likely error in the question's options or the provided answer key. If we assume a typo in the intended answer and look for the option that is "closest" by having the first and second words correct, '(C) Sunflower, Rainbow, Mountain, Ocean' might be the intended answer despite the error in the last two words. Without a matching correct option, the question is flawed.

 **Quick Tip**

When sorting in descending order, compare the first letters of each word against the reverse alphabet (Z, Y, X...). In this case: S comes before R, which comes before O, which comes before M.

**35. Identify the pattern in the number series and complete the sequence: 2, 5, 10, 17, --, --**

- (A) 26, 37
- (B) 25, 36
- (C) 28, 41
- (D) 24, 33

**Correct Answer:** (A) 26, 37

**Solution:**

**Step 1: Understanding the Concept:**

Number series questions require identifying the mathematical relationship between the terms in a sequence in order to predict the subsequent terms. There can be multiple ways to

identify the pattern.

**Step 2: Identifying the Pattern:**

**Method 1: Difference between Consecutive Terms**

Let's find the difference between each term and the one before it.

- $5 - 2 = 3$
- $10 - 5 = 5$
- $17 - 10 = 7$

The differences are 3, 5, and 7. This is a simple progression of consecutive odd numbers. The next differences in the series should be 9 and 11.

**Method 2: Relation to Square Numbers**

Let's observe the relationship of each term to the sequence of perfect squares

(1, 4, 9, 16, 25, ...).

- $2 = 1^2 + 1$
- $5 = 2^2 + 1$
- $10 = 3^2 + 1$
- $17 = 4^2 + 1$

The pattern is  $n^2 + 1$ , where  $n$  is the position of the term in the sequence (starting with  $n = 1$ ).

**Step 3: Calculating the Next Terms:**

Using either method, we can find the next two terms.

**Using Method 1 (Differences):**

- The next term is  $17 + 9 = 26$ .
- The term after that is  $26 + 11 = 37$ .

**Using Method 2 (Formula):**

- The fifth term ( $n = 5$ ) is  $5^2 + 1 = 25 + 1 = 26$ .
- The sixth term ( $n = 6$ ) is  $6^2 + 1 = 36 + 1 = 37$ .

Both methods yield the same result.

**Step 4: Final Answer:**

The next two numbers in the sequence are 26 and 37. This matches option (A).

**💡 Quick Tip**

When you see a number series, first check the differences between terms. If the differences form a simple pattern (like arithmetic progression), you've found the logic. If not, check if the terms are related to squares, cubes, or factorials.

**36. Identify the pattern in the number series and complete the sequence: 3, 8, 15, 24, --, --**

- (A) 35, 48 (Note: Corrected the second number from the PDF's 46 to the logical 48)
- (B) 32, 43
- (C) 33, 44
- (D) 28, 39

**Correct Answer:** (A) 35, 48

**Solution:**

**Step 1: Understanding the Concept:**

This question requires identifying the underlying mathematical rule governing a sequence of numbers to predict the next terms. Common methods include checking for a constant difference, a patterned difference, or a formula related to the term's position.

**Step 2: Identifying the Pattern:****Method 1: Difference between Consecutive Terms**

Let's calculate the difference between each term and the previous one.

- $8 - 3 = 5$
- $15 - 8 = 7$
- $24 - 15 = 9$

The differences are 5, 7, and 9. This is an arithmetic progression of consecutive odd numbers. The next differences in the series must be 11 and 13.

**Method 2: Relation to Square Numbers**

Let's see how each term relates to the sequence of perfect squares starting from  $n = 2$  (4, 9, 16, 25, ...).

- $3 = 2^2 - 1$
- $8 = 3^2 - 1$
- $15 = 4^2 - 1$
- $24 = 5^2 - 1$

The pattern is  $n^2 - 1$ , where  $n$  is the position of the term plus one ( $n = \text{position} + 1$ ).

**Step 3: Calculating the Next Terms:**

We can use either method to find the next two terms.

**Using Method 1 (Differences):**

- The next term is the previous term (24) plus the next difference (11):  $24 + 11 = 35$ .
- The term after that is 35 plus the next difference (13):  $35 + 13 = 48$ .

**Using Method 2 (Formula):**

- The fifth term in the sequence corresponds to  $n = 6$ :  $6^2 - 1 = 36 - 1 = 35$ .
- The sixth term in the sequence corresponds to  $n = 7$ :  $7^2 - 1 = 49 - 1 = 48$ .

**Step 4: Final Answer:**

Both methods confirm that the next two numbers in the sequence are 35 and 48. This corresponds to option (A). (Note: The provided PDF solution key has a calculation error, listing 46 instead of 48 for the final term.)

**💡 Quick Tip**

When the first differences between terms form a simple arithmetic sequence (like increasing by 2 each time), this indicates a quadratic relationship. Looking for a connection to square numbers ( $n^2$ ) is often the fastest way to find the formula.

**37. Statement:** Increasing the minimum wage will improve the overall economy.

**Arguments:**

- I.** Higher wages lead to increased consumer spending, which boosts economic activity.
- II.** Employers will struggle to afford increased wages, leading to job losses.
- III.** The government should focus on other economic policies rather than raising



the minimum wage.

Which of the following is a strong argument?

- (A) Only I
- (B) Only II
- (C) Only III
- (D) Both I and III

**Correct Answer:** (A) Only I

**Solution:**

**Step 1: Understanding the Concept:**

A "strong argument" is one that is logically sound, directly relevant to the statement, and provides a clear reason to support or oppose the statement. A "weak argument" may be irrelevant, ambiguous, based on opinion without evidence, or fail to address the core issue. The question asks us to evaluate which argument strongly supports or refutes the statement.

**Step 2: Detailed Explanation of Each Argument:**

- **Argument I: Higher wages lead to increased consumer spending, which boosts economic activity.**

- **Relevance:** This argument is directly relevant. It provides a clear cause-and-effect mechanism explaining *how* increasing the minimum wage could improve the economy.

- **Logic:** The reasoning is logical and based on a standard economic principle (the multiplier effect of consumer spending).

- **Strength:** It provides a strong, positive case in favor of the statement.

- **Argument II: Employers will struggle to afford increased wages, leading to job losses.**

- **Relevance:** This argument is also directly relevant, as it presents a potential negative consequence that would harm the economy, thus opposing the statement.

- **Logic:** The reasoning is a common counter-argument. However, it's presented as a simple assertion without evidence. The extent of job losses is a complex and debated issue. While relevant, it is often considered strong only if it's supported by data, which is absent here. In the context of "strong vs. weak," Argument I provides a clearer positive mechanism.

- **Argument III: The government should focus on other economic policies rather than raising the minimum wage.**

- **Relevance:** This argument is weak because it is evasive. It doesn't argue against the merits or demerits of raising the minimum wage itself. Instead, it shifts the focus to "other policies."

- **Logic:** It suggests an alternative without explaining why the proposed action is bad or ineffective. This is a form of a "red herring" fallacy.

- **Strength:** This is a weak argument because it avoids engaging with the core issue.

**Step 3: Final Answer:**

Argument I is the strongest because it provides a direct, logical, and well-reasoned explanation that supports the statement. Argument II presents a relevant counterpoint but is less structured as a complete argument here. Argument III is weak and evasive. Therefore, Argument I is the strongest.

 Quick Tip

A strong argument directly addresses the statement with clear reasoning. A weak argument is often vague, irrelevant, emotionally biased, or simply states an opinion without justification. Look for the argument that explains the "why" or "how" most effectively.

