CAREERS 360

PREPARATION Series

NIFT–UG 2025

Quantitative Ability Section

(Full Study Material + 5 Practice Tests)

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ABOUT THIS eBOOK

Explore the world of Quantitative Ability with our special ebook designed for NIFT exam preparation.

What's in the ebook?
In this ebook, we break down all the important topics in the NIFT quantitative section. We cover all the topics falling under the NIFT exam.

What makes this ebook super helpful for NIFT aspirants?
To make sure you're fully prepared, we've included five practice tests.
Each test has 20 carefully crafted questions that stimulate the exam conditions. This helps you get used to the types of questions you might face.
In addition, we provide an answer key and detailed solutions. It's not just about getting the right answer – we show you step by step how to solve problems, boosting your confidence for the real exam.

Furthermore, Our ebook goes the extra mile by being a one-stop resource.
It includes the complete NIFT guide, packed with insights into the exam's structure, marking schemes, and crucial tips for success. And for those aiming for B.Des and B.FTech, we've got you covered with 10 free mock tests designed specifically for these programs. You can easily find them on the **"Other Useful Resources" page.**

This eBook is not just a study tool – think of it as your strategic companion, providing the knowledge, practice, and resources you need to conquer the Quantitative Ability section of the NIFT exam.

Embrace your preparation with confidence and set yourself on the path to NIFT success.

QUANTITATIVE ABILITY SECTION: AN OVERVIEW

Content Areas:
- Basic Arithmetic: Focus on topics like percentages, profit and loss, ratios, and proportions.
- Elementary Algebra: Equations, inequalities, and basic algebraic concepts.
- Geometry: Fundamental geometric concepts, areas, and volumes.

Question Types:
- Arithmetic: Calculations involving percentages, discounts, mark-ups, etc.
- Algebra: Solving simple equations, inequalities, and expressing relationships.
- Geometry: Basic geometry problems related to shapes, angles, and areas.

Difficulty Level:
- Questions may range from easy to moderate difficulty.
- Emphasis on assessing basic quantitative skills and application of mathematical concepts.

Number of Questions:
- The number of questions in this section comprises 20 questions.
- Candidates need to manage their time effectively to answer all questions within the allotted time.
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Resources:
- Standard mathematics textbooks. You can also download the Free Mock Tests eBooks specifically designed for NIFT aspirants. You can also download the eBook like **10 Free Mock Tests of BDes** and **10 Free Mock Tests of BFTech.**
- Practice materials and sample papers provided by NIFT.

FEW TIPS AND TRICKS TO IMPROVE YOUR MATHEMATICAL SKILLS

Emphasize Practice:

Achieving proficiency in math requires more than just reading or listening. Actively engage in problem-solving to enhance your skills. The more problems you solve, the better equipped you'll be. Practice different problem-solving approaches to build versatility.

Learn from Mistakes:

When practicing, thoroughly analyze your solutions, especially if you make mistakes. Understand the shortcomings in your problem-solving approach. Identifying errors helps strengthen your skills and prevents repeating the same mistakes.

Grasp Key Concepts:

Avoid memorizing processes; instead, focus on understanding the underlying logic. Mathematics builds on sequential concepts, so ensure a solid grasp of fundamental principles before tackling more complex problems. Understanding the "why" is crucial for long-term success.

Address Doubts:

When stuck on a part of a problem, resist the urge to skip it. Take the time to comprehend the solution process. Once you understand the initial problem, use it as a foundation to progress through the entire question. Math mastery requires time, patience, and a willingness to confront challenges.

Optimize Your Study Environment:

Create a distraction-free study environment for math, a subject demanding high concentration. Background music, chosen carefully for a relaxing atmosphere, can aid focus. Eliminate distractions to enhance your ability to solve complex problems in geometry, algebra, or trigonometry.

Build a Mathematical Dictionary:

Compile notes, flashcards, or cheat sheets containing essential math concepts, terminology, and definitions. Include meanings, key points, and sample answers for quick reference. This resource will serve as a handy tool for reviewing and reinforcing your understanding.

Apply Math to Real-World Problems:

Relate mathematical concepts to real-world scenarios to make them more tangible. Applying math to practical situations can alter your perspective and enhance comprehension. For instance, use probability to assess risks in everyday decisions, such as buying a lottery ticket.

Remember to approach exams with confidence, knowing you've prepared thoroughly. Collaborating with a study partner can also be beneficial for discussing and solving complex problems.

Let's begin with the Study Material.

Profit and Loss

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Definitions:

1. CP (Cost Price): It is the price at which an article is purchased.

2. SP (Selling Price): It is the price at which an article is sold.

3. MP (Marked Price or List Price): It is the price marked on the article. Discounts are generally calculated on this price.

