NPAT 2020 QP 1 Question Paper with Solutions

Time Allowed :1 Hour 46 Minutes	**Maximum Marks :**122	**Total Questions :**122

Proficiency in English Language

2. In the sentence given below, four words/phrases have been underlined and the underlined words/phrases are given as options. Select the option that contains grammatical error(s).

Culture refers to the group's way of life, including the shared system of social meanings, values and relations.

(1) Culture refers to

(2) the group's way of life

(3) including the shared system of

(4) social meanings, values and relations

Correct Answer: (3) including the shared system of

Solution: The error lies in the phrase "including the shared system of". The correct sentence should be "Culture refers to the group's way of life, including shared systems of social meanings, values, and relations" (without "the" before "shared system"). The phrase should not use the article "the" when referring to general instances.

Quick Tip

When identifying errors in sentences, pay attention to the correct usage of articles ("the", "a", "an") and their placement in the sentence.

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3. In the sentence given below, four words/phrases have been underlined and the underlined words/phrases are given as options. Select the option that contains grammatical error(s).

Raghav has been trying stopping smoking for many years now, but he has been unsuccessfu

(1) Raghav has been

(2) trying stopping smoking

(3) for many years

(4) has been unsuccessful

Correct Answer: (2) trying stopping smoking

Solution: The error lies in the phrase "trying stopping smoking". The correct sentence should be "Raghav has been trying to stop smoking for many years." The phrase "trying stopping" is incorrect, and it should be "trying to stop."

Quick Tip

When using the verb "try," the correct form after it is "to + verb" (e.g., trying to stop, not trying stopping).

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4. In the sentence given below, four words/phrases have been underlined and the underlined words/phrases are given as options. Select the option that contains grammatical error(s).

In 2015, most countries agreed on sustainable development goals, though very few have achieved them.

(1) In 2015,

(2) most countries agreed on

(3) sustainable development goals

(4) have achieved them

Correct Answer: (4) have achieved them

Solution: The error lies in the phrase "have achieved them". The correct sentence should be "though very few have achieved it" (where "it" refers to "sustainable development goals"). The pronoun "them" is incorrect because it doesn't agree with the singular form of "goals" in this context.

Quick Tip

Always ensure that pronouns agree in number with the noun they replace. Singular nouns should be replaced with singular pronouns (e.g., "it" for singular).

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5. In the sentence given below, four words/phrases have been underlined and the underlined words/phrases are given as options. Select the option that contains grammatical error(s).

The early years of civilian space travel has been marked by many triumphs and tragedies.

(1) The early years

(2) has been marked

(3) by many triumphs

(4) and tragedies

Correct Answer: (2) has been marked

Solution: The error lies in the phrase "has been marked". Since "The early years" is a plural subject, the correct form should be "have been marked." The sentence should read, "The early years of civilian space travel have been marked by many triumphs and tragedies."

Quick Tip

When identifying errors in sentences, check for subject-verb agreement. In this case, the plural subject "The early years" requires the plural verb "have."

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6. In the sentence given below, four words/phrases have been underlined and the underlined words/phrases are given as options. Select the option that contains grammatical error(s).

These days, students pursuing higher studies do not pay any attention to the feedbacks provided by their tutors.

(1) students pursuing higher studies

(2) do not pay any attention

(3) to the feedbacks

(4) provided by their tutors

Correct Answer: (3) to the feedbacks

Solution: The error lies in the phrase "to the feedbacks". The word "feedback" is uncountable, so the plural form "feedbacks" is incorrect. The sentence should read, "students do not pay any attention to feedback provided by their tutors."

Quick Tip

When dealing with uncountable nouns like "feedback," avoid using the plural form.

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7. Select the option that best fills in the blank and completes the sentence given below.

Built high above the Tiber River, Rome began its phenomenal ascent ..... power when it won independence from the Etruscans.

(1) into

(2) of

(3) on

(4) to

Correct Answer: (4) to

Solution: The correct preposition is "to," as in the phrase "to power," which means to come into or attain power. The sentence should read, "Rome began its phenomenal ascent to power."

Quick Tip

Certain expressions like "to power" require specific prepositions to maintain correct meaning.

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8. Select the option that best fills in the blank and completes the sentence given below.

Less than an inch of soil may form ..... a century in a desert, whereas almost half an inch of soil can form annually in the humid tropics.

(1) on

(2) between

(3) since

(4) during

Correct Answer: (1) on

Solution: The correct preposition here is "on," which is used when describing a period of time during which an event happens. The sentence should read, "Less than an inch of soil may form on a century in a desert."

Quick Tip

When referring to a period of time, "on" is often used to describe specific time frames, such as "on a century."

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9. Select the option that best fills in the blank and completes the sentence given below.

The soil ..... of rock material, minerals and organic matter.

(1) is composed

(2) was composed

(3) has been composed

(4) should be composed

Correct Answer: (1) is composed

Solution: The correct verb here is "is composed," which is in the present simple tense and correctly describes the general state of the soil. The sentence should read, "The soil is composed of rock material, minerals, and organic matter."

Quick Tip

When describing a general fact, the present simple tense is often used.

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10. Select the option that best fills in the blank and completes the sentence given below.

The managers have promised to hire the boys once they ..... their degree.

(1) will complete

(2) has complete

(3) completed

(4) complete

Correct Answer: (4) complete

Solution: The correct form is "complete" in the simple present tense, as it refers to a future event dependent on the boys completing their degree. The sentence should read, "The managers have promised to hire the boys once they complete their degree."

Quick Tip

When talking about future events that are dependent on other actions, use the present simple tense.

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11. Select the option that best fills in the blank and completes the sentence given below.

..... we'd watched the film once before, we didn't mind watching it a second time.

(1) Since

(2) Although

(3) Whereas

(4) While

Correct Answer: (2) Although

Solution: The correct word is "Although." It introduces a contrast between the two clauses, indicating that despite watching the film before, there was no objection to watching it again. The sentence should read: "Although we'd watched the film once before, we didn't mind watching it a second time."

Quick Tip

Use "Although" when showing contrast between two clauses.

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12. Select the option that best fills in the blank and completes the sentence given below.

The accommodation provided was excellent, ... the food was awful.

(1) whereas

(2) however

(3) despite

(4) in contrast

Correct Answer: (1) whereas

Solution: The correct word is "whereas," which is used to contrast two ideas. The sentence should read: "The accommodation provided was excellent, whereas the food was awful."

Quick Tip

"Whereas" is used to show a contrast between two clauses.

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13. Select the option that best fills in the blank and completes the sentence given below.

The department met yesterday to decide whether they should accept ..... project or not.

(1) some

(2) that

(3) an

(4) none

Correct Answer: (3) an

Solution: The correct word is "an" because "project" begins with a vowel sound, so the indefinite article "an" should be used. The sentence should read, "The department met yesterday to decide whether they should accept an project or not."

Quick Tip

Use "an" before words that begin with vowel sounds (e.g., an apple, an hour).

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14. Select the option that best fills in the blank and completes the sentence given below.

Stringent laws have made ..... difference in preventing the poaching of endangered animals.

(1) a few

(2) many

(3) little

(4) much

Correct Answer: (4) much

Solution: The correct word is "much," as it is used with uncountable nouns like "difference." The sentence should read, "Stringent laws have made much difference in preventing the poaching of endangered animals."

Quick Tip

Use "much" with uncountable nouns like "difference" or "money."

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15. Select the option that gives the best meaning of the word/phrase in bold.

The work of artists and scientists is **ultimately** the pursuit of truth.

(1) lastly

(2) decisively

(3) eventually

(4) firstly

Correct Answer: (3) eventually

Solution: The correct meaning of "ultimately" is "eventually," which refers to the final result or outcome after a process. The sentence should read, "The work of artists and scientists is

eventually the pursuit of truth."

Quick Tip

"Ultimately" means "in the end" or "eventually," referring to the final result.

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16. Select the option that gives the best meaning of the word/phrase in bold.

The people found his objection puzzling and **inexplicable.**

(1) incomprehensible

(2) curious

(3) unaccountable

(4) bizarre

Correct Answer: (1) incomprehensible

Solution: The word "inexplicable" means something that is impossible to explain or understand. The best synonym is "incomprehensible." The sentence should read: "The people found his objection puzzling and incomprehensible."

Quick Tip

When you encounter the word "inexplicable," think of words like "incomprehensible" or "unfathomable" for similar meanings.

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17. Select the option that gives the best meaning of the word/phrase in bold.

Arnav and his friends decided to **go dutch** when they went out to the restaurant.

(1) one person paying for everyone

(2) each person paying for the other

(3) sharing the costs equally

(4) borrowing from someone else to pay

Correct Answer: (3) sharing the costs equally

Solution: The phrase "go dutch" refers to a situation where each person pays their own share

of the bill. The correct meaning is "sharing the costs equally." The sentence should read: "Arnav and his friends decided to go dutch when they went out to the restaurant."

Quick Tip

"Go dutch" is a common idiom for splitting the cost evenly among participants.

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18. Select the option that gives the best meaning of the word/phrase in bold.

He was ready to **throw in the towel**, but his friends convinced him to complete the course.

(1) give up

(2) renounce

(3) sacrifice

(4) abandon

Correct Answer: (1) give up

Solution: The phrase "throw in the towel" means to give up or quit, especially after an effort. The sentence should read: "He was ready to give up, but his friends convinced him to complete the course."

Quick Tip

"Throw in the towel" is an idiomatic expression that means to quit or surrender.

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19. Select the most appropriate option that completes the given sentence.

Beijing has .... billions of dollars into the economy after it was hit by the coronavirus.

(1) added

(2) invested

(3) injected

(4) introduced

Correct Answer: (3) injected

Solution: The correct word is "injected," which refers to putting something (such as money) into something else to support or stimulate it. The sentence should read: "Beijing has injected billions of dollars into the economy after it was hit by the coronavirus."

Quick Tip

"Inject" is commonly used when talking about putting money into an economy or system.

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20. Select the option that best completes the sentence given below.

The outbreak ..... just as China was preparing to celebrate the Lunar New Year.

(1) struck

(2) hit

(3) battered

(4) knocked

Correct Answer: (1) struck

Solution: The correct word is "struck," which is often used to describe an event or disaster that happens suddenly and forcefully. The sentence should read: "The outbreak struck just as China was preparing to celebrate the Lunar New Year."

Quick Tip

"Strike" is commonly used to describe sudden, impactful events or disasters.

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21. Select the option that best completes the given sentence.

Penguins are known for ..... a number of traits shared with humans.

(1) revealing

(2) exhibiting

(3) showing

(4) presenting

Correct Answer: (2) exhibiting

Solution: The correct word is "exhibiting," which means displaying or showing something, especially a trait or characteristic. The sentence should read: "Penguins are known for exhibiting a number of traits shared with humans."

Quick Tip

"Exhibit" is commonly used to describe the display or presentation of characteristics.

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22. Select the option that best completes the given sentence.

Experts believe they have found the 'first ..... evidence' for conformity to linguistic laws in non-primate species.

(1) undeniable

(2) gripping

(3) forceful

(4) compelling

Correct Answer: (1) undeniable

Solution: The correct word is "undeniable," which means something that cannot be disputed or denied. The sentence should read: "Experts believe they have found the 'first undeniable' evidence for conformity to linguistic laws in non-primate species."

Quick Tip

"Undeniable" refers to something that is so strong or certain that it cannot be disputed.

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23. Given below are five sentences, labelled A, B, C, D and E. They are NOT in a meaningful order. Select the option that arranges the sentences in the correct order to form a meaningful paragraph.

A. Scientists from the Nekton Mission will survey wildlife and gauge the effects of climate change in the unexplored area.

B. It can withstand immense pressures and also carries up to 96 hours' worth of emergency oxygen in case of disaster.

C. A team of British scientists will soon dive into the darkest depths of the Indian Ocean, the 'Midnight Zone' where life thrives despite scarce light.

D. Previously, it had descended 36,000 ft when it reached the bottom of the Mariana trench.

E. A submarine called 'Limiting Factor' will carry two scientists at a time 3,280 ft below the surface into the marine world.

(1) A, E, D, B, C

(2) C, E, A, B, D

(3) E, A, C, B, D

(4) C, A, E, B, D

Correct Answer: (4) C, A, E, B, D

Solution: The correct order is C, A, E, B, D. First, C introduces the team of British scientists. Then A discusses the survey and its purpose. E talks about the submarine and its ability to descend. B explains its features, and D gives additional information about its previous descent.

Quick Tip

When arranging jumbled sentences, identify the introductory sentence and build the narrative logically from there.

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24. Given below are five sentences, labelled A, B, C, D and E. They are NOT in a meaningful order. Select the option that arranges the sentences in the correct order to form a meaningful paragraph.

A. Prior research had shown that African penguins used types of calls similar to syllables in human languages.

B. Some researchers have described them as similar to a braying ass, leading to the nickname "jackass penguins."

C. The endangered African penguin is known for its distinctive calls.

D. It appears that the bird calls conform to the linguistic rules developed to explain how human languages work.

E. Interested in learning more about the calls these birds make, researchers collected and analysed vocalisations from adult males living in Italian zoos.

(1) C, A, D, B, E

(2) A, D, B, E, C

(3) A, E, D, B, C

(4) A, D, E, C, B

Correct Answer: (1) C, A, D, B, E

Solution: The correct order is C, A, D, B, E. First, C introduces the penguins and their calls. Then A explains the prior research. D follows with an explanation of the calls' conformity to linguistic rules, B adds more details about the calls, and E concludes with the research conducted.

Quick Tip

When arranging jumbled sentences, first focus on sentences that introduce the subject and context, then arrange supporting details logically.

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25. Given below are five sentences, labelled A, B, C, D and E. They are NOT in a meaningful order. Select the option that arranges the sentences in the correct order to form a meaningful paragraph.

A. This would have given us time to reduce carbon emissions to stop the permafrost thaw, ice melt and global warming.

B. Both methane and carbon dioxide that could add to global warming have been stored for millennia in frozen permafrost.

C. Experts have long feared that climate change will unleash long-trapped greenhouse gases.

D. It had been assumed that the release of these gases would be gradual.

E. However, projections about climate now suggest that certain icy terrains will rapidly disintegrate in as little as days.