**38. Statement:** Regular exercise is essential for maintaining good health.

**Arguments:**

**I.** Many successful people do not prioritize regular exercise, yet they are healthy.

**II.** People with busy lifestyles cannot find time for regular exercise.

**III.** Scientific studies consistently show the health benefits of regular exercise.

**Which of the following is a strong argument?**

- (A) Only I
- (B) Only II
- (C) Only III
- (D) Both I and III

**Correct Answer:** (C) Only III

**Solution:**

**Step 1: Understanding the Concept:**

We need to determine which argument provides the most logical and evidence-based support for the given statement. A strong argument should be based on verifiable facts or widely accepted principles, not on generalizations or anecdotal evidence.

**Step 2: Detailed Explanation of Each Argument:**

- **Argument I: Many successful people do not prioritize regular exercise, yet they are healthy.**

- **Type of Evidence:** Anecdotal. It relies on specific, unverified examples ("many successful people").

- **Logic:** This is a weak argument because it presents exceptions to the rule, which do not invalidate the general principle. Health is determined by many factors (genetics, diet, etc.), not just exercise. A few examples of healthy people who don't exercise do not disprove the overall benefits of exercise.

- **Strength:** Weak.

- **Argument II: People with busy lifestyles cannot find time for regular exercise.**

- **Type of Evidence:** Generalization. It makes a sweeping claim about a large group of people.

- **Logic:** This argument is weak because it doesn't address whether exercise is essential for health. Instead, it discusses the *difficulty* of doing it. Whether something is difficult is irrelevant to whether it is essential. Furthermore, the claim that people "cannot" find time is an overstatement and not universally true.

- **Strength:** Weak.

- **Argument III: Scientific studies consistently show the health benefits of regular exercise.**

- **Type of Evidence:** Empirical and evidence-based. It refers to scientific research, which is a reliable source of information for health claims.

- **Logic:** This argument directly supports the statement. If scientific studies consistently show health benefits, it provides a strong reason to believe that exercise is indeed essential for good health. This is the most robust form of reasoning.
- **Strength:** Strong.

**Step 3: Final Answer:**

Argument III is the only one that uses strong, evidence-based reasoning (appeal to scientific evidence) to directly support the statement. Arguments I and II are weak because they rely on anecdotal evidence and generalizations, respectively.

**💡 Quick Tip**

In evaluating arguments, give the most weight to those based on objective, verifiable evidence like scientific studies or established facts. Arguments based on personal examples (anecdotes), stereotypes, or unsubstantiated opinions are almost always weak.

**39. A person starts walking towards the east and covers a distance of 4 km. Then, the person turns right and walks 3 km. After that, the person turns left and covers 5 km. Finally, the person turns left again and walks 2 km. In which direction is the person now with respect to the starting point?**

- (A) North
- (B) South
- (C) East
- (D) West

**Correct Answer:** (C) East

**Solution:**

**Step 1: Understanding the Concept:**

This is a direction-sense problem that can be solved by tracking the movement on a 2D Cartesian plane. We can set the starting point as the origin (0,0) and represent East as the positive x-axis and North as the positive y-axis.

**Step 2: Key Formula or Approach:**

- Movement East:  $+x$
- Movement West:  $-x$
- Movement North:  $+y$
- Movement South:  $-y$

We will track the person's coordinates after each move.

**Step 3: Detailed Explanation of Movements:**

**1. Starts at Origin O(0,0). Walks 4 km East.**

The new position is  $P1(0 + 4, 0) = \mathbf{P1(4, 0)}$ . The person is facing East.

**2. Turns right from East and walks 3 km.**

A right turn from East means the person is now facing South. They walk 3 km South. The new position is  $P2(4, 0 - 3) = \mathbf{P2(4, -3)}$ . The person is facing South.

**3. Turns left from South and walks 5 km.**

A left turn from South means the person is now facing East. They walk 5 km East. The new position is  $P3(4 + 5, -3) = \mathbf{P3(9, -3)}$ . The person is facing East.

**4. Turns left from East and walks 2 km.**

A left turn from East means the person is now facing North. They walk 2 km North. The final position is  $P_4(9, -3 + 2) = \mathbf{P_4(9, -1)}$ .

**Step 4: Determining the Final Direction:**

- The starting point was (0,0).
- The final point is (9, -1).
- This means the net displacement is 9 km along the positive x-axis (East) and 1 km along the negative y-axis (South).
- The final position is in the South-East quadrant relative to the starting point.
- Since the options are single cardinal directions and the Eastward displacement (9 km) is much larger than the Southward displacement (1 km), the predominant direction is **East**.

**Step 5: Final Answer:**

The final position (9, -1) is located to the East and slightly to the South of the starting point (0,0). Given the options, the best description of the direction is East.

 **Quick Tip**

Using a coordinate system is a reliable way to solve direction problems. Define your axes (e.g., East = +x, North = +y), track the (x,y) coordinates after each step, and find the final position relative to the origin (0,0).

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**40. A car travels 10 km towards the north, then turns left and covers 5 km. After that, it turns right and travels 8 km. Finally, the car turns left and covers 3 km. In which direction is the car now with respect to the starting point?**

- (A) North
- (B) South
- (C) East
- (D) West

**Correct Answer:** (A) North

**Solution:**

**Step 1: Understanding the Concept:**

This problem requires tracking the net displacement of an object after a series of movements and turns. Using a coordinate system is an effective method. We'll define North as the positive y-axis and East as the positive x-axis. The starting point is the origin (0,0).

**Step 2: Detailed Explanation of Movements:**

**1. Starts at O(0,0). Travels 10 km North.**

The position becomes  $P_1(0, 0 + 10) = \mathbf{P_1(0, 10)}$ . The car is facing North.

**2. Turns left from North and covers 5 km.**

A left turn from North means the car now faces West. It travels 5 km West. The position becomes  $P_2(0 - 5, 10) = \mathbf{P_2(-5, 10)}$ . The car is facing West.

**3. Turns right from West and travels 8 km.**

A right turn from West means the car now faces North. It travels 8 km North. The position becomes  $P_3(-5, 10 + 8) = \mathbf{P_3(-5, 18)}$ . The car is facing North.

**4. Turns left from North and covers 3 km.**

A left turn from North means the car now faces West. It travels 3 km West.

The final position is  $P4(-5 - 3, 18) = \mathbf{P4(-8, 18)}$ .

**Step 3: Determining the Final Direction:**

- The starting point was the origin (0,0).
- The final point is (-8, 18).
- This represents a net displacement of 8 km to the West (negative x-direction) and 18 km to the North (positive y-direction).
- The final location is in the North-West quadrant relative to the starting point.
- To determine the principal direction from the given options, we compare the magnitudes of the displacement components. The Northward displacement (18 km) is significantly larger than the Westward displacement (8 km).
- Therefore, the car is predominantly to the **North** of its starting point.

**Step 4: Final Answer:**

The final position (-8, 18) is North-West of the origin. Since the North component (18) is larger than the West component (8), the main direction relative to the start is North.

 **Quick Tip**

After calculating the final coordinates (x, y), compare the absolute values  $|x|$  and  $|y|$ . If  $|y| > |x|$ , the predominant direction is North or South. If  $|x| > |y|$ , the predominant direction is East or West. The signs of x and y will tell you the exact direction (e.g.,  $x < 0, y > 0$  is North-West).

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**QUANTS**

**41. The mean of 50 observations is 28. Later it was found that the value 70 had been recorded as 7 and the value 24 had been recorded as 42. Find the correct average.**

- (A) 27.1
- (B) 26
- (C) 24.5
- (D) 32.2

**Correct Answer:** Correct calculated answer is 28.9, which is not among the options.

**Solution:**

**Step 1: Understanding the Concept:**

The mean (or average) is calculated by dividing the sum of all observations by the number of observations. If some observations are recorded incorrectly, the calculated sum will be incorrect. To find the correct mean, we must first find the correct sum by adjusting for the errors.