4. Profit or Gain: When SP > CP, the seller makes a profit.

   Profit = SP - CP

5. Loss: When CP > SP, the seller incurs a loss.

   Loss = CP - SP

6. Discount: It's a reduction given on the marked price (MP).

   Discount = MP - SP

Foundation Building Questions:

Question 1 :

A shopkeeper purchased a product for Rs. 100 and sold it at a loss of 10%. Find the selling price.

Solution:

Loss = 10% of 100 = Rs. 10

Selling Price = CP - Loss = 100 - 10 = Rs. 90

Question 2 :

A product is marked at Rs. 1200. The shopkeeper offers a discount of 20% on it. Find the selling price.

Solution:

Discount = 20% of 1200 = Rs. 240

Selling Price = MP - Discount = 1200 - 240 = Rs. 960

Tips and Tricks related to this concept:

1. Profit Percentage: It's calculated on CP.

   Profit % = (Profit / CP) × 100%

2. Loss Percentage: It's also calculated on CP.

   Loss % = (Loss / CP) × 100%

3. Discount Percentage: It's calculated on MP.

   Discount % = (Discount / MP) × 100%

4. If you're given both discount and profit/loss percentages, always find the discount first as it's calculated on MP, and then derive the SP to determine profit or loss.

5. A quick way to determine SP when given a discount or profit/loss percentage:

   If 10% discount, SP = 0.9 MP

If 10% profit, SP = 1.1 CP

Remember, practice is the key when it comes to quantitative aptitude. Go through various questions related to this concept to familiarize yourself with different scenarios and application of formulas.

When a shopkeeper sells two items for the same cost price but makes a profit on one and a loss on the other, determining the net profit or loss can be interesting. This is especially true when the profit percentage on one item equals the loss percentage on the other.

Formula and Insight:

If a person sells two items at the same cost price, and he gains $(x)\%$ on one item and loses $(x)\%$ on the other item, then the seller always incurs a loss, and the loss percentage is given by:

$$[\text{Loss}\% = (x^2/100)\%]$$

Foundation Building Questions:

Question 1 :

A shopkeeper bought two items, A and B, each for Rs. 500. He sold item A at a profit of 20% and item B at a loss of 20%. What is the total profit or loss?

Solution:

Using the insight given above:

$$\text{Loss}\% = (x^2/100)$$

$$\text{Loss}\% = (20^2/100) = 4\%$$

Total Loss = 4% of 500 = Rs. 20

(Note: The loss is calculated on a single item, but since the CP is the same for both, the net loss remains the same.)

Question 2 :

A vendor purchased two types of toys for Rs. 1500 each. He sold the first toy at a profit of 10% and the second toy at a loss of 10%. Find the total profit or loss.

Solution:

$$\text{Loss}\% = (x^2/100)$$

$$\text{Loss}\% = (10^2/100) = 1\%$$

Total Loss = 1% of 1500 = Rs. 15

Tips and Tricks related to this concept:

1. Quick Insight: If two articles are sold at the same cost price, and the profit percentage on one equals the loss percentage on the other, there will always be a net loss.

2. The formula for the loss percentage simplifies calculations in such scenarios.

3. When determining SP for each article, revert to Concept 1 formulas. This reinforces understanding and also gives a longer approach to the above insight.

4. While the formula gives a quick solution, always understanding the underlying principle is crucial for tackling unfamiliar problems.

We know:

Profit = SP - CP and Loss = CP - SP

For the above scenarios, calculate the SP for each article using the profit and loss percentages. Adding these will give the total SP for both items. Compare this with the total CP (which is double the CP of one item) to determine net profit or loss. This longer method should yield the same result as the formula-based method but will take more time.

Remember, the key to mastering these concepts is practice and understanding the underlying principles.

In situations where two items are sold for the same selling price, one yielding a profit and the other a loss, finding out the net gain or loss across both sales can be a bit tricky but is vital for competitive exams.

Conceptual Understanding:

If two items are sold at the same selling price, one at a profit of $p\%$ and the other at a loss of $l\%$, the net effect on the total transaction is:

- A profit, if (p > l).

- A loss, if (l > p).

- No profit, no loss, if (l = p).

Foundation Building Questions:

Question 1 :

A trader sells two items for Rs. 1000 each. On one, he gains 20%, and on the other, he loses 20%. What is the net gain or loss?

Solution:

Let the cost price of the first item be x.

Selling Price = (120/100) x = Rs. 1000

=> x = Rs. 833.33 (CP of the first item)

For the second item,

Selling Price = \(80/100 \) y = Rs. 1000

=> y = Rs. 1250 (CP of the second item)

Total CP = Rs. 2083.33

Total SP = Rs. 2000 (since each item is sold for Rs. 1000)

Loss = CP - SP = Rs. 83.33

Question 2 :

Two articles are sold for Rs. 1500 each. The first article was sold at a profit of 25%, and the second at a loss of 15%. Find the overall profit or loss.