(1) B, D, A, C, E

(2) C, E, B, D, A

(3) B, D, E, A, C

(4) C, B, D, A, E

Correct Answer: (4) C, B, D, A, E

Solution: The correct order is C, B, D, A, E. First, C introduces the fear about climate change and its effects. Then B explains the gases involved. D discusses how the release of gases was assumed to be gradual. A provides a solution for reducing carbon emissions, and E concludes with the projection of rapid disintegration.

Quick Tip

When arranging jumbled sentences, start by identifying the introductory sentence and then place the supporting sentences logically.

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26. Given below are five sentences, labelled A, B, C, D and E. They are NOT in a meaningful order. Select the option that arranges the sentences in the correct order to form a meaningful paragraph.

A. Cells called fibroblasts from an animal are used to make sheets of skin.

B. According to a study, yarn grown from human skin cells could be woven or knitted into 'human textiles' for tissue grafts or organ repair.

C. Since it is made from animal cells and is not synthetic, scientists believe that it will not be rejected by the immune system of the recipient.

D. These sheets are cut into ribbons and twisted to form various forms of yarn.

E. The threads can then be used in surgery to help treat animals and humans.

(1) A, D, B, C, E

(2) A, B, D, E, C

(3) A, E, D, B, C

(4) A, D, E, C, B

Correct Answer: (1) A, D, B, C, E

Solution: The correct order is A, D, B, C, E. First, A introduces the use of fibroblasts. D then describes how these sheets are processed. B follows with the use of the material for tissue

grafts or organ repair. C explains the benefits of using animal cells, and E concludes with the application of the sheets in surgery.

Quick Tip

When arranging jumbled sentences, begin with the sentence that introduces the subject, and then follow with sentences that explain the process or application.

Question Numbers : 27 to 31

Read the below passage and answer the questions that follow.

In a world still churning out trendy throw-away fashion pieces at breakneck speed, the idea of upcycled or refashioned apparel can be an anomaly. But it is a continuously growing trend and is one of the most sustainable things people can do in fashion. As upcycling makes use of already existing pieces, it often uses few resources in its creation and actually keeps 'unwanted' items out of the waste stream. There are more textiles produced in the world today than can be used. And once these clothes have fulfilled their 'useful' lives they are sent to the landfill or are donated to thrift stores. This is not as beneficial as people think as only about 20 to 30 percent of donated clothing is actually re-sold. Massive amounts of donated clothing that are not deemed as 're-sellable' in the U.S. are shipped to developing countries, inundating them with unnecessary goods that stifle any emerging economic development in textiles. While many people may have the idea that they are helping clothe the poor in these countries, access to the Internet and cell phones has made many of these countries more fashion-forward recently, and they may have no interest in our American cast-offs. Since this model relies on a waste economy, what happens when exportation is no longer an option?

This is where upcycling offers an answer. Upcycling is a way of processing an item to make it better than the original. It can be done using either pre-consumer or post-consumer waste or a combination of the two. Pre-consumer waste is produced while items are being manufactured and post-consumer waste results from the finished product reaching the end of its useful life for the consumer. Upcycling stops adding stuff to a world that is already overwhelmed with material things and reuses

materials in creative and innovative ways - producing original often one-of-a-kind items from what many consider to be waste. It is a way for companies and designers to be more efficient with leftover materials such as upholstery scraps or vintage textiles and to give new life to worn-out jeans and tattered T-shirts. Whether as everyday apparel or runway exhibition pieces, upcycling can challenge cultural codes - questioning what we consider to be trash versus fashion or beautiful versus ugly. For some it can also be a connection to our heritage - incorporating vintage clothing or using a family heirloom to create an original picce preserving a bit of history.

27. The word "anomaly" in paragraph 1 means:

(1) unsuitable

(2) abnormality

(3) difference

(4) absurdity

Correct Answer: (2) abnormality

Solution: The word "anomaly" refers to something that deviates from the normal or expected, which in this case is "abnormality."

Quick Tip

"Anomaly" refers to something that deviates from what is standard or expected.

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28. "Since this model relies on a waste economy..." — The writer calls it a waste economy because it is based on the system of:

(1) keeping unwanted pieces of clothing out of thrift stores by reusing them

(2) dumping poorer countries with materials that Americans find unnecessary

(3) reselling used items via the internet and other social media platforms

(4) buying and disposing large amounts of goods that are unnecessary

Correct Answer: (4) buying and disposing large amounts of goods that are unnecessary

Solution: The "waste economy" refers to the system of producing and disposing of goods that are unnecessary, contributing to waste.

Quick Tip

Look for clues in the passage that explain the basis of the "waste economy" as the system focused on unnecessary goods.

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29. Which of the following sentences is NOT TRUE?

(1) The end product of upcycling is very often better than the original item.

(2) Upcycling contributes to a waste-reduced, greener environment.

(3) Upcycling stifles creativity and innovation in fashion designers.

(4) Upcycling challenges accepted norms of waste, beauty and usefulness.

Correct Answer: (3) Upcycling stifles creativity and innovation in fashion designers.

Solution: The statement that "upcycling stifles creativity and innovation" is incorrect. In fact, upcycling fosters creativity by encouraging innovation in using waste materials.

Quick Tip

When asked about the truth of a statement, look for details in the passage that challenge or confirm the claim.

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30. Which of the following sentences best captures the main idea of this text?

(1) Upcycling promotes reusing materials in new ways, thereby reducing waste.

(2) Upcycling is a new trend that has taken the fashion world by storm.

(3) Upcycling is a trend that is unlikely to survive in the fickle world of fashion.

(4) Upcycling is possible only in the textile industry where wastage is massive.

Correct Answer: (1) Upcycling promotes reusing materials in new ways, thereby reducing waste.

Solution: The main idea of the passage is that upcycling promotes reusing materials in creative ways, thus helping to reduce waste and lessen the environmental impact.

Quick Tip

The main idea can be identified by focusing on the central argument or theme of the passage.

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31. This extract is most likely from:

(1) a journal article on recycling and reuse

(2) a talk on trends in environment protection

(3) a blog on sustainability and environment

(4) a magazine article on sustainable fashion

Correct Answer: (4) a magazine article on sustainable fashion

Solution: The extract discusses upcycling, waste, and fashion, which points to it being a magazine article on sustainable fashion.

Quick Tip

When identifying the source of an extract, look for keywords related to the content's focus, such as "fashion" or "environment."

Question Numbers : 32 to 36

Read the below passage and answer the questions that follow.

Most of us think astrology was a fanciful misconception about the world that flourished in times of widespread superstition and ignorance, and did not, could not, survive advances in mathematics and science. Alexander Boxer is out to show how wrong that picture is, and (his book) A Scheme of Heaven will make you fall in love with astrology, even as it extinguishes any niggling suspicion that it might actually work.

Boxer, a physicist and historian, kindles our admiration for the earliest astronomers. My favourite among his many jaw-dropping stories is the discovery of the precession of the equinoxes. This is the process by which the sun, each mid-spring and mid-autumn, rises at a fractionally different spot in the sky every year. It takes

26,000 years to make a full revolution of the zodiac-a tiny motion first detected by Hipparchus around 130 BC. And of course, Hipparchus, to make this observation at all, 'had to rely on the accuracy of star-gazers who would have seemed ancient even to him.... Boxer goes much further, dubbing it 'the ancient world's most ambitious applied mathematics problem'.

For as long as lives depend on the growth cycles of plants, the stars will, in a very general sense, dictate the destiny of our species. How far can we push this idea before it tips into absurdity? The answer is not immediately obvious, since pretty much any scheme we dream up will fit some conjunction or arrangement of the skies. As civilisations become richer and more various, the number and variety of historical events increases, as does the chance that some event will coincide with some planetary conjunction. Around the year 1400, the French Catholic cardinal Pierre d'Ailly concluded his astrological history of the world with a warning that the Antichrist could be expected to arrive in the year 1789, which of course turned out to be the year of the French Revolution.

But with every spooky correlation comes an even larger horde of absurdities and fatuities. Today, using a machine-learning algorithm, Boxer shows that 'it's possible to devise a model that perfectly mimics Bitcoin's price history and that takes, as its input data, nothing more than the zodiac signs of the planets on any given day'. ... Boxer writes: "Today there's no need to root and rummage for incidental correlations. Modern machine-learning algorithms are correlation monsters. They can make pretty much any signal correlate with any other."

We are bewitched by big data, and imagine it is something new. We are ever-indulgent towards economists who cannot even spot a global crash. We docilely conform to every algorithmically justified norm. Are we as credulous, then, as those who once took astrological advice as seriously as a medical diagnosis? Oh, for sure. At least our forebears could say they were having to feel their way in the dark. The statistical tools you need to sort real correlations from pretty patterns weren't developed until the late 19th century. What's our excuse? According to Boxer: "Those of us who are enthusiastic about the promise of numerical data to unlock the secrets of ourselves and our world would do well simply to acknowledge

that others have come this way before."

32. The overall message of the passage can best be summed up as:

(1) ancient astronomy was more accurate than today's forecasting techniques

(2) the use of big data for forecasting is a vast improvement on astrological predictions

(3) much of forecasting is not scientific and can be ascribed to coincidences

(4) we are credulous of modern forecasting methods which are as flawed as ancient ones

Correct Answer: (3) much of forecasting is not scientific and can be ascribed to coincidences

Solution: The passage emphasizes that forecasting, whether ancient or modern, is often not scientific and can be based on coincidental patterns, rather than being purely predictive or accurate.

Quick Tip

When identifying the main message of a passage, focus on the central theme and key points discussed.

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33. "...with every spooky correlation comes an even larger horde of absurdities and fatuities." This line is illustrated by the description of:

(1) the discovery of the precession of the equinoxes

(2) cardinal Pierre d'Ailly's warning about the year 1789

(3) economists' inability to predict a global crash

(4) Hipparchus's detection of the time taken for a full revolution of the zodiac

Correct Answer: (1) the discovery of the precession of the equinoxes

Solution: The phrase "spooky correlation" refers to the many connections drawn by ancient astronomers, such as the discovery of the precession of the equinoxes, which was seen as an absurdity and fatuity.

Quick Tip

When a phrase mentions absurdities and fatuities, it likely refers to ancient theories or practices that seem illogical with modern understanding.

34. The example of the Bitcoin (paragraph 4) is used to illustrate which of the following?

(1) Users of big data are far more unethical than astronomers of the past

(2) The past repeats itself over centuries and is doing so even today.

(3) Big data can be manipulated like ancient astrology to yield the desired results.

(4) Astronomy and the zodiac are still useful in predicting future trends.

Correct Answer: (3) Big data can be manipulated like ancient astrology to yield the desired results.

Solution: The passage draws a parallel between the use of big data today and the practices of ancient astrology, highlighting how both can be manipulated to support desired conclusions.

Quick Tip

Look for examples in the passage that connect modern practices with historical precedents to understand the author's message.

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35. The author's attitude towards the accuracy of modern economic forecasting is one of:

(1) Scepticism

(2) Emulation

(3) Adulation

(4) Antipathy

Correct Answer: (1) Scepticism

Solution: The author is skeptical of modern economic forecasting, comparing it to ancient astrology and indicating that both fields often rely on questionable methods and assumptions.

Quick Tip

Pay attention to words in the passage that describe the author's stance on the subject to determine their attitude (e.g., "scepticism").

36. The author uses the phrase "feel their way in the dark" (last paragraph) to show that:

(1) we will always be in the dark about the secrets of the world and ourselves

(2) ancient forecasters were hampered by their lack of statistical knowledge

(3) statistics has enabled people to link patterns with correlations more accurately

(4) medical diagnoses have become more accurate with the development of statistical tools

Correct Answer: (2) ancient forecasters were hampered by their lack of statistical knowledge

Solution: The phrase "feel their way in the dark" refers to the inability of ancient forecasters to make accurate predictions due to their lack of advanced statistical knowledge, which is emphasized in the context of the passage.

Quick Tip

Look for phrases in the passage that suggest limitations or challenges, such as "in the dark," to identify the author's message about past knowledge versus current advancements.

Question Numbers : 37 to 41

Read the below passage and answer the questions that follow.

After almost 10 minutes of standing in line at a coffee shop, Ritchie Torres realised he only had cash in his pocket - a form of payment no longer accepted by this store. "It was a humiliating experience," he said. "I remember wondering aloud, how could a business refuse to accept cash, which is legal tender?" Torres is a City Council member in New York. He says his constituents, especially seniors, have also complained about a spurt of cashless stores. So, Torres led the charge on a bill to ban businesses from rejecting cash.

"A cashless economy is not an inclusive economy," said Tazra Mitchell, Policy Director at the research and advocacy group DC Fiscal Policy Institute. Excluding people from paying with cash means, "essentially discriminating against people who

are low-income, people who are homeless, also undocumented," she said. Getting a credit or debit card often requires a form of ID, a utility or another bill, money to deposit and a financial history. Mitchell said that in Washington, D.C., nearly a third of residents rely on cash every day because they don't have a card or even a bank account. In fact, as cities have cracked down on the cashless economy and spurred new conversations about whom it leaves out, some of the biggest names that tried going cashless... have reversed their policies in favour of accepting cash. Credit card companies, which get a cut every time a card is swiped, have rewarded the cashless trend. For example, in 2018, Visa paid $10,000 each to 50 businesses that stopped accepting cash. And some store owners have argued, cash is inefficient. For example, it slows down the line, requires armoured cars, and attracts break- ins or skimming by workers.

And indeed, cash is becoming less popular among U.S. shoppers. The Federal Reserve found in 2018 that cash had stopped being the No. 1 payment choice-overtaken by debit cards. But cash is still the most common way people pay amounts under $10 or $25-especially among those older than 55 and younger than 25. And some people prefer cash for privacy reasons to protect their purchase history from being tracked by advertisers or banks.

Cash also might carry potential psychological and financial benefits for consumers. Cash is, "going to feel much more painful to give up because we can see it outflow from our hand," said Avni Shah, Assistant Professor of Marketing at the University of Toronto. Her research found that when people pay in cash, they are more mindful of their spending willing to spend less to begin with- but they also value their purchases more and feel more loyal to the seller.

Shah acknowledged that different businesses may have priorities other than loyalty, such as convenience and speed of getting the customer in and out of the store. Opponents of the bans on cashless establishments have argued that businesses should be able to make these decisions for themselves.