**Step 2: Key Formula or Approach:**

The fundamental relationship is:

$$\text{Sum of Observations} = \text{Mean} \times \text{Number of Observations}$$

We will calculate the incorrect sum, apply corrections to find the correct sum, and then calculate the correct mean.

$$\text{Correct Mean} = \frac{\text{Correct Sum}}{\text{Number of Observations}}$$

**Step 3: Detailed Explanation:**

**1. Calculate the Incorrect Sum:**

Given that the incorrect mean is 28 for 50 observations, the sum they were working with was:

$$\text{Incorrect Sum} = 28 \times 50 = 1400$$

**2. Calculate the Net Correction:**

We need to adjust the sum for the two errors.

- **Error 1:** The value 70 was incorrectly recorded as 7. The recorded value was too low.

Correction needed = (Correct Value) - (Incorrect Value) =  $70 - 7 = +63$ . We must add 63 to the sum.

- **Error 2:** The value 24 was incorrectly recorded as 42. The recorded value was too high.

Correction needed = (Correct Value) - (Incorrect Value) =  $24 - 42 = -18$ . We must subtract 18 from the sum.

**3. Calculate the Correct Sum:**

We apply these corrections to the incorrect sum.

$$\text{Correct Sum} = \text{Incorrect Sum} + 63 - 18$$

$$\text{Correct Sum} = 1400 + 45 = 1445$$

**4. Calculate the Correct Mean:**

Now we use the correct sum and the original number of observations (which hasn't changed).

$$\text{Correct Mean} = \frac{1445}{50} = 28.9$$

**Step 4: Final Answer:**

The correct average is 28.9. This value does not match any of the given options. There is likely an error in the question's options or the provided correct answer. Based on the data given, the calculated correct mean is 28.9.

**💡 Quick Tip**

When correcting a mean, the most efficient method is to find the net change required for the sum. Sum up all the differences between correct and incorrect values ('Correct - Incorrect'). Add this net difference to the original sum and then re-calculate the mean.

**42. If  $\log(10x) = 3$ , what is the value of  $x$ ?**

- (A) 10
- (B) 100
- (C) 1,000
- (D) 1

**Correct Answer:** (B) 100

**Solution:**

**Step 1: Understanding the Concept:**

The equation involves a logarithm. When the base of a logarithm is not explicitly written (as in 'log(A)'), it is assumed to be the common logarithm, which has a base of 10. The logarithm is the inverse operation of exponentiation.

**Step 2: Key Formula or Approach:**

The fundamental definition of a logarithm is:

$$\log_b(A) = k \text{ is equivalent to } A = b^k$$

We will use this definition to convert the given logarithmic equation into an exponential equation, which is easier to solve.

**Step 3: Detailed Explanation:**

**1. Rewrite the equation with the base:**

The given equation is 'log(10x) = 3'. This means 'log' to the base 10.

$$\log_{10}(10x) = 3$$

**2. Convert to exponential form:**

Using the rule ' $\log_b(A) = k \Rightarrow A = b^k$ ', with ' $b = 10$ ', ' $A = 10x$ ', and ' $k = 3$ ' :

$$10x = 10^3$$

**3. Solve for x:**

We know that  $10^3 = 10 \times 10 \times 10 = 1000$ .

$$10x = 1000$$

Divide both sides by 10:

$$x = \frac{1000}{10} = 100$$

**4. Verification:**

Substitute  $x = 100$  back into the original equation to check the answer.

$$\log(10 \times 100) = \log(1000) = \log(10^3) = 3$$

The solution is correct.

**Step 4: Final Answer:**

The value of x is 100. Therefore, option (B) is the correct answer.

 **Quick Tip**

Remember the relationship: ' $\log(A) = k$ ' means "10 to the power of what gives A?". So if ' $\log(\text{something}) = 3$ ', that "something" must be ' $10^3$ ' or 1000.

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**43. A printing press has three machines: A, B, and C. If all three work together, they complete the task in 4 hours. If machine C is not used, the task is completed**

in 6 hours. If only machines A and B are used, the task is completed in 9 hours. How many hours would it take for machine C alone to complete the entire task?

- (A) 12 hours
- (B) 15 hours
- (C) 18 hours
- (D) 24 hours

**Correct Answer:** (A) 12 hours (Based on a logical interpretation of the inconsistent data)

**Solution:**

**Step 1: Understanding the Concept:**

This is a work-rate problem. The key is to work with the rates of the machines (how much of the task they complete per hour), not the time. The rate is the reciprocal of the time taken. If a machine takes  $T$  hours to complete a task, its rate is  $1/T$  task/hour.

**Step 2: Identifying the Contradiction:**

Let the rates of machines A, B, and C be  $r_A, r_B, r_C$  respectively.

From the problem statement:

1. "If machine C is not used, the task is completed in 6 hours." This means machines A and B working together take 6 hours. So, their combined rate is  $r_A + r_B = 1/6$ .
2. "If only machines A and B are used, the task is completed in 9 hours." This is the same condition as statement 1, but gives a different time. This means their combined rate is  $r_A + r_B = 1/9$ .

The problem provides contradictory information ( $1/6 \neq 1/9$ ). Therefore, the question is flawed as written.

**Step 3: Solving Based on a Likely Interpretation:**

In competitive exams, such questions often have a typo, and one of the contradictory statements is the intended one. Let's solve for both possibilities.

The non-contradictory information is:

- All three machines together take 4 hours:  $r_A + r_B + r_C = 1/4$ .

**Scenario 1: Assume the time for A and B together is 6 hours.**

- We have  $r_A + r_B = 1/6$ .
- We also have  $(r_A + r_B) + r_C = 1/4$ .
- Substitute the combined rate of A and B:  $1/6 + r_C = 1/4$ .
- Solve for C's rate:  $r_C = 1/4 - 1/6 = 3/12 - 2/12 = 1/12$ .
- The time for C alone is the reciprocal of its rate:  $\text{Time}_C = 1/r_C = 12$  hours. This matches option (A).

**Scenario 2: Assume the time for A and B together is 9 hours.**

- We have  $r_A + r_B = 1/9$ .
- Substitute into the main equation:  $1/9 + r_C = 1/4$ .
- Solve for C's rate:  $r_C = 1/4 - 1/9 = 9/36 - 4/36 = 5/36$ .
- The time for C alone is:  $\text{Time}_C = 1/r_C = 36/5 = 7.2$  hours. This does not match any option.

**Step 4: Final Answer:**

Since Scenario 1 leads to a valid option (12 hours) and Scenario 2 does not, it is highly probable that the "9 hours" was a typo and the intended time for A and B was 6 hours. Therefore, the most logical answer is 12 hours. The provided answer key's choice of (C) 18 hours cannot be logically derived from any reasonable interpretation of the text.



 Quick Tip

When faced with contradictory information in a work-rate problem, state the contradiction. Then, test each piece of conflicting information separately. The one that leads to a valid answer choice is likely based on the intended, non-typo version of the problem.

**44. A shopkeeper marked a watch 25% above its cost price, sold it with a 15% discount, and received \$850. Find the cost price.**

- (A) \$1000
- (B) \$800
- (C) \$900
- (D) \$750

**Correct Answer:** (B) \$800

**Solution:**

**Step 1: Understanding the Concept:**

This problem involves a sequence of percentage changes: a markup followed by a discount. We need to find the original Cost Price (CP) given the final Selling Price (SP). The key is to relate CP to SP through the Marked Price (MP).

**Step 2: Key Formula or Approach:**

Let  $C$  be the Cost Price.

1. A markup of  $x\%$  means the new price is  $(1 + x/100)$  times the old price.
2. A discount of  $y\%$  means the new price is  $(1 - y/100)$  times the old price.

We can create a single equation:  $CP \times (\text{Markup Factor}) \times (\text{Discount Factor}) = SP$

**Step 3: Detailed Explanation:**

**1. Define the Markup Factor:**

The watch is marked up by 25%. The markup factor is  $1 + 0.25 = 1.25$ .

So, Marked Price (MP) =  $C \times 1.25$ .

**2. Define the Discount Factor:**

It is sold with a 15% discount. The discount is applied to the Marked Price. The discount factor is  $1 - 0.15 = 0.85$ .

So, Selling Price (SP) =  $MP \times 0.85$ .

**3. Combine into a Single Equation:**

We can substitute the expression for MP into the SP equation:

$$SP = (C \times 1.25) \times 0.85$$

$$SP = C \times (1.25 \times 0.85)$$

$$SP = C \times 1.0625$$

**4. Solve for the Cost Price (C):**

We are given that the final Selling Price (SP) is \$850.

$$850 = C \times 1.0625$$

$$C = \frac{850}{1.0625}$$

$$C = 800$$

#### Step 4: Verification and Final Answer:

Let's check the answer.

- Cost Price (CP) = \$800.
- Marked Price (MP) =  $\$800 \times 1.25 = \$1000$ .
- Selling Price (SP) =  $\$1000 \times 0.85 = \$850$ .

This matches the information given in the problem. The cost price is \$800. (Note: The PDF's header indicating the answer is \$1000 is incorrect, but its detailed calculation correctly arrives at \$800).

#### 💡 Quick Tip

For problems with successive percentage changes (like markup then discount), it's best to multiply the factors. A 25% markup is a factor of 1.25. A 15% discount is a factor of 0.85. The final price is  $CP \times 1.25 \times 0.85$ . This avoids intermediate calculations and reduces errors.

**45. A trader marked up shirts by 40%, offered a 20% discount during a sale, and sold each for \$234. Find the number of shirts he purchased.**

- (A) 25 shirts
- (B) 20 shirts
- (C) 30 shirts
- (D) Cannot be determined

**Correct Answer:** (D) Cannot be determined

#### Solution:

##### Step 1: Understanding the Concept:

The problem gives information about the pricing of a single shirt (markup, discount, final selling price). It then asks for the total number of shirts purchased. To find a quantity, we typically need a total value (like total revenue or total cost) in addition to the per-unit value.

##### Step 2: Calculate the Cost Price of a Single Shirt:

Let  $C$  be the cost price per shirt. We can find  $C$  using the same method as the previous problem.

1. **Markup Factor:** 40% markup means a factor of  $1 + 0.40 = 1.4$ .

Marked Price (MP) =  $C \times 1.4$ .

2. **Discount Factor:** 20% discount means a factor of  $1 - 0.20 = 0.8$ .

Selling Price (SP) =  $MP \times 0.8$ .

3. **Combined Equation:**

$$SP = (C \times 1.4) \times 0.8 = C \times 1.12$$

4. **Solve for C:**

We are given  $SP = \$234$ .

$$234 = C \times 1.12$$

$$C = \frac{234}{1.12} \approx \$208.93$$

So, we know the cost and selling price for one shirt.

**Step 3: Analyze the Final Question:**

The question asks for the "number of shirts he purchased." The formula for this would be:

$$\text{Number of Shirts} = \frac{\text{Total Cost of all Shirts}}{\text{Cost Price per Shirt (C)}}$$

or

$$\text{Number of Shirts} = \frac{\text{Total Revenue from all Shirts}}{\text{Selling Price per Shirt (SP)}}$$

The problem provides the per-shirt values (SP = \$234, and we calculated  $C \approx \$208.93$ ), but it does **not** provide any total amount (total cost or total revenue).

**Step 4: Final Answer:**

Without information on the total amount of money spent or received, it is impossible to determine the total number of shirts purchased. The problem has missing information. Therefore, the correct answer is that it cannot be determined.

 Quick Tip

Be vigilant for questions with missing information. If a question asks for a total quantity, you must be given a total value somewhere in the problem. If you only have per-unit information, you can only calculate other per-unit values.

**46. In a group of 5 students, how many ways can the positions of president, vice-president, and treasurer be filled?**

- (A) 60
- (B) 120
- (C) 30
- (D) 210

**Correct Answer:** (A) 60

**Solution:**

**Step 1: Understanding the Concept:**

This is a counting problem. We need to determine if the order of selection matters. Since the positions (president, vice-president, treasurer) are distinct and unique, assigning Student A as President and Student B as VP is different from assigning Student B as President and Student A as VP. When order matters, we use **permutations**.

**Step 2: Approach 1 - The Multiplication Principle (Slot Method):**

We can think of filling the three positions one by one.

1. **President:** There are 5 students available to choose from. So, there are 5 ways to fill this position.

2. **Vice-President:** After a president is chosen, there are 4 students remaining. So, there are 4 ways to fill this position.

3. **Treasurer:** After the first two positions are filled, there are 3 students remaining. So, there are 3 ways to fill this position.

The total number of ways is the product of the choices for each position:

$$\text{Total Ways} = 5 \times 4 \times 3 = 60$$

### Step 3: Approach 2 - The Permutation Formula:

The number of ways to arrange 'r' items from a set of 'n' distinct items is given by the permutation formula:

$${}_nP_r = \frac{n!}{(n-r)!}$$

In this problem:

- 'n' = total number of students = 5.

- 'r' = number of positions to fill = 3.

Substituting these values into the formula:

$${}_5P_3 = \frac{5!}{(5-3)!} = \frac{5!}{2!} = \frac{5 \times 4 \times 3 \times 2 \times 1}{2 \times 1} = 5 \times 4 \times 3 = 60$$

### Step 4: Final Answer:

Both methods yield the same result. There are 60 different ways to fill the three positions. Therefore, option (A) is the correct answer.

#### Quick Tip

Remember the difference: use **Permutations** when the order of selection creates a different outcome (e.g., specific roles, arranging letters in a word). Use **Combinations** when the order does not matter (e.g., forming a committee with identical roles).

---

47. In a division sum, the divisor  $d = 457$ , the quotient  $q = 110$ , and the remainder  $r = 242$ . Find the dividend.

- (A) 50512
- (B) 50270
- (C) 50272
- (D) 50702

**Correct Answer:** (A) 50512

#### **Solution:**

##### **Step 1: Understanding the Concept:**

This problem uses the fundamental principle of division, known as the Division Algorithm. It states that for any two integers, a dividend and a divisor, there exist a unique quotient and remainder.

##### **Step 2: Key Formula or Approach:**

The relationship between the four components of division is given by the formula:

$$\text{Dividend} = (\text{Divisor} \times \text{Quotient}) + \text{Remainder}$$

Let  $N$  be the dividend. The formula is:

$$N = (d \times q) + r$$

**Step 3: Detailed Explanation:**

**1. Identify the given values:**

- Divisor ( $d$ ) = 457
- Quotient ( $q$ ) = 110
- Remainder ( $r$ ) = 242

**2. Substitute the values into the formula:**

$$N = (457 \times 110) + 242$$

**3. Calculate the product ( $d \times q$ ):**

To make the multiplication easier, we can write 110 as  $(100 + 10)$ .

$$\begin{aligned} 457 \times 110 &= 457 \times (100 + 10) = (457 \times 100) + (457 \times 10) \\ &= 45700 + 4570 = 50270 \end{aligned}$$

**4. Add the remainder ( $r$ ):**

$$N = 50270 + 242$$

$$N = 50512$$

**5. Verification:**

A condition for the division algorithm is that the remainder must be less than the divisor ( $0 \leq r < d$ ). Here,  $242 < 457$ , which is true. The calculation is valid.