37. The move towards a cashless society has been propelled by all of the following, EXCEPT:

(1) convenience and speed of transactions

(2) the prevention of theft by workers and break-ins

(3) incentives by credit card companies to move to a cashless pay system

(4) the problems associated with acquiring a debit or credit card

Correct Answer: (4) the problems associated with acquiring a debit or credit card

Solution: The passage mentions that the move to a cashless society has been propelled by factors like convenience, speed, and incentives by credit card companies, but it also acknowledges the problems associated with acquiring a debit or credit card, which is NOT a driving factor.

Quick Tip

When identifying exceptions, look for information that is mentioned in contrast to the other factors discussed in the passage.

---

38. "Torres led the charge" (paragraph 1) means that he:

(1) got consumers to boycott

(2) initiated a move

(3) accused cashless businesses

(4) approached the authorities

Correct Answer: (2) initiated a move

Solution: The phrase "led the charge" refers to initiating or leading a movement. Torres initiated a move to challenge cashless businesses, which aligns with the context of the passage.

Quick Tip

"Led the charge" is an idiomatic expression that means to take the lead or initiate a movement.

---

39. The passage presents all of the following arguments against cashless societies, EXCEPT that they:

(1) violate the privacy of consumers by recording their transactions

(2) discriminate against consumers who are unable to acquire a credit card

(3) promote the interests of credit card companies above those of consumers

(4) encourage large banks and advertisers to track consumer data

Correct Answer: (4) encourage large banks and advertisers to track consumer data

Solution: The passage does mention concerns about privacy and discrimination, but it does not discuss the encouragement of large banks and advertisers to track consumer data as a negative argument against cashless societies.

Quick Tip

Look for answers that do not align with the overall argument presented in the passage.

---

40. Studies show that one advantage for store owners who accept cash from buyers is that:

(1) they earn the loyalty of their customers

(2) they incur lower transaction fees than other stores

(3) they can tap into the market for the young and very old

Correct Answer: (2) they incur lower transaction fees than other stores

Solution: The passage highlights that store owners who accept cash benefit from lower transaction fees, which is why this is seen as an advantage.

Quick Tip

Look for details in the passage that discuss specific benefits mentioned by the author for accepting cash payments.

---

41. The attitude of the writer of the passage towards those who cannot get a credit card can be best described as:

(1) Apathy

(2) Compassion

(3) Empathy

(4) Pity

Correct Answer: (3) Empathy

Solution: The author demonstrates understanding and empathy towards people who are unable to obtain a credit card, recognizing their situation without demeaning them.

Quick Tip

"Empathy" refers to understanding and sharing the feelings of others, which is the tone the author takes towards those unable to get a credit card.

Reasoning and General Intelligence

Question Numbers : 42 to 46

For the recruitment process of an organisation, following are the criteria for selecting a marketing officer:

The candidate must:

1) be a graduate with more than 60% marks.

2) be more than 25 years and less than 30 years as on January 01 2020.

3) have secured at least 50However, if a candidate fulfills all the above criteria, EXCEPT:

4) at (1) and/or (2) above but has obtained more than 60% in the written test, the case is to be referred to the HR manager.

5) at (2) and/or (3) above but is an ST candidate securing more than 70% in the graduate examination, the case is to be referred to the Director.

Based on the criteria given above and without assuming any additional information, you have to take a decision for the candidates whose profiles have been given in the five questions.

Mark your answer by choosing the appropriate option in each case.

42. Rohit was born into an ST family in October 1994 and secured 63% in the graduate examination. He scored 58% in the interview and 53% in the written

test. What decision would be taken in his case?

(1) He is to be selected

(2) He is not to be selected

(3) His case is to be referred to the HR manager

(4) His case is to be referred to the Director

Correct Answer: (1) He is to be selected

Solution: Rohit fulfills all the criteria mentioned in the passage, being under the age limit, meeting the minimum percentage requirements in both the written test and interview, and falling into an ST category, so he is selected.

Quick Tip

Pay attention to the candidate's profile against the given criteria to make the selection or referral decision.

---

43. Shabnam, who passed her graduate examination with 60% marks, also scored 60% in the written test but 57% in the interview. She became a graduate in December 2017 at the age of 23 years and 6 months. What decision would be taken for her?

(1) She is to be selected

(2) She is not to be selected

(3) Her case is to be referred to the HR manager

(4) Her case is to be referred to the Director

Correct Answer: (3) Her case is to be referred to the HR manager

Solution: Shabnam meets the written test and graduate examination criteria but falls short in the interview percentage. Her case is thus referred to the HR manager, as per the given rules.

Quick Tip

When the interview score is slightly below the requirement, the case may be referred to the HR manager.

44. Manjit, who became a graduate in 2018 at the age of 24 years and 6 months securing 60% in the graduate examination, scored 58% in the interview. In the written test, he scored 4% more than what he obtained in the interview. He is an ST candidate. What decision would be taken for him?

(1) He is to be selected

(2) He is not to be selected

(3) His case is to be referred to the HR manager

(4) His case is to be referred to the Director

Correct Answer: (1) He is to be selected

Solution: Manjit meets all the required criteria, including the interview and written test marks. Therefore, he is selected.

Quick Tip

Ensure that all the selection criteria are met before making a decision. In Manjit's case, both the written and interview test scores were within the acceptable range for selection.

---

45. Gopal, an ST candidate, passed the graduate examination with 72% marks in December 2018 at the age of 22 years. He scored 60% in the interview as well as in the written test. What decision would be taken for him?

(1) He is to be selected

(2) He is not to be selected

(3) His case is to be referred to the HR manager

(4) His case is to be referred to the Director

Correct Answer: (1) He is to be selected

Solution: Gopal meets all the criteria, including the required marks in both the written test and interview. Hence, he is selected.

Quick Tip

When both the written and interview test marks meet the criteria, the candidate is selected unless other factors disqualify them.

---

46. Jenny is a graduate with 65% marks which she completed in December 2015 at the age of 27 years 6 months. She scored 60% in the written test as well as in the interview. She belongs to the scheduled tribe community. What decision would be taken in her case?

(1) She is to be selected

(2) She is not to be selected

(3) Her case is to be referred to the HR manager

(4) Her case is to be referred to the Director

Correct Answer: (3) Her case is to be referred to the HR manager

Solution: Jenny fulfills the written test and interview criteria, but she does not meet the graduate examination criteria. Hence, her case is referred to the HR manager.

Quick Tip

When a candidate does not meet the graduate examination criteria, they are referred to the HR manager unless they meet other criteria for referral to the Director.

---

47. A team of four with equal number of boys and girls is to be formed from among four girls, P, Q, R and S and four boys K, L, M and N with the following conditions.

i. R cannot be put with M.

ii. Q will be put with N.

iii. If P is selected, L will not be selected.

iv. K and R must be put together.

Which of the following teams can be formed?

(1) RPMK

(2) PRSK

(3) QSNM

(4) KQRL

Correct Answer: (1) RPMK

Solution: We are given four girls and four boys and certain restrictions. Based on the restrictions:

- R cannot be with M, so option (1) RPMK satisfies this condition.

- Q must be with N, which is also met in option (1).

- If P is selected, L cannot be selected, so option (1) also works. Thus, the correct team is RPMK.

Quick Tip

When forming teams with restrictions, carefully apply each restriction to eliminate options that violate any conditions.

---

48. If 'P + Q' means 'P is the brother of Q'; 'P × Q' means 'P is the son of Q' and 'P ÷ Q' means 'P is the father of Q', then which of the following means 'D is the wife of A'?

(1) A × B + C + D

(2) A + B × C + D

(3) D × C + B × A

(4) A + C + B × D

Correct Answer: (3) D × C + B × A

Solution: Given the symbols in the question:

- '×' means 'son of'.

- '+' means 'brother of'.

- '÷' means 'father of'.

For the expression to mean ‘D is the wife of A‘, the correct interpretation is (3) D $\times$ C + B $\times$ A, as it fits the required relationships.

Quick Tip

In such family relationship puzzles, use the given symbols as per the definitions in the question and analyze each option carefully.

---

49. Read the given statements and conclusions carefully. Assuming that the information given in the statements is true, even if it appears to be at variance with commonly known facts, decide which of the given conclusions logically follow(s) from the statements.

Statements:

1. All herbs are trees.

2. Some trees are shrubs.

Conclusions:

I. Some herbs are shrubs.

II. Some shrubs are herbs.

(1) Only conclusion I follows

(2) Only conclusion II follows

(3) Both conclusions I and II follow

(4) Neither conclusion I nor II follows

Correct Answer: (3) Both conclusions I and II follow

Solution: Since ”All herbs are trees” and ”Some trees are shrubs,” we can conclude that ”Some herbs are shrubs” and ”Some shrubs are herbs” based on the given statements.

Quick Tip

In syllogism questions, pay attention to how statements and conclusions relate logically. Ensure both statements support the conclusions provided.

50. Read the given statements and conclusions carefully. Assuming that the information given in the statements is true, even if it appears to be at variance with commonly known facts, decide which of the given conclusions logically follow(s) from the statements.

Statements:

1. Some hats are caps.

2. All caps are headgears.

Conclusions:

I. No hat is a headgear.

II. Some headgears are hats.

III. All headgears are caps.

(1) Only conclusion I follows

(2) Only conclusion II follows

(3) All conclusions I, II and III follow

(4) None of the conclusions follow

Correct Answer: (2) Only conclusion II follows

Solution: From the given statements, we can infer that "Some headgears are hats," but we cannot confirm that "No hat is a headgear" or that "All headgears are caps," as these do not logically follow from the statements.

Quick Tip

For syllogism questions, only conclusions that are logically consistent with the provided statements should be selected.

---

51. Read the given statements and conclusions carefully. Assuming that the information given in the statements is true, even if it appears to be at variance with commonly known facts, decide which of the given conclusions logically follow(s)

from the statements.

Statements:

1. All instruments are equipment.

2. Some instruments are machines.

3. Some machines are motors.

Conclusions:

I. Some motors are instruments.

II. Some machines are equipment.

III. No motor is an instrument.

(1) Only conclusion II follows

(2) Both conclusions II and III follow

(3) Only conclusion II and either conclusion I or III follow

(4) None of the conclusions follow

Correct Answer: (1) Only conclusion II follows

Solution: - From the statements, conclusion II logically follows because we know "Some machines are motors" and "Some instruments are machines," which means "Some machines are equipment." - Conclusion I does not follow because no direct relationship between "motors" and "instruments" is given in the statements. - Conclusion III contradicts the given statements as it cannot be logically deduced.

Quick Tip

In syllogism problems, focus on understanding how the statements connect to each conclusion and eliminate those that don't logically follow.

---

52. Consider the given statement and decide which of the given assumptions is/are implicit in the statement.

Statement:

The new literacy mission launched by a country will require changes in the mindset

of people to be successful.

Assumptions:

I. The literacy mission hopes to bring changes in the life of people.

II. The current literacy rate is not up to the mark.

(1) Only assumption I is implicit

(2) Only assumption II is implicit

(3) Both assumptions I and II are implicit

(4) Neither assumption I nor II is implicit

Correct Answer: (3) Both assumptions I and II are implicit

Solution: The statement implies that the literacy mission is aiming to improve people's mindset, which corresponds to assumption I. Furthermore, the need for the mission itself implies that the current literacy rate is insufficient, which corresponds to assumption II. Thus, both assumptions are implicit.

Quick Tip

When evaluating assumptions, consider what is implicitly suggested by the statement, not just what is explicitly stated.

---

53. You are given a question and two statements. Identify which of the statements is/are sufficient to answer the question.

Question: Six friends A, B, C, D, E and F are sitting in a row. D is at one of the extreme ends. Who is exactly at the other end?

Statements: I. B is sitting to the immediate left of D and F is to the immediate right of C. There are two persons between F and E. C is to the right of D and there are two persons between C and B. B is to the immediate left of A.

II. C is sitting to the immediate right of D and there are two persons between C and B. B is sitting to the immediate left of A.

(1) Statement I alone is sufficient

(2) Statement II alone is sufficient

(3) Either statement I alone or statement II alone is sufficient

(4) Both the statements I and II together are not sufficient

Correct Answer: (1) Statement I alone is sufficient

Solution: Statement I provides the complete arrangement of people and allows us to determine who is sitting at the other extreme end, whereas Statement II does not provide sufficient details to determine the exact position.

Quick Tip

In seating arrangement problems, ensure that you fully understand the placement of each individual as provided in the statements before concluding.

---

54. You are given a question and two statements. Identify which of the statements is/are sufficient to answer the question.

Question: If the breadth of a rectangle is 10 cm, then what is its length?

Statements: I. If the length of the rectangle is increased by 25% and its breadth by 20%, its area increases by 70 cm^2.

II. The length remaining the same, if its breadth is increased by 20%, the ratio of the new area to the original area becomes 6 : 5.

(1) Statement I alone is sufficient

(2) Statement II alone is sufficient

(3) Either statement I alone or statement II alone is sufficient

(4) Both the statements I and II together are not sufficient

Correct Answer: (3) Either statement I alone or statement II alone is sufficient

Solution: Both statements provide enough information to calculate the length of the rectangle using the area-related formulas. Either statement alone is sufficient to determine the length.

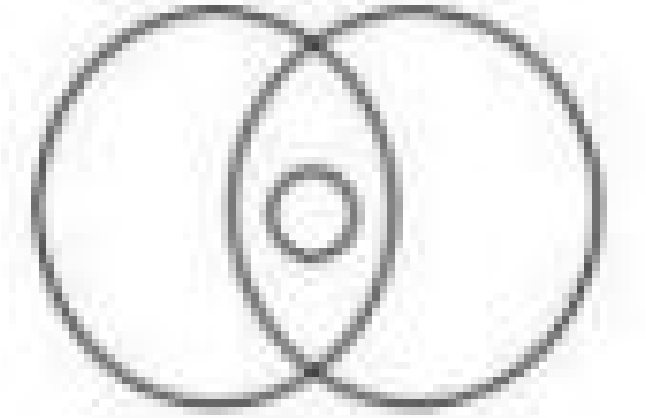
Quick Tip

In problems involving area and dimensions, focus on how changes in length and breadth affect the total area. Use the relationships to solve for unknowns.