**Step 4: Final Answer:**

The dividend is 50512. Therefore, option (A) is the correct answer.

**💡 Quick Tip**

Always remember the Division Algorithm formula: 'Dividend = (Divisor  $\times$  Quotient) + Remainder'. After calculating, perform a quick check to ensure the remainder is smaller than the divisor.

---

**48. Three bells ring once every 12 minutes, 20 minutes and 36 minutes respectively. If all of them ring together at 6:30 a.m., at what time will they next ring together on the same morning?**

- (A) 8:30 a.m.
- (B) 9:30 a.m.
- (C) 10:30 a.m.
- (D) 11:30 a.m.

**Correct Answer:** (B) 9:30 a.m.

**Solution:**

**Step 1: Understanding the Concept:**

This is a synchronization problem. When events occur at regular, different intervals and start at the same time, the next time they will occur simultaneously is after a time interval that is the Least Common Multiple (LCM) of their individual intervals.

**Step 2: Key Formula or Approach:**

We need to find the LCM of the three time intervals: 12, 20, and 36 minutes. The most systematic way to find the LCM is through prime factorization.

**Step 3: Detailed Explanation:**

1. **Prime Factorization of each interval:**

$$12 = 2 \times 6 = 2 \times 2 \times 3 = 2^2 \times 3^1$$

$$20 = 2 \times 10 = 2 \times 2 \times 5 = 2^2 \times 5^1$$

$$36 = 2 \times 18 = 2 \times 2 \times 9 = 2^2 \times 3^2$$

2. **Calculate the LCM:**

The LCM is found by taking the highest power of each prime factor present in the numbers. The prime factors are 2, 3, and 5.

- Highest power of 2 is  $2^2$ .
- Highest power of 3 is  $3^2$ .
- Highest power of 5 is  $5^1$ .

$$\text{LCM}(12, 20, 36) = 2^2 \times 3^2 \times 5^1 = 4 \times 9 \times 5 = 180$$

So, the bells will ring together again after 180 minutes.

3. **Convert Minutes to Hours:**

There are 60 minutes in an hour.

$$\text{Time in hours} = \frac{180 \text{ minutes}}{60 \text{ minutes/hour}} = 3 \text{ hours}$$

4. **Calculate the Next Ringing Time:**

The bells last rang together at 6:30 a.m. They will ring together again after 3 hours.

$$\text{Next Time} = 6 : 30 \text{ a.m.} + 3 \text{ hours} = 9 : 30 \text{ a.m.}$$

**Step 4: Final Answer:**

The bells will next ring together at 9:30 a.m. Therefore, option (B) is the correct answer.

 **Quick Tip**

For any problem involving recurring events at different intervals (like ringing bells, flashing lights, or runners on a circular track), the time until they align again is always the LCM of their individual time periods.

**49. The mean of 50 observations was 36. It was found later that an observation 48 was wrongly taken as 23. The corrected new mean is?**

- (A) 36.5
- (B) 37
- (C) 35.5
- (D) 37.5

**Correct Answer:** (A) 36.5

**Solution:**

**Step 1: Understanding the Concept:**

To correct an average after an error in one of the observations, we first need to find the sum of all observations that was used to calculate the incorrect mean. Then, we adjust this sum by removing the wrong value and adding the correct value. Finally, we calculate the new mean with the corrected sum.

**Step 2: Key Formula or Approach:**

$$\text{Sum} = \text{Mean} \times \text{Number of Observations}$$

$$\text{Correct Sum} = \text{Incorrect Sum} - \text{Wrong Value} + \text{Correct Value}$$

$$\text{Correct Mean} = \frac{\text{Correct Sum}}{\text{Number of Observations}}$$

**Step 3: Detailed Explanation:**

**1. Calculate the Incorrect Sum:**

The incorrect mean of 50 observations is 36.

$$\text{Incorrect Sum} = 36 \times 50 = 1800$$

**2. Calculate the Correct Sum:**

An observation was wrongly taken as 23 instead of 48.

We must subtract the wrong value (23) and add the correct value (48) to the sum.

$$\text{Correct Sum} = 1800 - 23 + 48$$

$$\text{Correct Sum} = 1800 + 25 = 1825$$

**3. Calculate the Correct Mean:**

The number of observations remains 50.

$$\text{Correct Mean} = \frac{1825}{50}$$

To simplify the division, we can multiply the numerator and denominator by 2:

$$\text{Correct Mean} = \frac{1825 \times 2}{50 \times 2} = \frac{3650}{100} = 36.5$$

**Step 4: Final Answer:**

The corrected new mean is 36.5. Therefore, option (A) is the correct answer.

 Quick Tip

A faster way is to find the net difference (Correct Value - Wrong Value) and distribute this difference over the number of observations. Here, the difference is  $48 - 23 = 25$ . The increase in the mean is  $\frac{25}{50} = 0.5$ . So, the new mean is  $36 + 0.5 = 36.5$ .

**50. In a collection of coins, the ratio of the number of 2-rupee coins to 5-rupee coins to 1-rupee coins is 3:4:5. If the total value of these coins is 18.75 rupees, how much money is represented by the 5-rupee coins?**

- (A) 3.75
- (B) 5.00
- (C) 6.25
- (D) 7.50

**Correct Answer:** The correct calculated value is approx 12.10, which is not an option, indicating an error in the question's data.

**Solution:**

**Step 1: Understanding the Concept:**

This problem combines ratios with monetary value. We need to set up an algebraic equation representing the total value of the coins in terms of a common multiplier, 'x', derived from the ratio.

**Step 2: Setting up the Value Equation:**

Let 'x' be the common multiplier for the ratio.

- Number of 2-rupee coins =  $3x$ . Their value is  $2 \times (3x) = 6x$  rupees.
- Number of 5-rupee coins =  $4x$ . Their value is  $5 \times (4x) = 20x$  rupees.
- Number of 1-rupee coins =  $5x$ . Their value is  $1 \times (5x) = 5x$  rupees.

The total value of all coins is the sum of these individual values:

$$\text{Total Value} = 6x + 20x + 5x = 31x$$

**Step 3: Solving for the Multiplier 'x':**

We are given that the total value is 18.75 rupees.

$$31x = 18.75$$

To avoid decimals, let's convert 18.75 to a fraction:  $18.75 = \frac{75}{4}$ .

$$\begin{aligned} 31x &= \frac{75}{4} \\ x &= \frac{75}{4 \times 31} = \frac{75}{124} \end{aligned}$$

**Step 4: Calculating the Value of 5-Rupee Coins:**

The question asks for the value represented by the 5-rupee coins, which we defined as  $20x$ .

$$\text{Value of 5-rupee coins} = 20x = 20 \times \left( \frac{75}{124} \right)$$



$$= \frac{1500}{124} = \frac{375}{31} \approx 12.096$$

The value is approximately 12.10 rupees.

**Step 5: Final Answer and Analysis:**

The calculated value of approximately 12.10 rupees does not match any of the provided options. This strongly suggests there is an error in the numbers given in the problem statement (either the ratio or the total value). For example, if the total value had been 11.625 rupees, the value of the 5-rupee coins would have been exactly 7.50 rupees. As the question stands, none of the options are correct.

**💡 Quick Tip**

When dealing with ratios of items with different values, create a "value ratio" first. Here, the number ratio is 3:4:5. The value ratio is  $(3 \times 2) : (4 \times 5) : (5 \times 1) = 6 : 20 : 5$ . The total value is split in this ratio.

**51. Rubina could get equal number of 55, 85 and 105 tickets for a movie. She spends 2940 for all the tickets. How many of each did she buy?**

- (A) 10
- (B) 12
- (C) 15
- (D) 20

**Correct Answer:** (B) 12

**Solution:**

**Step 1: Understanding the Concept:**

The problem states that an equal number of tickets of three different prices were bought for a total cost. We can represent the unknown quantity of each ticket type with a single variable and set up an equation for the total cost.

**Step 2: Setting up the Equation:**

Let 'n' be the number of tickets of each type that Rubina bought.

- Cost of the first type of tickets =  $55 \times n$
- Cost of the second type of tickets =  $85 \times n$
- Cost of the third type of tickets =  $105 \times n$

The total cost is the sum of these amounts, which is given as 2940.

$$55n + 85n + 105n = 2940$$

**Step 3: Solving for 'n':**

We can factor out 'n' from the left side of the equation.

$$(55 + 85 + 105)n = 2940$$

First, sum the prices of the tickets:

$$55 + 85 = 140$$

$$140 + 105 = 245$$

Now substitute this sum back into the equation:

$$245n = 2940$$

Isolate 'n' by dividing the total cost by the sum of the prices:

$$n = \frac{2940}{245}$$

To simplify the fraction, we can divide both by 5:

$$n = \frac{588}{49}$$

We know that  $49 \times 10 = 490$ . The remainder is  $588 - 490 = 98$ . And  $49 \times 2 = 98$ . So,  $588 = 49 \times 12$ .

$$n = 12$$

#### Step 4: Final Answer:

Rubina bought 12 tickets of each type. Therefore, option (B) is the correct answer.

#### 💡 Quick Tip

When buying an equal number ('n') of different items, the total cost can be calculated as 'n' times the sum of the individual item prices. This simplifies the equation from the start: 'Total Cost = n \* (Price1 + Price2 + Price3)'.

**52. Six-elevenths of a first number equals twenty-two percent of a second number. The second number equals one-fourth of a third number. If the third number is 2400, then what is 45% of the first number?**

- (A) 111.7
- (B) 117.6
- (C) 123.4
- (D) None of these

**Correct Answer:** (D) None of these

#### Solution:

##### Step 1: Understanding the Concept:

This is a multi-step problem involving fractions and percentages. The best approach is to work backward from the known value (the third number) to find the unknown values (the second and first numbers) sequentially.

##### Step 2: Translating the Statements into Equations:

Let the first, second, and third numbers be A, B, and C respectively.

1.  $\frac{6}{11}A = 22\% \times B = 0.22B$
2.  $B = \frac{1}{4}C$
3.  $C = 2400$

We need to find  $45\% \times A$ .

**Step 3: Detailed Calculation:**

**1. Find the second number (B):**

Using the relationship  $B = \frac{1}{4}C$  and  $C = 2400$ :

$$B = \frac{1}{4} \times 2400 = 600$$

**2. Find the first number (A):**

Now use the relationship between A and B:  $\frac{6}{11}A = 0.22B$ .

Substitute  $B = 600$ :

$$\frac{6}{11}A = 0.22 \times 600$$

$$\frac{6}{11}A = 132$$

To find A, multiply both sides by  $\frac{11}{6}$ :

$$A = 132 \times \frac{11}{6}$$

$$A = \left(\frac{132}{6}\right) \times 11 = 22 \times 11 = 242$$

**3. Calculate 45% of the first number (A):**

The first number is 242. We need to find 45% of it.

$$\begin{aligned} 45\% \text{ of } 242 &= 0.45 \times 242 \\ &= \frac{45}{100} \times 242 = \frac{9}{20} \times 242 = \frac{9 \times 242}{20} = \frac{2178}{20} = 108.9 \end{aligned}$$

**Step 4: Final Answer:**

The result is 108.9. This value is not listed in options (A), (B), or (C). Therefore, the correct choice is (D) None of these.

 **Quick Tip**

In chain-relationship problems like this, always start from the number with a known value and work your way backward through the chain of equations to find the value you need.

---

**53. From a bank, Ram and Shyam together took loans under simple interest and lent the total to Mohan at 2% higher simple interest. After 4 years, Ram's total money earned (after paying the bank interest) was 400 more than Shyam's. By how much was the amount borrowed by Ram more than that borrowed by Shyam?**

- (A) 10000
- (B) 20000
- (C) 5000

(D) 25000

**Correct Answer:** (C) 5000

**Solution:**

**Step 1: Understanding the Concept:**

This is a simple interest problem focused on the concept of "interest arbitrage," where money is borrowed at one rate and lent at a higher rate. The profit (or net gain) comes from the difference in the interest rates. The actual interest rate ( $r$ ) of the bank is not needed to solve the problem.

**Step 2: Key Formula or Approach:**

Let  $R$  be the principal borrowed by Ram and  $S$  be the principal borrowed by Shyam.

The net gain for each person is based on the interest rate difference over the given time period.

Net Gain = Principal  $\times$  (Rate Difference)  $\times$  Time

**Step 3: Detailed Explanation:**

1. **Calculate the Net Gain Rate:**

- Interest rate paid to the bank =  $r\%$  per annum.
- Interest rate received from Mohan =  $(r + 2)\%$  per annum.
- Net gain interest rate =  $(r + 2)\% - r\% = 2\%$  per annum.

2. **Calculate the Total Gain over 4 Years:**

The total gain for each person is their principal amount multiplied by the net gain rate over the entire period.

- Total net gain rate over 4 years =  $2\%$  per year  $\times$  4 years =  $8\%$ .

3. **Set up the Equation for Gains:**

- Ram's total gain =  $8\%$  of his principal ( $R$ ) =  $0.08 \times R$ .
- Shyam's total gain =  $8\%$  of his principal ( $S$ ) =  $0.08 \times S$ .

4. **Use the Given Difference in Gains:**

The problem states that Ram's gain was 400 more than Shyam's gain.

$$(\text{Ram's Gain}) - (\text{Shyam's Gain}) = 400$$

$$0.08R - 0.08S = 400$$

5. **Solve for the Difference in Principals ( $R - S$ ):**

Factor out 0.08 from the left side:

$$0.08(R - S) = 400$$

$$R - S = \frac{400}{0.08}$$

$$R - S = \frac{40000}{8} = 5000$$

**Step 4: Final Answer:**

The amount borrowed by Ram was 5000 more than the amount borrowed by Shyam.

Therefore, option (C) is the correct answer.

 Quick Tip

In problems where money is borrowed and lent simultaneously, the profit depends only on the difference in interest rates. The original rates cancel out, simplifying the calculation significantly.

**54. 160000 is divided into two equal parts. One part is invested in a scheme giving 12% interest compounded annually for 2 years. The other part is invested in a scheme offering simple interest of 13% for 2 years. Find the difference between the interest earned in the two schemes.**

- (A) 512
- (B) 426
- (C) 448
- (D) 568

**Correct Answer:** (C) 448

**Solution:**

**Step 1: Understanding the Concept:**

We need to calculate the interest earned from two different investment schemes—one with compound interest (CI) and one with simple interest (SI)—and then find the difference between the two amounts of interest.

**Step 2: Key Formulas:**

- **Simple Interest (SI):**  $SI = \frac{P \times R \times T}{100}$ , where P is principal, R is rate, and T is time.

- **Compound Interest (CI):**  $A = P(1 + \frac{R}{100})^T$ , where A is the final amount, and  $CI = A - P$ .

**Step 3: Detailed Calculation:**

**1. Determine the Principal for each scheme:**

Total amount = 160000, divided into two equal parts.

Principal (P) for each scheme =  $160000/2 = 80000$ .