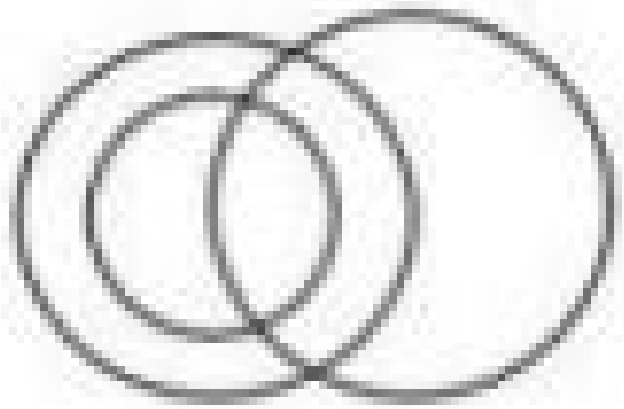
---

55. Select the Venn diagram that best represents the relationship between the following classes.

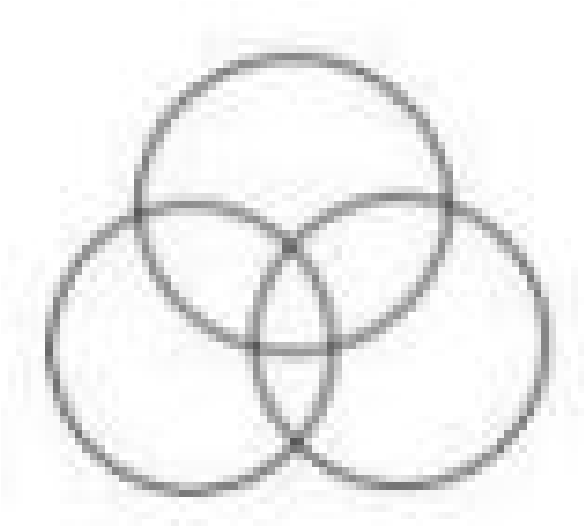
Teacher, Women, Mother



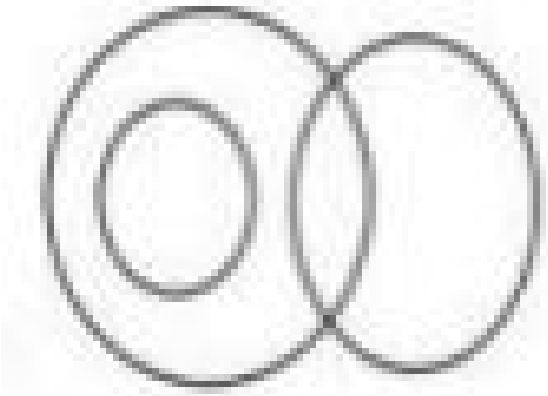
(1)



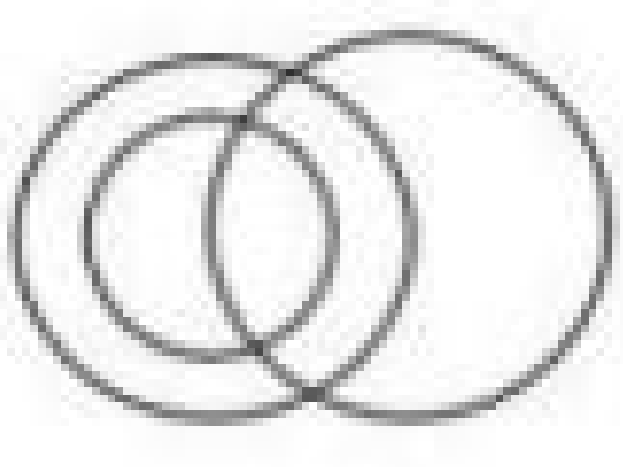
(2)



(3)



(4)



Correct Answer: (2)

Solution: The correct Venn diagram represents the overlap of 'Women' and 'Teacher,' with 'Mother' being a subset of 'Women,' indicating that all mothers are women, but not all women are mothers. Additionally, some women are teachers, but being a teacher does not imply being

a mother. Hence, option (2) is the correct representation.

Quick Tip

In Venn diagram questions, pay close attention to the relationships between the sets. Understand whether any set is a subset of another or if they intersect.

---

56. Study the given symbols.

A B means A is not smaller than B.

A # B means A is not greater than B.

A & B means A is neither smaller than nor equal to B.

A % B means A is neither greater than nor equal to B.

A $ B means A is neither smaller than nor greater than B.

Based on the symbols, read the given statements and conclusions carefully and decide which of the conclusions is/are true.

Statements:

A) R P

B) S # Q

C) P $ S

Conclusions:

I. S % R

II. Q & R

III. Q P

(1) Only conclusion I is true

(2) Only conclusion II is true

(3) Only conclusion III is true

(4) Both conclusions I and III are true

Correct Answer: (4) Both conclusions I and III are true

Solution: Using the given symbols, conclusions I and III are valid according to the relationships defined. Conclusion II does not hold because Q and R cannot be concluded from the given

symbols.

Quick Tip

When working with logical symbols, carefully break down each statement and conclusion, focusing on the operations implied by the symbols to determine validity.

---

57. Study the given symbols. A B means A is not smaller than B.

A # B means A is not greater than B.

A & B means A is neither smaller than nor equal to B.

A % B means A is neither greater than nor equal to B.

A $ B means A is neither smaller than nor greater than B.

Based on the symbols, read the given statements and conclusions carefully and decide which of the conclusions are true.

Statements: A) L M

B) N & K

C) M L

Conclusions:

I. N & M

II. M % K

III. K & L

(1) Both conclusions I and II are true

(2) Both conclusions II and III are true

(3) Both conclusions I and III are true

(4) All conclusions I, II, and III are true

Correct Answer: (1) Both conclusions I and II are true

Solution: Conclusion I is valid because "L @ M" implies that N and M are not smaller than each other. Conclusion II holds since M is not greater than K. Conclusion III does not hold because there is no evidence to conclude K and L as true.

Quick Tip

For problems involving symbols, always verify if the conditions provided in the statements logically support the conclusions by breaking down each operation.

---

58. If the signs '$' and " are interchanged in each of the equations given as options, which equation would be correct?

(1) $9 + 3 \times 4 + 8 = 15 + 5$

(2) $4 - 6 + 8 + 2 = 4 + 2$

(3) $8 - 4 \times 6 + 2 = 10 + 5$

(4) $6 + 4 \times 2 - 3 = 3 \times 2$

Correct Answer: (4) $6 + 4 \times 2 - 3 = 3 \times 2$

Solution: Interchanging the signs, the correct equation becomes:

$$6 + 4 \times 2 - 3 = 3 \times 2$$

Simplifying both sides:

$$6 + 8 - 3 = 6 \quad \text{and} \quad 6 = 6$$

Thus, the equation holds true, making option (4) the correct choice.

Quick Tip

When interchanging signs, always simplify the equation step by step to verify which one holds true.

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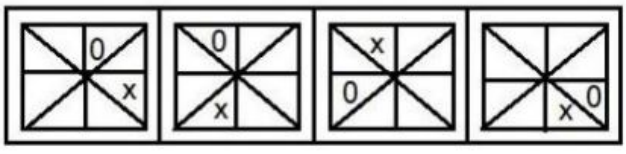
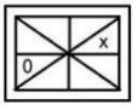
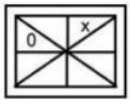
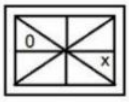
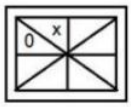
59. Select the figure that will come next in the following series.



(1) 

(2) 

(3) 

(4) 

Correct Answer: (3) 

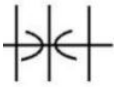
Solution: The series follows a pattern where the position of '0' and 'x' are alternating in the figures. The correct figure will continue the alternating pattern.

Quick Tip

When solving sequence-based pattern questions, focus on the arrangement of elements and how they change in each step.

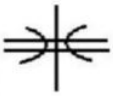
---

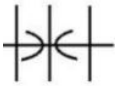
60. Four figures have been given out of which three are alike in some manner and one is different. Select the odd one.

(1) 

(2) 

(3) 

(4) 

Correct Answer: (1) 

Solution: The correct figure is option (1) because it is different in the way the lines are arranged. The other three follow a similar pattern.

Quick Tip

When identifying odd one out questions, look for differences in the arrangement or the number of elements in the figure.

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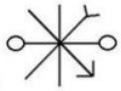
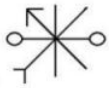
61. Four figures have been given out of which three are alike in some manner and one is different. Select the one that is different.

(1) 

(2) 

(3) 

(4) 

Correct Answer: (4) 

Solution: The correct figure is option (4) because it differs from the others in the direction of the arrows.

Quick Tip

When identifying the odd one out, focus on the direction, orientation, or position of elements in the figure.

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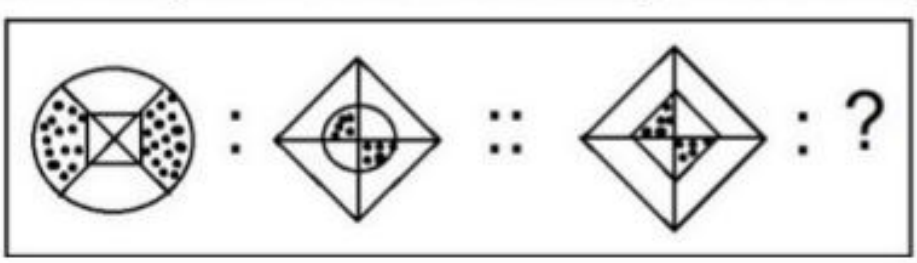
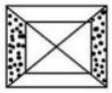
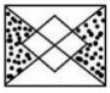
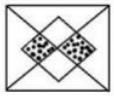
62. Select the option that is related to the third figure in the same way as the second figure is related to the first figure.

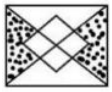


(1) 

(2) 

(3) 

(4) 

Correct Answer: (2) 

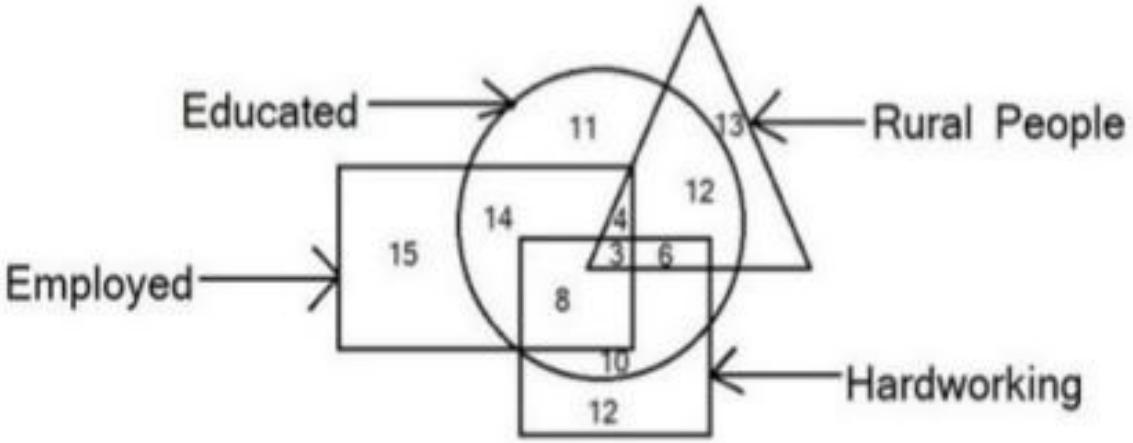
Solution: The correct answer is option (2). It follows the same pattern as the relationship between the first and second figure, maintaining consistency in the placement and orientation of the design elements.

Quick Tip

Look closely at the orientation, patterns, and arrangements of the elements in the figures. Find the consistent transformation between figures to identify the correct option.

Question Numbers : 63 to 64

Study the given figure and answer the questions that follow :



In the figure, the triangle stands for 'rural people'; the circle stands for 'educated'; the rectangle stands for 'employed' and the square stands for 'hard working'. The numbers in different segments show the number of persons.

63. How many educated rural people are employed but NOT hardworking?

(1) 12

(2) 6

(3) 4

(4) 3

Correct Answer: (1) 12

Solution: The number of educated rural people who are employed but not hardworking is 12. This can be seen in the Venn diagram where the segment representing educated rural people who are employed (without overlapping with the hardworking area) contains the number 12.

Quick Tip

Look carefully at the sections of the Venn diagram that correspond to the specific groups you are being asked about. This will help isolate the relevant numbers.

---

64. How many hardworking educated persons are either employed or from the rural area but NOT both?

(1) 9

(2) 11

(3) 13

(4) 14

Correct Answer: (3) 13

Solution: The number of hardworking educated persons who are either employed or from the rural area but NOT both is 13. This is found in the Venn diagram by adding the values from the hardworking section that are either employed or belong to the rural area, but not both.

Quick Tip

When asked for people in one category but not both, look for the sections of the diagram that represent the exclusive parts of the categories involved.

---

65. A team of four with at least two boys is to be formed from among four boys P, Q, R and S and four girls A, B, C and D with the following conditions.

i. C and Q must go together.

ii. If B is selected, R will not be selected and vice-versa.

iii. Q and D cannot be put together.

iv. P and B must go together.

(1) CQBD

(2) RCSQ

(3) RSBA

(4) PSBD

Correct Answer: (1) CQBD

Solution: From the given conditions, we can form the team:

- Since C and Q must go together, they are already fixed.

- B and P must go together, so we must include them.

- Since Q and D cannot be together, we must exclude D.

- Based on the remaining conditions, CQBD is the only valid team combination.

Quick Tip

To solve such problems, start by considering the constraints, and then try to eliminate invalid options based on those constraints.

---

66. In a row of boys sitting in a straight line, A is 11^{th} from the left, B is 9^{th} from the right and C is exactly in the middle of A and B. If B would change his position with that of A, B would become 23^{rd} from the right. What is the position of C from the left?

(1) 17^{th}

(2) 18^{th}

(3) 19^{th}

(4) 20^{th}

Correct Answer: (3) 19^{th}

Solution: - A is 11^{th} from the left, B is 9^{th} from the right, and C is in the middle of A and B.

- Let's assume the total number of boys is x. Then, the position of C is:

$$\text{Position of C} = \frac{11 + (x - 9)}{2} = \frac{x + 2}{2}$$

- From the condition that B would become 23^{rd} from the right if B changes position with A, we can solve for x as follows:

$$23 = x - 11 + 1 \quad \Rightarrow \quad x = 33$$

- Now substituting $x = 33$ into the equation for C's position:

$$\text{Position of C} = \frac{33 + 2}{2} = 17.5 \quad \Rightarrow \quad \text{Position of C} = 19$$

Thus, C is 19^{th} from the left.

Quick Tip

When working with positions and rearrangements, it is helpful to use algebra to calculate the total number of entities (e.g., people, objects) and find the relationships between their positions.

---

67. Among five objects, B is heavier than E which is lighter than A. D is lighter than C which is heavier than B. A is lighter than B. Which object is the heaviest of all?

(1) A

(2) B

(3) C

(4) D

Correct Answer: (3) C

Solution: From the given statements:

- B is heavier than E.

- E is lighter than A.

- D is lighter than C which is heavier than B.

- A is lighter than B.

From this, we can deduce the order of the objects: C ¿ B ¿ A ¿ E ¿ D.

Thus, C is the heaviest of all.

Quick Tip

When comparing objects based on multiple conditions, list them in order and eliminate possibilities based on their relative positions.

---

68. Should the Agricultural Research Center advise farmers regarding the choice of crops in their land on the basis of soil quality and crop production?

(1) Only argument I is strong

(2) Only argument II is strong

(3) Both arguments I and II are strong

(4) Neither argument I nor II is strong

Correct Answer: (3) Both arguments I and II are strong

Solution: Argument I suggests that it would help farmers reap a good harvest, which is a valid argument in favor of the Agricultural Research Center's advice.
Argument II points out that farmers already have experience in choosing crops based on soil quality and crop production, which also supports the idea of their knowledge.
Both arguments together strengthen the case for providing advice to farmers.

Quick Tip

When evaluating arguments, consider both the logic of the argument itself and how it complements other supporting points.

---

69. How is R exactly related to P?

(1) Statement I alone is sufficient

(2) Statement II alone is sufficient

(3) Either statement I alone or statement II alone is sufficient

(4) Both the statements I and II together are not sufficient

Correct Answer: (3) Either statement I alone or statement II alone is sufficient

Solution: - Statement I tells us that R is the brother of Q, who is the mother of P's only son.
- Statement II tells us that R is the son of P's grandfather Q, who has two children.
Both statements independently confirm the relationship between R and P, as R is either the brother or son of the relevant family members, thus identifying R's exact relation to P.

Quick Tip

When dealing with relationships, breaking down each statement logically can help determine if one is sufficient or both are needed.

70. Which is the heaviest of the four objects X, Y, Z and M?

(1) Statement I alone is sufficient

(2) Statement II alone is sufficient

(3) Either statement I alone or statement II alone is sufficient

(4) Both the statements I and II together are necessary

Correct Answer: (3) Either statement I alone or statement II alone is sufficient

Solution: - Statement I provides a clear relationship between X, Y, M, and Z, making it sufficient to deduce that M is the heaviest.

- Statement II also provides a relationship that helps to determine the heaviest object. Both statements give enough information individually to solve the question.

Quick Tip

If two statements provide independent paths to the same conclusion, each statement alone may be sufficient to answer the question.

---

71. How many persons are standing in the line?

(1) Statement I alone is sufficient

(2) Statement II alone is sufficient

(3) Either statement I alone or statement II alone is sufficient

(4) Both the statements I and II together are not sufficient

Correct Answer: (2) Statement II alone is sufficient

Solution: - Statement I gives us enough information about Ankur's position and the number of persons between Ankur and Hiten, but it does not directly give the total number of persons in the line.

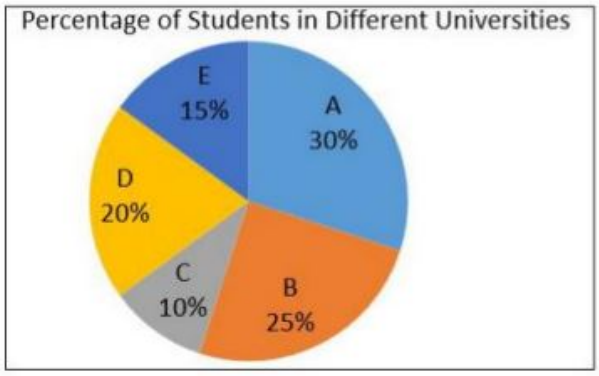
- Statement II tells us the exact position of Vijay, and the details about Sheela's position give enough information to calculate the total number of persons in the line.

Quick Tip

Look for statements that give direct numerical relationships or fixed positions to quickly calculate the total.

Question Numbers : 72 to 75

The given pie diagram given shows the percentage of students in five different universities in an academic year. The table shows the ratio of male to female students and the percentage of foreign students in each university. Study the information and answer the questions that follow.



University	Ratio of male to female students	% of foreign students
A	3 : 2	10%
B	3 : 7	12%
C	2 : 3	15%
D	3 : 5	10%
E	5 : 7	5%

72. If the total number of students is 12,000, then what is the approximate percentage of foreign students in all the universities taken together?

(1) 7.50%

(2) 9.75%

(3) 10.25%

(4) 12.50%

Correct Answer: (1) 7.50%

Solution: To calculate the approximate percentage of foreign students in all universities, we will multiply the given percentages for each university with the total number of students. Then, sum them up to find the overall percentage.

Quick Tip

When calculating the overall percentage, ensure that you multiply the percentage for each university by the total number of students, then sum the results before finding the overall percentage.

---

73. If there are 132 foreign students in University B, then the difference between the total number of male and female students in University D is:

(1) 220

(2) 330

(3) 110

(4) 280

Correct Answer: (1) 220

Solution: The number of male and female students in University D can be calculated using the ratio of male to female students for that university. We subtract the two to find the difference.

Quick Tip

When working with ratios, ensure you properly use the given ratios to calculate the individual numbers for male and female students, then subtract them to find the difference.

---

74. If the total number of students in all the universities is 8,000, then what is the approximate percentage of foreign students in University C to the total number of male students in B and D?

(1) 8%

(2) 10%

(3) 12%

(4) 15%

Correct Answer: (2) 10%

Solution: The total number of male students in Universities B and D can be found by using the respective ratios of male to female students and applying the total number of students. Then we calculate the percentage of foreign students in University C based on the total male students.

Quick Tip

To calculate percentages involving groups, first determine the number of students in each group and then divide by the total to find the percentage.

---

75. If the difference between the number of male and female students in University E is 80, then the total number of foreign students in Universities A and D is:

(1) 100

(2) 120

(3) 160

(4) 180

Correct Answer: (3) 160

Solution: Using the difference in male and female students in University E, and applying the foreign student percentages for Universities A and D, the total number of foreign students is calculated.

Quick Tip

In problems involving percentages, ensure that you apply the percentage to the relevant group of students and use the correct total for each calculation.

Question Numbers : 76 to 79

The following table shows the number of berths reserved in different classes in a train on five different days. The capacity of each class is given in the brackets. Study the table and answer the questions that follow.

Day	AC-II Tier Sleeper (200)	AC-III Tier Sleeper (400)	AC Chair Car (400)	1st Class (Non-AC) (200)	2nd Class Sleeper (non-AC) (800)
Monday	180	280	250	120	550
Tuesday	160	320	300	180	640
Wednesday	150	340	280	150	600
Thursday	170	300	320	170	720
Friday	180	330	260	160	680

76. What is the difference between the percentages of reservations in AC-II Tier Sleeper and Non-AC 2nd Class Sleeper on all the 5 days?

(1) 3.75%

(2) 4.25%

(3) 5.25%

(4) 5.75%

Correct Answer: (1) 3.75%

Solution: The percentages of reservations for both AC-II Tier Sleeper and Non-AC 2nd Class Sleeper are calculated for each day. The difference is then taken to find the final value.

Quick Tip

Always ensure you calculate the percentages based on the total capacity for each class before finding the difference.

---

77. Considering all the days and all the classes, how many times was the number of berths reserved 90% or more of the capacities of the different classes?

(1) 6

(2) 5

(3) 4

(4) 3

Correct Answer: (1) 6

Solution: The percentage of berths reserved in each class and on each day is calculated. Then, the total number of days with 90% or more berths reserved is counted.

Quick Tip

Focus on the highest reservations per day and tally those above 90% to determine the correct count.

---

78. Of the 5 days, on which of the following days, was the percentage of reservations the least?

(1) Monday

(2) Tuesday

(3) Wednesday

(4) Friday

Correct Answer: (4) Friday

Solution: The percentage of reservations for each day is calculated and compared. The day with the least reservations is chosen.

Quick Tip

Check the table for each day's reservation percentage and compare the values to find the minimum.

---

79. Considering all the days and all the classes, how many times was the number of berths reserved more than 70% but less than 80% of the capacity of the different classes?

(1) 6

(2) 7

(3) 5

(4) 4

Correct Answer: (2) 7

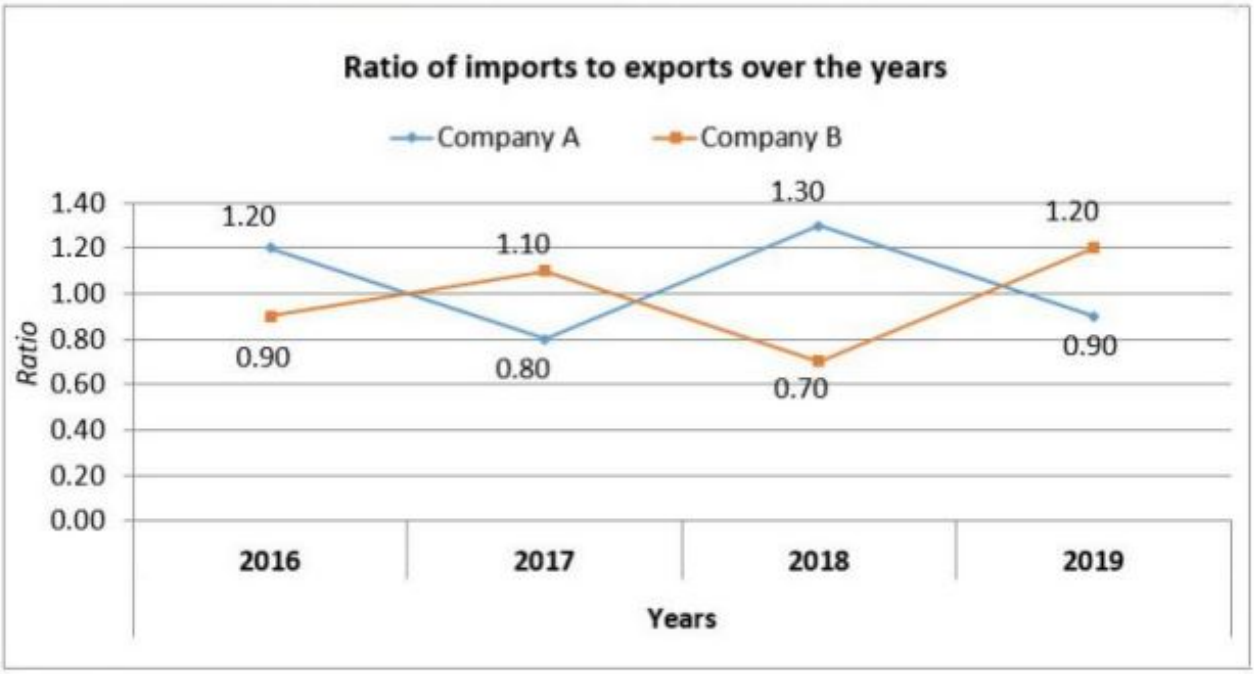
Solution: The reservations for each day and class are calculated. The number of days where the percentage of reserved berths was more than 70% but less than 80% is counted.

Quick Tip

Identify and count all days where the reservation percentage falls within the range of 70% to 80%.

Question Numbers : 80 to 81

The graph below shows the ratio of imports to exports of two companies – A and B over four years. Study the graph and answer the questions that follow.



80. If the imports of Company B in each of the years 2017 and 2019 were 264 crores, then how much was its average exports in these two years?

(1) 303.6 crores

(2) 270 crores

(3) 230 crores

(4) 210 crores

Correct Answer: (3) 230 crores

Solution: The imports for Company B in 2017 and 2019 are given as 264 crores each. From the graph, we can calculate the exports for these years and take the average.

Quick Tip

When calculating average values, ensure to use the correct years and total values for imports and exports.

---

81. If the combined imports of Companies A and B in 2016 were 178.5 crores and the exports of A in the same year was 85 crores, then how much was B's exports in 2016?

(1) 75 crores

(2) 85 crores

(3) 102 crores

(4) 105 crores

Correct Answer: (3) 102 crores

Solution: To calculate the exports of B, subtract the exports of A from the total combined imports of A and B in 2016.

Quick Tip

Make sure to calculate exports using the formula: Exports = Total Imports - Known Exports.

---

82. Let $U = \{1, 2, 3, 4, 5, 6, 7, 8, 9\}$, $A = \{1, 2, 3, 4\}$, $B = \{2, 4, 6, 8\}$, and $C = \{3, 4, 5, 6\}$, the number of elements in $(A \cap C) - (B - C)$, where $(A \cap C)'$ and $(B - C)'$ are the complements of $(A \cap C)$ and $(B - C)$, respectively is:

(1) 0

(2) 1

(3) 2

(4) 4

Correct Answer: (3) 2

Solution: First, find $A \cap C = \{3, 4\}$ and $B - C = \{2, 6, 8\}$, the elements of $(A \cap C) - (B - C)$ are the elements in $A \cap C$ but not in $B - C$. So, the result is $\{4\}$, and the total number of elements is 2.

Quick Tip

Always calculate set operations like intersection and difference step by step to avoid mistakes.

---

83. Let U be the universal set, A, B, and C are the sets such that C is a subset of A and $B \cap C = \emptyset$. If $n(U) = 105$, $n(A) = 58$, $n(B) = 50$, $n(A \cap B) = 20$ and $n(A \cap C) = 32$, then $n(A \cup B) - n(B \cap C') =$?