**2. Calculate the Simple Interest (SI):**

- P = 80000, R = 13% p.a., T = 2 years.

$$SI = \frac{80000 \times 13 \times 2}{100} = 800 \times 26 = 20800$$

**3. Calculate the Compound Interest (CI):**

- P = 80000, R = 12% p.a., T = 2 years.

First, calculate the final amount (A):

$$A = 80000 \left(1 + \frac{12}{100}\right)^2 = 80000(1.12)^2$$

$$A = 80000 \times 1.2544 = 100352$$

Next, calculate the interest earned:

$$CI = A - P = 100352 - 80000 = 20352$$

#### 4. Find the Difference between the interests:

$$\text{Difference} = |SI - CI| = |20800 - 20352| = 448$$

The simple interest scheme earned 448 more than the compound interest scheme.

#### Step 4: Final Answer:

The difference between the interest earned in the two schemes is 448. Therefore, option (C) is the correct answer.

#### 💡 Quick Tip

For 2 years, the difference between CI and SI can be quickly calculated with the formula:  $\text{Difference} = P \left( \frac{R}{100} \right)^2$  if the rates are the same. Since the rates here are different (12% and 13%), you must calculate them separately as shown.

**55. A principal of \$25000 is invested at 7% p.a., compounded semi-annually. Find the total amount after 1.5 years.**

- (A) \$26722.50
- (B) \$26406.25
- (C) \$27717.95 (Corrected from PDF to reflect calculation)
- (D) \$26890.00

**Correct Answer:** (C) \$27717.95 (Note: The provided options and answer in the PDF appear to be incorrect based on the problem statement.)

#### Solution:

##### Step 1: Understanding the Concept:

This problem involves compound interest. When interest is compounded semi-annually, it means the interest is calculated and added to the principal twice a year. Therefore, we must adjust the annual interest rate and the number of compounding periods accordingly.

##### Step 2: Key Formula or Approach:

The formula for the final amount (A) with compound interest is:

$$A = P \left( 1 + \frac{r}{n} \right)^{nt}$$

Where:

- $P$  = Principal amount
- $r$  = Annual interest rate (as a decimal)
- $n$  = Number of times interest is compounded per year
- $t$  = Number of years

For semi-annual compounding,  $n = 2$ .

##### Step 3: Detailed Explanation:

###### 1. Identify the variables:

- Principal ( $P$ ) = \$25000
- Annual interest rate ( $r$ ) = 7% = 0.07
- Time ( $t$ ) = 1.5 years

- Compounding frequency ( $n$ ) = 2 (semi-annually)

**2. Calculate the adjusted rate and number of periods:**

- The interest rate per compounding period is the annual rate divided by the number of periods per year:

$$\text{Effective rate } i = \frac{r}{n} = \frac{0.07}{2} = 0.035 \text{ (or 3.5\%).}$$

- The total number of compounding periods is the number of years multiplied by the frequency:

$$\text{Total periods } N = n \times t = 2 \times 1.5 = 3.$$

**3. Apply the simplified compound interest formula:**

The formula can be written as  $A = P(1 + i)^N$ .

$$A = 25000 \times (1 + 0.035)^3$$

$$A = 25000 \times (1.035)^3$$

**4. Calculate the value of  $(1.035)^3$ :**

$$(1.035)^2 = 1.071225$$

$$(1.035)^3 = 1.071225 \times 1.035 \approx 1.108717875$$

**5. Calculate the final amount (A):**

$$A = 25000 \times 1.108717875 \approx 27717.946875$$

Rounding to two decimal places, we get \$27717.95.

**Step 4: Final Answer and Analysis:**

The calculated total amount is \$27717.95. This value is not among the original options (A, B, D). This indicates a significant error in the question's provided options and the "correct answer." The calculation shown in the PDF also leads to this result, confirming the discrepancy. Based on the problem statement, none of the original options are correct.

**💡 Quick Tip**

For semi-annual compounding, remember to halve the annual rate and double the number of years. For quarterly compounding, divide the rate by 4 and multiply the years by 4.

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**56. What is the sum of an infinite geometric series with first term equal to 1 and common ratio  $\frac{1}{2}$ ?**

- (A) 1.5
- (B) 2
- (C) 2.5
- (D) Infinity

**Correct Answer:** (B) 2

**Solution:**

**Step 1: Understanding the Concept:**

An infinite geometric series is the sum of an infinite sequence of terms where each term after the first is found by multiplying the previous one by a fixed, non-zero number called the common ratio. This sum converges to a finite value only if the absolute value of the common ratio is less than 1.

**Step 2: Key Formula or Approach:**

The formula for the sum of an infinite geometric series ( $S_\infty$ ) is:

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

This formula is valid only when  $|r| < 1$ .

Where:

- $a$  = the first term of the series.
- $r$  = the common ratio.

**Step 3: Detailed Explanation:**

**1. Identify the given values:**

- First term ( $a$ ) = 1
- Common ratio ( $r$ ) =  $\frac{1}{2}$

**2. Check the condition for convergence:**

The absolute value of the common ratio is  $|r| = |\frac{1}{2}| = \frac{1}{2}$ .

Since  $\frac{1}{2} < 1$ , the series converges, and we can use the sum formula.

**3. Substitute the values into the formula:**

$$S_\infty = \frac{1}{1 - \frac{1}{2}}$$
$$S_\infty = \frac{1}{\frac{1}{2}}$$

Dividing by a fraction is the same as multiplying by its reciprocal:

$$S_\infty = 1 \times 2 = 2$$

The series is  $1 + \frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \dots$ , and as you add more terms, the sum gets closer and closer to 2.

**Step 4: Final Answer:**

The sum of the infinite geometric series is 2. Therefore, option (B) is the correct answer.

 **Quick Tip**

Always check if  $|r| < 1$  before applying the sum formula for an infinite geometric series. If  $|r| \geq 1$ , the series does not have a finite sum (it diverges).

---

**57. If  $3^{(x-y)} = 27$  and  $3^{(x+y)} = 243$ , find the value of  $x$ .**

- (A) 4
- (B) 6
- (C) 2
- (D) 0



**Correct Answer:** (A) 4

**Solution:**

**Step 1: Understanding the Concept:**

This problem involves solving a system of equations where the variables are in the exponents. The key to solving this is to express all numbers with the same base. Once the bases are equal, we can equate the exponents.

**Step 2: Key Formula or Approach:**

The fundamental property of exponents used here is:

If  $b^m = b^n$ , then  $m = n$  (for  $b > 0, b \neq 1$ ).

**Step 3: Detailed Explanation:**

1. **Rewrite the equations with a common base (base 3):**

- For the first equation:  $3^{(x-y)} = 27$ . We need to express 27 as a power of 3. Since  $3 \times 3 \times 3 = 27$ , we have  $27 = 3^3$ .

So, the equation becomes:  $3^{(x-y)} = 3^3$ .

- For the second equation:  $3^{(x+y)} = 243$ . We need to express 243 as a power of 3.  $27 \times 3 = 81$ , and  $81 \times 3 = 243$ . So,  $243 = 3^5$ .

So, the equation becomes:  $3^{(x+y)} = 3^5$ .

2. **Equate the exponents:**

Now that the bases are the same in each equation, we can equate the exponents to form a simple system of linear equations.

- From the first equation:  $x - y = 3$  (Equation 1)

- From the second equation:  $x + y = 5$  (Equation 2)

3. **Solve the system of linear equations:**

We have a pair of simultaneous equations:

1)  $x - y = 3$

2)  $x + y = 5$

To find 'x', we can use the elimination method by adding the two equations together. The 'y' terms will cancel out.

$$(x - y) + (x + y) = 3 + 5$$

$$2x = 8$$

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

**Step 4: Final Answer:**

The value of x is 4. Therefore, option (A) is the correct answer. (We can also find y by substituting x=4 into either equation, which gives y=1).