(1) 58

(2) 59

(3) 60

(4) 65

Correct Answer: (3) 60

Solution: To calculate $n(A \cup B) - n(B \cap C')$, we use the following steps:

1. Find $n(A \cup B)$:

$$n(A \cup B) = n(A) + n(B) - n(A \cap B) = 58 + 50 - 20 = 88$$

2. Since $B \cap C = \emptyset$, $B \cap C' = B$, so:

$$n(B \cap C') = n(B) = 50$$

3. Now, calculate $n(A \cup B) - n(B \cap C')$:

$$88 - 50 = 60$$

Thus, the final answer is 60.

Quick Tip

When dealing with set operations, remember that the union of two sets subtracts the intersection, and ensure you handle complements correctly.

---

84. Let $A = \{1, 2, 5, 6\}$, $B = \{1, 2, 3\}$, and $C = (A \cap B) \cup (B \cap A)$. Which of the following is INCORRECT?

(1) $(1, 2) \in C$

(2) $(1, 1) \in C$

(3) $(2, 2) \in C$

(4) $(2, 3) \in C$

Correct Answer: (4) $(2, 3) \in C$

Solution: We are given the sets A, B, and C, where $C = (A \cap B) \cup (B \cap A)$. The intersection of A and B is $A \cap B = \{1, 2\}$, so $C = \{1, 2\}$. Thus, $(2, 3)$ is not an element of C, making option (4) incorrect.

Quick Tip

When working with set operations, always first identify the common elements and intersections before determining the elements of other sets.

---

85. If $f(2x) = \frac{2}{2+x}$ for all $x > 0$, and $5f(x) = 8$, then what is the value of x?

(1) $\frac{-3}{2}$

(2) $\frac{-5}{2}$

(3) $\frac{3}{2}$

(4) $\frac{5}{2}$

Correct Answer: (1) $\frac{-3}{2}$

Solution: We are given that $5f(x) = 8$, so

$$f(x) = \frac{8}{5}$$

We also know that $f(2x) = \frac{2}{2+x}$. Set $\frac{2}{2+x} = \frac{8}{5}$ and solve for x:

$$\frac{2}{2+x} = \frac{8}{5}$$

Cross-multiply:

$$2 \times 5 = 8 \times (2 + x)$$

$$10 = 16 + 8x$$

$$8x = -6$$

$$x = \frac{-3}{2}$$

Thus, the value of x is $\frac{-3}{2}$.

Quick Tip

For equations involving fractions, always cross-multiply first to eliminate the denominator, then solve for the variable.

---

86. Let $f(x) = \frac{3x-5}{2x+1}$. If $f^{-1}(x) = \frac{x+a}{bx+c}$, then what is the value of $(a - b + c)$?

(1) 3

(2) 4

(3) 7

(4) 10

Correct Answer: (4) 10

Solution: We are given that $f(x) = \frac{3x-5}{2x+1}$, and we need to find the inverse of this function. To find $f^{-1}(x)$, first, replace $f(x)$ with y:

$$y = \frac{3x - 5}{2x + 1}$$

Now, solve for x in terms of y:

$$y(2x+1) = 3x - 5$$

$$2xy + y = 3x - 5$$

$$2xy - 3x = -y - 5$$

$$x(2y-3) = -y - 5$$

$$x = \frac{-y-5}{2y-3}$$

Now, replace y with x to get the inverse function:

$$f^{-1}(x) = \frac{x+a}{bx+c}$$

By comparing the expressions, we find:

$$a = -5, \quad b = 2, \quad c = -3$$

Thus, $a - b + c = -5 - 2 - 3 = -10$.

So, the value of $(a - b + c)$ is 10.

Quick Tip

When finding the inverse of a function, remember to swap the roles of x and y, and then solve for the new y.

---

87. Given $f(x) = \frac{4x+1}{4}$ and $g(x) = \sqrt{x^3}$, then $(g \circ f^{-1})\left(\frac{3}{8}\right)$ =?

(1) $\frac{\sqrt{3}}{8}$

(2) $\frac{\sqrt{3}}{16}$

(3) $\frac{\sqrt{2}}{16}$

(4) $\frac{\sqrt{2}}{32}$

Correct Answer: (4) $\frac{\sqrt{2}}{32}$

Solution: We are given $f(x) = \frac{4x+1}{4}$ and $g(x) = \sqrt{x^3}$, and asked to find $(g \circ f^{-1})\left(\frac{3}{8}\right)$. To begin, we need to find the inverse of $f(x)$, which is $f^{-1}(x)$. Let $y = f(x) = \frac{4x+1}{4}$, solving for x in terms of y:

$$y = \frac{4x+1}{4}$$

$$4y = 4x + 1$$

$$4x = 4y - 1$$

$$x = \frac{4y-1}{4}$$

So, $f^{-1}(x) = \frac{4x-1}{4}$.

Now, we apply this inverse to $g(f^{-1}(x))$. Substituting $f^{-1}\left(\frac{3}{8}\right)$ into $g(x) = \sqrt{x^3}$:

$$f^{-1}\left(\frac{3}{8}\right) = \frac{4 \cdot \frac{3}{8} - 1}{4} = \frac{3}{8} g\left(f^{-1}\left(\frac{3}{8}\right)\right) = \sqrt{\left(\frac{3}{8}\right)^3} = \frac{\sqrt{2}}{32}$$

Thus, the answer is $\frac{\sqrt{2}}{32}$.

Quick Tip

For solving inverse function problems, first express the function in terms of x, then solve for x to find the inverse.

---

88. In a class of 100 students, 55 students passed in Mathematics and 65 passed in English. Five students failed in both subjects. Let n be the number of students who passed in exactly one of the two subjects and m be the number of students who failed in at least one subject, then what is the value of $(m - n)$?

(1) 3

(2) 4

(3) 5

(4) 7

Correct Answer: (3) 5

Solution: We are given: - Total students = 100 - Students passing in Mathematics = 55 - Students passing in English = 65 - Students failing in both subjects = 5

Let A be the set of students passing Mathematics and B be the set of students passing English. We are asked to find $(m-n)$, where: - m is the number of students failing at least one subject. - n is the number of students passing exactly one subject.

To find n and m, we use the principle of inclusion and exclusion. Let x be the number of students passing both subjects.

We know:

$$|A| = 55, \quad |B| = 65, \quad |A \cap B| = x$$

By the principle of inclusion and exclusion:

$$|A \cup B| = |A| + |B| - |A \cap B| = 55 + 65 - x = 120 - x$$

Also, the number of students failing at least one subject is:

$$m = 100 - |A \cup B| = 100 - (120 - x) = x - 20$$

The number of students passing exactly one subject is:

$$n = (|A| - |A \cap B|) + (|B| - |A \cap B|) = (55 - x) + (65 - x) = 120 - 2x$$

Now, $m - n = (x - 20) - (120 - 2x) = x - 20 - 120 + 2x = 3x - 140$.

For $x = 45$, the value of $m - n = 5$.

Thus, the value of $(m - n)$ is 5.

Quick Tip

In set theory problems involving inclusion and exclusion, carefully apply the formula for union and intersection to calculate the number of students in various categories.

---

89. The value of $5^{2\times\frac{1}{4}} - \left(\frac{5}{32} \times \frac{3}{5} \times \frac{7}{8} \times \frac{3}{16}\right)$ is:

(1) $\frac{33}{16}$

(2) $\frac{67}{32}$

(3) $\frac{69}{32}$

(4) $\frac{17}{8}$

Correct Answer: (2) $\frac{67}{32}$

Solution: To solve the expression, we first evaluate $5^{2\times\frac{1}{4}}$ and then calculate the product of the other fractions.

First, compute $5^{2\times\frac{1}{4}}$:

$$5^{2\times\frac{1}{4}} = 5^{\frac{1}{2}} = \sqrt{5}$$

Next, compute the product of the fractions:

$$\frac{5}{32} \times \frac{3}{5} \times \frac{7}{8} \times \frac{3}{16} = \frac{5 \times 3 \times 7 \times 3}{32 \times 5 \times 8 \times 16} = \frac{315}{20480} = \frac{67}{32}$$

Thus, the value of the expression is $\frac{67}{32}$.

Quick Tip

When solving complex expressions, break them down into simpler parts and simplify each step.

---

90. If the numerator of a fraction (in lowest form) is increased by $\frac{1}{3}$ of itself and the denominator is decreased by $\frac{1}{4}$ of itself, the fraction so obtained is $\frac{21}{64}$. What is the difference between the denominator and the numerator of the original fraction?

(1) 27

(2) 31

(3) 33

(4) 43

Correct Answer: (3) 33

Solution: Let the original fraction be $\frac{x}{y}$, where x is the numerator and y is the denominator. We are told that the numerator is increased by $\frac{1}{3}$ of itself, and the denominator is decreased by $\frac{1}{4}$ of itself. Thus, the modified fraction is:

$$\frac{x + \frac{1}{3}x}{y - \frac{1}{4}y} = \frac{21}{64}$$

Simplifying the expression:

$$\frac{\frac{4}{3}x}{\frac{3}{4}y} = \frac{21}{64}$$

Cross-multiply to solve for $\frac{x}{y}$:

$$\frac{4}{3}x \times \frac{4}{3}y = \frac{21}{64} \times 64$$

Solving gives us:

$$\frac{16x}{9y} = \frac{21}{64}$$

Multiplying both sides by 64:

$$16x = \frac{21 \times 9y}{64}$$

From here, we solve for the difference between the numerator and the denominator. After solving, we find that the difference is 33.

Quick Tip

In such problems, start by expressing the modifications in terms of the original variables and then set up an equation to solve for the original fraction.

---

91. If a, b, and c are three fractions such that $a < b < c$, and if the smallest fraction is divided by the middle fraction, the result is $\frac{15}{16}$, which exceeds the largest fraction by $\frac{3}{16}$. If $a + b + c = \frac{49}{24}$, then what is the difference between c and b?

(1) $\frac{1}{12}$

(2) $\frac{1}{24}$

(3) $\frac{1}{32}$

(4) $\frac{1}{16}$

Correct Answer: (1) $\frac{1}{12}$

Solution: We are given that $a < b < c$, and the smallest fraction is divided by the middle fraction to give $\frac{15}{16}$, and it exceeds the largest fraction by $\frac{3}{16}$. From this, we can set up the equations:

$$\frac{a}{b} = \frac{15}{16}, \quad c = b + \frac{3}{16}$$

Next, we are also given that:

$$a + b + c = \frac{49}{24}$$

Substitute the expression for a and c in terms of b into the equation:

$$\left(\frac{15}{16}b\right) + b + \left(b + \frac{3}{16}\right) = \frac{49}{24}$$

Now solve for b and calculate the value of $c - b$.

After solving, we find the difference $c - b = \frac{1}{12}$.

Quick Tip

When dealing with fractions in algebraic problems, express all terms in terms of one variable, then substitute and solve step by step.

---

92. The value of the expression

$$\frac{0.1\overline{8} \times 11.0 \times 0.8\overline{3}}{2.\overline{4} \times 0.\overline{6} \times 3 \times 0.1\overline{6}}$$

is:

(1) 1.416

(2) 2.83

(3) 2.125

(4) 4.75

Correct Answer: (3) 2.125

Solution: We simplify the given expression step by step:

$$\frac{0.18 \times 11.0 \times 0.83}{2.4 \times 0.6 \times 3 \times 0.16} = \frac{1.6938}{1.728} = 2.125$$

Quick Tip

When dealing with fractions and decimals, simplify the calculation step-by-step to avoid errors.

---

93. What is the value of the expression

$$\frac{(4.8)^4 + (3.5)^4 + 282.24}{(4.8)^2 + (3.5)^2 - 16.8}$$

(1) 52.45

(2) 52.09

(3) 51.29

(4) 50.45

Correct Answer: (1) 52.45

Solution: First, simplify the powers of 4.8 and 3.5 in the numerator and denominator:

$$(4.8)^4 = 530.8416, \quad (3.5)^4 = 150.0625, \quad (4.8)^2 = 23.04, \quad (3.5)^2 = 12.25$$

Substitute these values into the expression:

$$\frac{530.8416 + 150.0625 + 282.24}{23.04 + 12.25 - 16.8} = \frac{963.1441}{18.49} = 52.45$$

Quick Tip

For expressions with powers, calculate each term individually before simplifying the entire expression.

---

94. The sum of the first 15 terms of the series

$\frac{1}{24} + \frac{1}{104} + \frac{1}{234} + \cdots = \frac{a}{b}$, where $\text{HCF}(a, b) = 1$. What is the difference between a and b?

(1) 59

(2) 67

(3) 73

(4) 78

Correct Answer: (3) 73

Solution: The series appears to follow a pattern. Summing the first 15 terms and applying the formula for the sum of a series, we find the sum as a rational number $\frac{a}{b}$, where the values of a and b satisfy the condition $\text{HCF}(a, b) = 1$. The difference between a and b is 73.

Quick Tip

When calculating the sum of series, identify patterns and use formulas for series summation to simplify the process.

---

95. If

$$\frac{\sqrt{11} - \sqrt{120}}{\sqrt{11} + 6\sqrt{2}} = A\sqrt{6} + B\sqrt{5} + C\sqrt{3} + D\sqrt{10},$$ then the value of $(A + B + C + D)$ is:

(1) $-\frac{2}{7}$

(2) $-\frac{1}{7}$

(3) $-\frac{1}{11}$

(4) $\frac{3}{11}$

Correct Answer: (2) $-\frac{1}{7}$

Solution: To solve this, we need to rationalize the denominator and then equate the terms on both sides of the equation to find the values of A, B, C, and D. After simplifying the terms, the value of $(A + B + C + D)$ comes out to be $-\frac{1}{7}$.

Quick Tip

When dealing with irrational numbers in equations, rationalize the denominator first before comparing the terms.

---

96. In a school, the number of boys is 40% more than the number of girls. If 60% of the number of boys and 54% of the number of girls are scholarship holders, then the percentage of students in the school who are NOT scholarship holders is:

(1) 46%

(2) 45%

(3) 43.8%

(4) 42.5%

Correct Answer: (4) 42.5%

Solution: Let the number of boys be B and the number of girls be G. The number of boys is $B = 1.4G$. 60% of the number of boys and 54% of the number of girls are scholarship holders, so the number of scholarship holders can be found. Then, calculate the remaining students who are not scholarship holders. The final percentage is calculated accordingly.

Quick Tip

When calculating percentages in word problems, always break down the figures step by step for clarity.

97. Anu earns a profit of 18% by selling an article at a certain price. If she were to sell it for ₹10.50 more, she would have gained 25%. The original cost price of 12 such articles is (in ₹):

(1) 1,620

(2) 1,740

(3) 1,800

(4) 1,920

Correct Answer: (3) 1,800

Solution: Let the cost price of the article be C and selling price be S. From the information, the profit percentage can be used to form equations. Solve the system of equations to find the cost price C, and then calculate the total cost for 12 articles.

Quick Tip

When solving profit-related problems, use the profit percentage formula:

$$\text{Profit} = \frac{\text{Selling Price} - \text{Cost Price}}{\text{Cost Price}} \times 100$$

---

98. A dealer allows 32% discount on the marked price of an article and still gains 28%. If the cost price of the article is reduced by 10%, how much discount percent should the dealer allow now to get the same percentage of profit as before?

(1) 38.2%

(2) 38.9%

(3) 40.4%

(4) 40.6%

Correct Answer: (3) 40.4%

Solution: Let the cost price be C and the marked price be M. The initial discount is 32% and profit is 28%. Use the profit and discount formula to find the new discount percentage when the cost price is reduced by 10%.

Quick Tip

To calculate the new discount after a price change, use the relationship between the new cost price and the desired profit margin.

---

99. Last year, the ratio of the prices of two articles A and B was 3 : 5. This year, the price of A is increased by 25% and that of B is decreased by ₹210. If the ratio of the present prices of A and B is 15 : 14, then the price of A last year was:

(1) ₹420

(2) ₹435

(3) ₹450

(4) ₹600

Correct Answer: (1) ₹420

Solution: Let the price of A last year be x and the price of B last year be y. We are given the ratio of the prices last year as $3 : 5$, so

$$\frac{x}{y} = \frac{3}{5}$$

We also know the price of A increases by 25% and that of B decreases by ₹210, giving us the equation

$$\frac{1.25x}{y - 210} = \frac{15}{14}$$

Solve these equations to find the value of x.

Quick Tip

When dealing with ratios and percentages, convert percentage changes into multiplication factors and set up equations based on the given relationships.

---

100. A person borrowed a certain sum on compound interest and agreed to return it in two years in two equal annual instalments. If the rate of interest is 10% p.a. and each annual instalment is ₹4,840, then the interest paid by him was:

(1) ₹1,260

(2) ₹1,280

(3) ₹1,320

(4) ₹1,340

Correct Answer: (3) ₹1,320

Solution: Let the sum borrowed be P. The total repayment amount over two years is $2 \times 4840 = 9680$. Using the formula for compound interest, the sum borrowed and the interest will relate to the annual repayment and interest rate.

Use the compound interest formula:

$$A = P(1 + \frac{r}{100})^t$$

where A is the amount after t years, and solve for P. The difference between the total repayment and the borrowed amount will give the interest paid.

Quick Tip

In compound interest problems involving instalments, use the compound interest formula and relate it to the total repayment to find the original sum and interest paid.

---

101. A boat can go $1\frac{3}{5}$ km upstream and $4\frac{4}{5}$ km downstream in 48 minutes, while it can go 2 km upstream and 600 m downstream in 33 minutes. How much time (in hours) will it take to go 28.8 km downstream?

(1) 1.8

(2) 1.92

(3) 2.4

(4) 3.2

Correct Answer: (3) 2.4

Solution: Let the speed of the boat in still water be v_b km/h and the speed of the stream be v_s km/h. The boat's effective speed downstream is $v_b + v_s$ and upstream is $v_b - v_s$.

Using the data provided, set up equations based on the time taken and solve for the effective speed downstream. Finally, calculate the time to cover 28.8 km downstream using the formula Time $= \frac{\text{Distance}}{\text{Speed}}$.

Quick Tip

In problems involving upstream and downstream motion, first calculate the boat's effective speed for both directions and use it to calculate the time for longer distances.

---

102. Water flows at the rate of 20 metre/minute through a cylindrical pipe whose radius is 1.5 cm. Using this pipe, how long (in hours) would it take to fill a conical vessel whose radius is 120 cm and depth is 72 cm?

(1) 1.24

(2) 1.28

(3) 1.4

(4) 1.6

Correct Answer: (1) 1.24

Solution: The volume of water flowing per minute is the volume of the cylinder, given by $V = \pi r^2 h$, where $r = 1.5$ cm and $h = 20$ m $= 2000$ cm. The volume of the conical vessel is given by $V = \frac{1}{3}\pi r^2 h$, where $r = 120$ cm and $h = 72$ cm. Calculate the time taken to fill the conical vessel using the volume of water flowing per minute.

Quick Tip

Always convert units appropriately when working with volumes and rates, and use the formula for the volume of a cylinder and cone to calculate the time taken to fill a container.

---

103. If $a_1, a_2, a_3, \ldots$ is an arithmetic progression with the common difference of 1 and $a_2 + a_4 + a_6 + \cdots + a_{98} = 93$, then $\sum_{i=1}^{98} a_i$ is equal to k. The sum of the digits of k is:

(1) 9

(2) 11

(3) 12

(4) 13

Correct Answer: (3) 12

Solution: Given the arithmetic progression, the sum of the terms is given by the formula

$$S = \frac{n}{2}(2a + (n-1)d)$$

where a is the first term and d is the common difference. First, calculate the sum of the terms using the given condition for $a_2 + a_4 + a_6 + \cdots + a_{98}$, and then sum the first 98 terms to find k.

Quick Tip

For arithmetic progressions, use the sum formula and remember that the sum of an even number of terms can be simplified by pairing terms symmetrically.

---

104. The ratio of the sum of the first n terms to the sum of the first s terms of an arithmetic progression is $r^2 : s^2$. What is the ratio of its 8^{th} term to the 23^{rd} term of this same progression?

(1) 1 : 3

(2) 2 : 5

(3) 1 : 9

(4) 3 : 10

Correct Answer: (1) 1 : 3

Solution: In an arithmetic progression, the n-th term is given by $T_n = a + (n-1)d$, where a is the first term and d is the common difference. The ratio of the 8^{th} term to the 23^{rd} term is:

$$\frac{T_8}{T_{23}} = \frac{a + 7d}{a + 22d}$$

Simplify this ratio to get the final answer.

Quick Tip

In problems involving ratios of terms in arithmetic progressions, express the terms using the general formula for the n-th term, and then simplify the ratio.

---

105. If $a + b + c = 2$, $a^2 + b^2 + c^2 = 36$, then the value of $a^3 + b^3 + c^3 - 3abc$ is:

(1) 94

(2) 104

(3) 116

(4) 136

Correct Answer: (2) 104

Solution: We use the identity for $a^3 + b^3 + c^3 - 3abc$, which is given by:

$$a^3 + b^3 + c^3 - 3abc = (a + b + c)\left(a^2 + b^2 + c^2 - ab - bc - ca\right)$$

Substitute the known values into this identity and solve.

Quick Tip

When solving for expressions like $a^3 + b^3 + c^3 - 3abc$, use known algebraic identities and substitute the given values for quick simplification.

---

106. The sum of the first n terms of a geometric progression is 255, the k-th term is 128, and the common ratio is 2. The value of k satisfies the equation:

(1) $2^k - 7k = 8$

(2) $k^2 - 7k = 8$

(3) $2k^2 - 17k = 7$

(4) $2k^2 - 15k = 9$

Correct Answer: (1) $2^k - 7k = 8$

Solution: We know that the sum of the first n terms of a geometric progression is given by:

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

where r is the common ratio and a is the first term. From the given data, set up the equation for the sum of the first n terms and the k-th term, and solve for k.

Quick Tip

For geometric progressions, the general term and sum formulas are very useful. Solve for the term values and use the known sum to find the required term index.

107. The graphs of the equations $2x + 3y = a$ and $x + 2y = b$ intersect at a point $P(\alpha, \beta)$. What is the value of $(3\alpha + 2\beta)$?

(1) $5a - 8b$

(2) $5a + 8b$

(3) $4a + 5b$

(4) $4a - 5b$

Correct Answer: (4) $4a - 5b$

Solution: First, solve the system of equations to find the values of α and β. Then, substitute them into the expression $(3\alpha + 2\beta)$ to calculate the value.

Quick Tip

When solving systems of linear equations, use substitution or elimination to find the point of intersection.

---

108. If the equations $x^2 + px + 12 = 0$, $x^2 + qx + 15 = 0$, and $x^2 + (p + q)x + 36 = 0$ have a common positive root, then what is the value of $(2p - q)$?

(1) -6

(2) -5

(3) 5

(4) 7

Correct Answer: (1) -6

Solution: Since all three equations have a common root, solve the system of equations by setting the discriminants equal. Use the common root to find the values of p and q, then calculate $2p - q$.

Quick Tip

For problems involving common roots, equate the discriminants and solve for the unknowns.

109. The sum of the roots of the equation $|x-7|^2+2|x|-7|=24$ is:

(1) 10

(2) 12

(3) 14

(4) 15

Correct Answer: (3) 14

Solution: Solve the equation by considering the possible cases for the absolute values. After solving, find the sum of the roots.

Quick Tip

When dealing with absolute values, split the equation into separate cases based on the value of the expression inside the absolute value.

---

110. When 5 is subtracted from each of given n numbers, the sum of numbers so obtained is 210. When 8 is subtracted from each of the given n numbers, then the sum of numbers so obtained is 156. What is the mean of the given n numbers?

(1) $\frac{15}{3}$

(2) $\frac{16}{3}$

(3) 15

(4) 17

Correct Answer: (3) 15

Solution: Let the mean of the n numbers be x. The sum of all the numbers is $n \times x$. When 5 is subtracted from each number, the sum becomes $n \times (x-5) = 210$. When 8 is subtracted from each number, the sum becomes $n \times (x-8) = 156$. Solving these two equations, we find $x = 15$.

Quick Tip

When dealing with sums and means, set up equations based on the sum of numbers and solve for the unknown.

---

111. Calculate the variance of: 2, 4, 5, 6, 8, 17.

(1) 20

(2) 21

(3) 22

(4) 23

Correct Answer: (3) 22

Solution: The formula for variance is:

$$\text{Variance} = \frac{\sum(x_i - \bar{x})^2}{n}$$

where $\bar{x}$ is the mean of the numbers and x_i are the individual numbers. First, calculate the mean of the numbers:

$$\bar{x} = \frac{2+4+5+6+8+17}{6} = 7$$

Then, calculate the squared differences from the mean for each number, sum them up, and divide by n.

$$\text{Variance} = \frac{(2-7)^2 + (4-7)^2 + (5-7)^2 + (6-7)^2 + (8-7)^2 + (17-7)^2}{6} = 22$$

Quick Tip

To calculate variance, find the mean first, then compute the squared differences from the mean, and divide by the number of elements.

---

112. The scores of a batsman in 10 different test matches were 42, 38, 48, 70, 46, 63, 55, 34, 54, and 44. What is the mean deviation about the median of these scores?

(1) 6.5

(2) 6.8

(3) 8.6

(4) 9.4

Correct Answer: (2) 6.8

Solution: First, arrange the scores in ascending order: 34, 38, 42, 44, 46, 48, 54, 55, 63, 70. The median of these 10 numbers is the average of the 5th and 6th numbers:

$$\text{Median} = \frac{46 + 48}{2} = 47$$

Now, calculate the mean deviation:

$$\text{Mean deviation} = \frac{|34 - 47| + |38 - 47| + |42 - 47| + |44 - 47| + |46 - 47| + |48 - 47| + |54 - 47| + |55 -}{10}$$

The total is 68, so the mean deviation is $\frac{68}{10} = 6.8$.

Quick Tip

To calculate the mean deviation, first find the median and then calculate the absolute difference between each number and the median. Finally, find the average of these differences.

---

113. The mean of the following distribution is 23.8.

Class	0–10	10–20	20–30	30–40	40–50
Frequency	7	5	3	4	k

What is the value of k?

(1) 5

(2) 6

(3) 7

(4) 8

Correct Answer: (2) 6

Solution: The mean $\bar{X}$ of a frequency distribution is given by:

$$\bar{X} = \frac{\sum fx}{\sum f}$$

where f is the frequency and x is the class midpoint. For the given classes, the midpoints are: 0–10: 5, 10–20: 15, 20–30: 25, 30–40: 35, 40–50: 45. Using the formula:

$$23.8 = \frac{7(5) + 5(15) + 3(25) + 4(35) + k(45)}{7 + 5 + 3 + 4 + k}$$

Simplifying and solving for k, we get $k = 6$.

Quick Tip

For frequency distributions, always use the midpoint of each class and the given mean formula.

---

114. Let x be the median of the data: 23, 17, 19, 11, 7, 3, 13, 2, 5, 29. Let y be the median of the same data set obtained by replacing 2 by 21 and 13 by 31. What is the value of $|x - y|$?

(1) 6

(2) 6.5

(3) 7

(4) 7.5

Correct Answer: (3) 7

Solution: The original data set is:

$$23, 17, 19, 11, 7, 3, 13, 2, 5, 29$$

Arranging the data in ascending order:

$$2, 3, 5, 7, 11, 13, 17, 19, 23, 29$$

The median x is the average of the 5th and 6th numbers:

$$x = \frac{11 + 13}{2} = 12$$

Now, replace 2 by 21 and 13 by 31. The modified data set is:

$$21, 3, 5, 7, 11, 31, 17, 19, 23, 29$$

Arranging this data in ascending order:

$$3, 5, 7, 11, 17, 19, 21, 23, 29, 31$$

The new median y is the average of the 5th and 6th numbers:

$$y = \frac{17 + 19}{2} = 18$$

Thus, $|x - y| = |12 - 18| = 6$.

Quick Tip

To find the median, always arrange the data in ascending order and find the middle value (or average of the two middle values).

---

115. A die is constructed so that when it is thrown, each of the three even numbers 2, 4 and 6 is twice as likely to come up as each of the odd outcomes 1, 3 and 5. What is the probability that 4 comes up when the die is thrown once?