 **Quick Tip**

When you see equations with variables in the exponent, your first goal should be to rewrite all numbers in the equation as powers of the same base. Once the bases are equal, the problem simplifies to just equating the exponents.

---

**58. Write  $8^{2x+3}$  in the form  $2^y$  and express the relation between x and y.**

- (A)  $y = 6x + 3$
- (B)  $y = 2x + 6$
- (C)  $y = 6x + 9$
- (D)  $y = 3x + 6$

**Correct Answer:** (C)  $y = 6x + 9$

**Solution:**

**Step 1: Understanding the Concept:**

This problem requires converting an exponential expression from one base (base 8) to another (base 2). This is done by first expressing the original base as a power of the new base.

**Step 2: Key Formula or Approach:**

We will use the "power of a power" rule of exponents, which states:

$$(a^m)^n = a^{m \times n}$$

**Step 3: Detailed Explanation:**

1. **Express the base 8 in terms of base 2:**

We know that  $8 = 2 \times 2 \times 2 = 2^3$ .

2. **Substitute the new base into the expression:**

The original expression is  $8^{2x+3}$ . Replace 8 with  $2^3$ :

$$(2^3)^{2x+3}$$

3. **Apply the power of a power rule:**

According to the rule  $(a^m)^n = a^{mn}$ , we multiply the exponents:

$$2^{3 \times (2x+3)}$$

4. **Simplify the exponent:**

Distribute the 3 across the terms in the parenthesis:

$$3 \times (2x + 3) = (3 \times 2x) + (3 \times 3) = 6x + 9$$

So, the expression becomes  $2^{6x+9}$ .

5. **Express the relation between x and y:**

We are asked to write the expression in the form  $2^y$ . By comparing our result with this form, we can see that the exponent 'y' must be equal to the exponent we calculated.

$$2^y = 2^{6x+9}$$

Therefore,  $y = 6x + 9$ .

**Step 4: Final Answer:**

The relationship between x and y is  $y = 6x + 9$ . This matches option (C).

#### 💡 Quick Tip

To change the base of an exponential expression, first write the old base as a power of the new base (e.g.,  $9 = 3^2$ ,  $27 = 3^3$ ). Then, use the power of a power rule  $(a^m)^n = a^{mn}$  to simplify the new exponent.

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**59. If  $a$  and  $b$  are whole numbers such that  $ab = 121$ , find the value of  $(a - 1)b + 1$ .**

- (A) 1
- (B) 111
- (C) 121
- (D) The value is not unique

**Correct Answer:** (D) The value is not unique

**Solution:**

**Step 1: Understanding the Concept:**

The problem asks for the value of an expression that depends on two variables, ' $a$ ' and ' $b$ '. We are given a relationship between ' $a$ ' and ' $b$ ' ( $ab = 121$ ). We must check if the expression gives a single, constant value for all possible pairs of ' $a$ ' and ' $b$ ' that satisfy the given condition.

**Step 2: Simplifying the Expression:**

Let's first simplify the expression to see its structure.

$$(a - 1)b + 1$$

Distribute ' $b$ ' across the parenthesis:

$$(ab - 1b) + 1$$

$$ab - b + 1$$

We are given that  $ab = 121$ . Substitute this into the simplified expression:

$$121 - b + 1$$

$$122 - b$$

The value of the expression is  $122 - b$ . This means the final value depends on the specific value of ' $b$ '.

**Step 3: Finding Possible Values for ' $b$ ':**

We need to find all pairs of whole numbers ( $a, b$ ) such that their product is 121.

The factors of 121 are 1, 11, and 121. The possible pairs are:

- **Pair 1:**  $a = 1, b = 121$  (since  $1 \times 121 = 121$ )

- **Pair 2:**  $a = 11, b = 11$  (since  $11 \times 11 = 121$ )

- **Pair 3:**  $a = 121, b = 1$  (since  $121 \times 1 = 121$ )

**Step 4: Evaluating the Expression for Each Pair:**

Now, let's calculate the value of  $122 - b$  for each possible value of ' $b$ '.

- **For Pair 1 ( $b=121$ ):**

$$\text{Value} = 122 - 121 = 1.$$

- **For Pair 2 ( $b=11$ ):**

$$\text{Value} = 122 - 11 = 111.$$

- **For Pair 3 ( $b=1$ ):**

$$\text{Value} = 122 - 1 = 121.$$

**Step 5: Final Answer:**

The expression yields three different possible values (1, 111, and 121) depending on the pair of factors chosen for 121. Since the value is not unique without further conditions on ' $a$ ' and ' $b$ ', the answer is that the value is not unique.

 Quick Tip

When an expression involves variables with a given product or sum, first simplify the expression. If the variables don't cancel out, the value will likely depend on the specific factors or terms. Always check all possible pairs to see if the result is constant.

**60. The base area of a cylinder is  $154 \text{ cm}^2$  and the height is 5 cm. Find the volume of the cylinder.**

- (A)  $770 \text{ cm}^3$
- (B)  $616 \text{ cm}^3$
- (C)  $880 \text{ cm}^3$
- (D)  $754 \text{ cm}^3$

**Correct Answer:** (A)  $770 \text{ cm}^3$

**Solution:**

**Step 1: Understanding the Concept:**

The volume of any right prism or cylinder is the amount of space it occupies. It is calculated by multiplying the area of its base by its height. This is because the volume can be thought of as stacking layers of the base area up to the given height.

**Step 2: Key Formula or Approach:**

The formula for the volume of a cylinder is:

$$V = \text{Base Area} \times \text{Height}$$

or, in terms of radius:

$$V = \pi r^2 h$$

Since the base area is already given, we can use the first, more direct formula.

**Step 3: Detailed Explanation:**

**1. Identify the given values:**

- Base Area ( $A$ ) =  $154 \text{ cm}^2$
- Height ( $h$ ) = 5 cm

**2. Substitute the values into the formula:**

$$\begin{aligned} V &= A \times h \\ V &= 154 \text{ cm}^2 \times 5 \text{ cm} \end{aligned}$$

**3. Calculate the product:**

$$V = 770$$

**4. Determine the units:**

When you multiply an area (in  $\text{cm}^2$ ) by a length (in cm), the resulting unit for volume is cubic centimeters ( $\text{cm}^3$ ).

$$V = 770 \text{ cm}^3$$

**Step 4: (Optional) Cross-check by finding the radius:**

Let's verify this using the formula  $V = \pi r^2 h$ . We need to find the radius from the base area first.

Base Area =  $\pi r^2 = 154$ . Using the approximation  $\pi \approx \frac{22}{7}$ :

$$\begin{aligned}\frac{22}{7}r^2 &= 154 \\ r^2 &= 154 \times \frac{7}{22}\end{aligned}$$

Since  $154 = 7 \times 22$ ,

$$\begin{aligned}r^2 &= (7 \times 22) \times \frac{7}{22} = 7 \times 7 = 49 \\ r &= \sqrt{49} = 7 \text{ cm}\end{aligned}$$

Now calculate the volume with this radius:

$$V = \pi r^2 h = \frac{22}{7} \times (7)^2 \times 5 = \frac{22}{7} \times 49 \times 5 = 22 \times 7 \times 5 = 154 \times 5 = 770 \text{ cm}^3$$

The result is consistent.

**Step 5: Final Answer:**

The volume of the cylinder is  $770 \text{ cm}^3$ . Therefore, option (A) is the correct answer.

**💡 Quick Tip**

If a problem gives you the base area of a cylinder or prism directly, there is no need to calculate the radius. Use the simpler formula 'Volume = Base Area  $\times$  Height' to save time and avoid unnecessary calculations.