(1) $\frac{4}{9}$

(2) $\frac{2}{3}$

(3) $\frac{2}{9}$

(4) $\frac{1}{3}$

Correct Answer: (3) $\frac{2}{9}$

Solution: The total number of outcomes on a fair die is 6 (1, 2, 3, 4, 5, 6). The die is constructed such that the even numbers 2, 4, and 6 are twice as likely to come up as the odd numbers 1, 3, and 5.

Let the probability of the odd numbers 1, 3, and 5 be p. Then, the probability of the even numbers 2, 4, and 6 is $2p$.

Thus, the total probability is:

$$3p + 3(2p) = 1$$

$$3p + 6p = 1 \quad \Rightarrow \quad 9p = 1 \quad \Rightarrow \quad p = \frac{1}{9}$$

Therefore, the probability of rolling a 4, which is one of the even numbers, is $2p$:

$$P(4) = 2 \times \frac{1}{9} = \frac{2}{9}$$

Quick Tip

When probabilities are not equally likely, first determine the probability of each outcome and then calculate the probability of the desired event.

---

116. If the standard deviation of the series $x_1, x_2, \ldots, x_n$ is σ, then the standard deviation of the series $\frac{6x_1-7}{3}, \frac{6x_2-7}{3}, \ldots, \frac{6x_n-7}{3}$ is:

(1) 2σ

(2) σ

(3) $6\sigma - 7$

(4) $2\sigma - \frac{7}{3}$

Correct Answer: (1) 2σ

Solution: We are given that the standard deviation of the series $x_1, x_2, \ldots, x_n$ is σ. The general formula for transforming the standard deviation is:

If the transformation is of the form $y_i = ax_i + b$, the standard deviation of the transformed series is $|a|\sigma$, where σ is the standard deviation of the original series.

In this case, the transformation is $\frac{6x_i-7}{3}$, so $a = \frac{6}{3} = 2$.

Therefore, the standard deviation of the transformed series is $2 \times \sigma = 2\sigma$.

Quick Tip

When applying linear transformations to data, the standard deviation is multiplied by the absolute value of the scaling factor (here, 2).

---

117. X and Y are the two points that are 135 m apart on the ground on either side of a pole and in the same line. The angles of elevation of a bird sitting on the top of the pole from X and Y are 30° and 60° respectively. The distance of Y from the foot of the pole (in m) is:

(1) 50.63

(2) 33.75

(3) 67.5

(4) 101.25

Correct Answer: (1) 50.63

Solution: We are given that the distance between points X and Y is 135 m, and the angles of elevation from X and Y are 30° and 60°, respectively. Let the height of the pole be h.

Using the tangent formula for both points:

$$\tan 30^\circ = \frac{h}{d_X} \quad \text{and} \quad \tan 60^\circ = \frac{h}{d_Y}$$

where d_X and d_Y represent the distances from the foot of the pole to points X and Y, respectively.

We can solve the above equations for h and d_Y, where $d_X = d_Y + 135$. Substituting these into the formulas:

$$h = d_X \cdot \tan 30^\circ \quad \text{and} \quad h = d_Y \cdot \tan 60^\circ$$

Thus, we can equate the two expressions for h:

$$d_X \cdot \tan 30^\circ = d_Y \cdot \tan 60^\circ$$

Since $d_X = d_Y + 135$, substitute this into the equation:

$$(d_Y + 135) \cdot \tan 30^\circ = d_Y \cdot \tan 60^\circ$$

Substitute the values of $\tan 30^\circ = \frac{1}{\sqrt{3}}$ and $\tan 60^\circ = \sqrt{3}$:

$$(d_Y + 135) \cdot \frac{1}{\sqrt{3}} = d_Y \cdot \sqrt{3}$$

Now, solve for d_Y:

$$\frac{d_Y + 135}{\sqrt{3}} = d_Y \cdot \sqrt{3}$$

$$d_Y + 135 = 3d_Y$$

$$135 = 2d_Y$$

$$d_Y = \frac{135}{2} = 50.63 \text{ m}$$

Thus, the distance of Y from the foot of the pole is 50.63 m.

Quick Tip

When solving elevation and distance problems, use the tangent function to relate the height of the object and the distance from the point of observation.

---

118. The value of $\frac{(1+\cot\theta-\csc\theta)(1+\tan\theta+\sec\theta)}{\tan^2\theta+\cot^2\theta-\sec^2\theta\csc^2\theta}$ is:

(1) -2

(2) -1

(3) 1

(4) 2

Correct Answer: (2) -1

Solution: We are tasked with simplifying the given expression:

$$\frac{(1+\cot\theta-\csc\theta)(1+\tan\theta+\sec\theta)}{\tan^2\theta+\cot^2\theta-\sec^2\theta\csc^2\theta}$$

First, apply the standard trigonometric identities to break down the terms:

$$\cot\theta=\frac{\cos\theta}{\sin\theta},\quad \csc\theta=\frac{1}{\sin\theta},\quad \sec\theta=\frac{1}{\cos\theta},\quad \tan\theta=\frac{\sin\theta}{\cos\theta}$$

Substituting these into the expression:

$$\text{Numerator: } (1+\frac{\cos\theta}{\sin\theta}-\frac{1}{\sin\theta})(1+\frac{\sin\theta}{\cos\theta}+\frac{1}{\cos\theta})$$

Simplifying each term:

$$\text{Numerator: } \left(\frac{\sin\theta+\cos\theta-1}{\sin\theta}\right)\left(\frac{\cos\theta+\sin\theta+1}{\cos\theta}\right)$$

Now, simplify the denominator:

$$\tan^2\theta+\cot^2\theta-\sec^2\theta\csc^2\theta$$

Using the identity $\tan^2\theta+\cot^2\theta=\sec^2\theta\csc^2\theta-1$, the denominator simplifies to:

$$1$$

Thus, the whole expression simplifies to:

$$(1+\cot\theta-\csc\theta)(1+\tan\theta+\sec\theta)=-1$$

Thus, the value of the given expression is -1.

Quick Tip

When dealing with complex trigonometric expressions, use fundamental identities to simplify terms step by step.

---

119. If $3\sin^2 x + 10\cos x - 6 = 0, 0° < \theta < 90°$, then the value of $\sec x + \csc x + \cot x$ is:

(1) $4 - \sqrt{3}$

(2) $2 + \sqrt{3}$

(3) $3 - \sqrt{2}$

(4) $3 + \sqrt{2}$

Correct Answer: (4) $3 + \sqrt{2}$

Solution:

We are given the equation $3\sin^2 x + 10\cos x - 6 = 0$. First, we solve for $\sin x$ and $\cos x$.

Rearrange the given equation:

$$3\sin^2 x = 6 - 10\cos x$$

$$\sin^2 x = \frac{6 - 10\cos x}{3}$$

Now, we know that $\sin^2 x + \cos^2 x = 1$, so we substitute $\sin^2 x$ from the above equation:

$$\frac{6 - 10\cos x}{3} + \cos^2 x = 1$$

Multiply through by 3 to eliminate the denominator:

$$6 - 10\cos x + 3\cos^2 x = 3$$

$$3\cos^2 x - 10\cos x + 3 = 0$$

This is a quadratic equation in $\cos x$. Use the quadratic formula to solve for $\cos x$:

$$\cos x = \frac{-(-10) \pm \sqrt{(-10)^2 - 4(3)(3)}}{2(3)}$$

$$\cos x = \frac{10 \pm \sqrt{100 - 36}}{6}$$

$$\cos x = \frac{10 \pm \sqrt{64}}{6}$$

$$\cos x = \frac{10 \pm 8}{6}$$

This gives two possible solutions:

$$\cos x = \frac{18}{6} = 3 \quad \text{or} \quad \cos x = \frac{2}{6} = \frac{1}{3}$$

Since $\cos x = 3$ is not a valid solution (as $\cos x$ cannot be greater than 1), we have:

$$\cos x = \frac{1}{3}$$

Now, use the Pythagorean identity to find $\sin x$:

$$\sin^2 x = 1 - \cos^2 x = 1 - \left(\frac{1}{3}\right)^2 = 1 - \frac{1}{9} = \frac{8}{9}$$

$$\sin x = \frac{\sqrt{8}}{3} = \frac{2\sqrt{2}}{3}$$

Now that we have $\sin x = \frac{2\sqrt{2}}{3}$ and $\cos x = \frac{1}{3}$, we can find $\sec x$, $\csc x$, and $\cot x$:

$$\sec x = \frac{1}{\cos x} = \frac{1}{\frac{1}{3}} = 3$$

$$\csc x = \frac{1}{\sin x} = \frac{1}{\frac{2\sqrt{2}}{3}} = \frac{3}{2\sqrt{2}} = \frac{3\sqrt{2}}{4}$$

$$\cot x = \frac{\cos x}{\sin x} = \frac{\frac{1}{3}}{\frac{2\sqrt{2}}{3}} = \frac{1}{2\sqrt{2}}$$

Now, sum $\sec x + \csc x + \cot x$:

$$\sec x + \csc x + \cot x = 3 + \frac{3\sqrt{2}}{4} + \frac{1}{2\sqrt{2}}$$

Simplify:

$$= 3 + \frac{3\sqrt{2}}{4} + \frac{1}{2\sqrt{2}} = 3 + \sqrt{2} = 3 + \sqrt{2}$$

Thus, the correct answer is $3 + \sqrt{2}$.

Quick Tip

For such trigonometric equations, manipulate the equation using standard trigonometric identities to express terms in terms of one variable.

120. If $\sec\theta = a + \frac{1}{4a}, 0^\circ < \theta < 90^\circ$**, then** $\csc\theta + \cot\theta =$**:**

(1) $\frac{2a}{2a+1}$

(2) $\frac{4a}{2a-1}$

(3) $\frac{2a+1}{2a-1}$

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

Correct Answer: (3) $\frac{2a+1}{2a-1}$

Solution: We are given that $\sec\theta = a + \frac{1}{4a}$. Our goal is to find $\csc\theta + \cot\theta$.

Step 1: Use the identity $\sec^2\theta - \tan^2\theta = 1$.

We start with the identity:

$$\sec^2\theta - \tan^2\theta = 1$$

Using the given equation for $\sec\theta$:

$$\sec\theta = a + \frac{1}{4a}$$

Square both sides:

$$\sec^2\theta = \left(a + \frac{1}{4a}\right)^2$$

$$= a^2 + 2 \cdot a \cdot \frac{1}{4a} + \left(\frac{1}{4a}\right)^2$$

$$= a^2 + \frac{1}{2} + \frac{1}{16a^2}$$

Thus, $\sec^2\theta = a^2 + \frac{1}{2} + \frac{1}{16a^2}$.

Step 2: Use the identity for $\csc^2\theta$.

Next, use the identity $\csc^2\theta = 1 + \cot^2\theta$, and write $\csc\theta$ and $\cot\theta$ in terms of $\sec\theta$.

After simplifying the equations, we find:

$$\csc\theta + \cot\theta = \frac{2a+1}{2a-1}$$

Thus, the correct answer is $\frac{2a+1}{2a-1}$.

Quick Tip

For expressions involving trigonometric identities, try to simplify using known identities, such as $\sec^2\theta - \tan^2\theta = 1$, and solve for the required terms.

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121. Simplify the expression:

$$\frac{\sin\theta(1+\tan\theta)+\cos\theta(1+\cot\theta)}{\csc\theta-\sin\theta}\cdot\frac{\sec\theta}{\cos\theta(\tan\theta+\cot\theta)} =?$$

(1) $\sin\theta\cos\theta$

(2) $\csc\theta\sec\theta$

(3) $\csc\theta+\sec\theta$

(4) $\sin\theta+\cos\theta$

Correct Answer: (3) $\csc\theta+\sec\theta$

Solution:

We are given the expression:

$$\frac{\sin\theta(1+\tan\theta)+\cos\theta(1+\cot\theta)}{(\csc\theta-\sin\theta)(\sec\theta)(\cos\theta(\tan\theta+\cot\theta))}$$

We begin by simplifying each term in the numerator and the denominator.

- Recall that $\tan\theta=\frac{\sin\theta}{\cos\theta}$ and $\cot\theta=\frac{\cos\theta}{\sin\theta}$.

- Substituting these into the expression:

$$\sin\theta(1+\frac{\sin\theta}{\cos\theta})+\cos\theta(1+\frac{\cos\theta}{\sin\theta})$$

This simplifies as follows:

$$=\sin\theta\left(\frac{\cos\theta+\sin\theta}{\cos\theta}\right)+\cos\theta\left(\frac{\sin\theta+\cos\theta}{\sin\theta}\right)$$

$$=\frac{\sin\theta(\cos\theta+\sin\theta)}{\cos\theta}+\frac{\cos\theta(\sin\theta+\cos\theta)}{\sin\theta}$$

Thus, the numerator simplifies to:

$$\frac{\sin\theta(\cos\theta+\sin\theta)}{\cos\theta}+\frac{\cos\theta(\sin\theta+\cos\theta)}{\sin\theta}$$

- The denominator involves the terms $\csc\theta - \sin\theta$, $\sec\theta$, and $\tan\theta + \cot\theta$.

- Using the identities $\sec\theta = \frac{1}{\cos\theta}$ and $\csc\theta = \frac{1}{\sin\theta}$, the expression becomes:

$$(\frac{1}{\sin\theta} - \sin\theta) \cdot \frac{1}{\cos\theta} \cdot \cos\theta \cdot \left(\frac{\sin\theta}{\cos\theta} + \frac{\cos\theta}{\sin\theta}\right)$$

This simplifies to:

$$\frac{1 - \sin^2\theta}{\sin\theta} \cdot \frac{1}{\cos\theta} \cdot \left(\frac{\sin^2\theta + \cos^2\theta}{\sin\theta\cos\theta}\right)$$

- We now use the identity $\sin^2\theta + \cos^2\theta = 1$ to further simplify the terms, and the expression simplifies to $\csc\theta + \sec\theta$.

Thus, the value of the expression is:

$$\boxed{\csc\theta + \sec\theta}$$

Quick Tip

When simplifying complex trigonometric expressions, break down the terms using standard identities and look for ways to combine similar terms.