Solution:

For the first article,

SP = (125/100) a = Rs. 1500

=> a = Rs. 1200 (CP of the first article)

For the second article,

SP = (85/100) b = Rs. 1500

=> b = Rs. 1764.71 (CP of the second article)

Total CP = Rs. 2964.71

Total SP = Rs. 3000

Profit = SP - CP = Rs. 35.29

Tips and Tricks related to this concept:

1. Comparison Method: Always start by determining which percentage is larger - the profit or the loss. This will give a quick sense of whether the combined transaction results in an overall profit or loss.

2. Equal Percentages: If profit percent is equal to the loss percent, the seller always faces a net loss.

3. Work Backwards: Instead of calculating the cost price from the given selling price, you can assume a convenient cost price and determine the corresponding selling price based on the given profit or loss percentage. Compare the derived selling price with the given selling price to find the ratio of equivalence, which can then be used to find the actual cost prices.

We know that,

Profit = SP - CP and Loss = CP - SP. These foundational formulas will frequently come into play.

In the scenarios described, after deriving the SP for both items, calculate the combined CP using the profit and loss percentages provided. Comparing the combined CP to the combined SP (which is twice the SP of one item since SPs are the same) will give the net profit or loss.

Again, practicing various questions and understanding the essence of the problem will prove beneficial in the exam scenario.

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Number System

Even and Odd numbers are important concepts in mathematics. An even number is any integer that is exactly divisible by 2, while an odd number is an integer that is not divisible by 2.

- Even numbers: 2, 4, 6, 8, 10, 12, ...
- Odd numbers: 1, 3, 5, 7, 9, 11, ...

Properties of Even and Odd Numbers

- An even number can be represented as 2k, where k is an integer.
- An odd number can be represented as 2k + 1, where k is an integer.

Identification of Even and Odd Numbers

- A number is even if it has 0, 2, 4, 6, or 8 at the unit's place.
- A number is odd if it has 1, 3, 5, 7, or 9 at the unit's place.

Operations on Even and Odd Numbers

- Even + Even = Even
- Odd + Odd = Even
- Even + Odd = Odd
- Even - Even = Even
- Odd - Odd = Even
- Even - Odd = Odd
- Even × Even = Even
- Odd × Odd = Odd

- Even × Odd = Even
- Odd ÷ Odd = Non-terminating decimal
- Even ÷ Odd = Non-terminating decimal

Solved Example:

Example 1:

The sum of two consecutive even numbers is 88. What are the numbers?

Example 2:

If the product of two consecutive odd numbers is 315, what are the numbers?

Example 3:

If the difference between two consecutive odd numbers is 6, what are the numbers?

Tips and Tricks

- The last digit of an even number is always even (0, 2, 4, 6, or 8).
- The last digit of an odd number is always odd (1, 3, 5, 7, or 9).
- To quickly calculate the sum or product of even or odd numbers, follow the rules mentioned above for operations.

A decimal number can be defined as a number whose whole number part and the fractional part is separated by a decimal point. The dot in a decimal number is called a decimal point The digits following the decimal point show a value smaller than one.

Decimal Numbers can be classified as
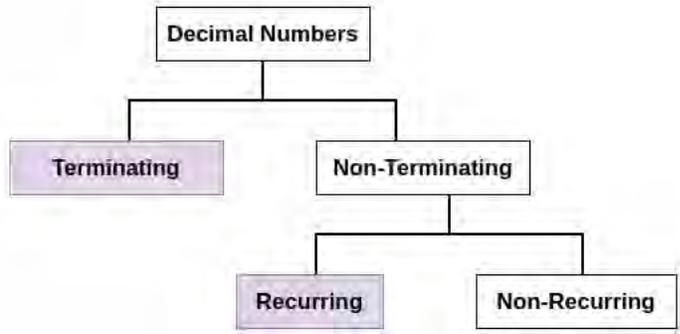
In the above diagram, Rational Numbers are:

1. Terminating decimal numbers and
2. Non-terminating repeating (recurring) decimal numbers.

And Irrational Numbers are Non-terminating non-repeating (non-recurring) decimal numbers. (This we will discuss in upcoming concepts.)

Note:

- If $q = 2^n \cdot 5^n$ where n is any whole number then we will get Terminating Decimal Numbers
- If $q \neq 2^n \cdot 5^n$ where n is any whole number then we will get Non-Terminating Repeating Decimal Numbers

Terminating decimal: Now if we convert fractions to decimals. Remember that the fraction bar indicates division. So $\dfrac{4}{5}$ can be written 4÷5. This means that we can convert a fraction to a decimal by treating it as a division problem.

Example: $\dfrac{1}{8}$

Solution:

Here 8 can be re-written as $8 = 2^3 \cdot 5^0$

```
        0 . 1 2 5
   8 )  1 . 0 0 0
      -    8
            20
          - 1 6
              40
            - 4 0
                0
```

$$\frac{1}{8} = 0.125$$

In this a finite number of digits occurs after the decimal.

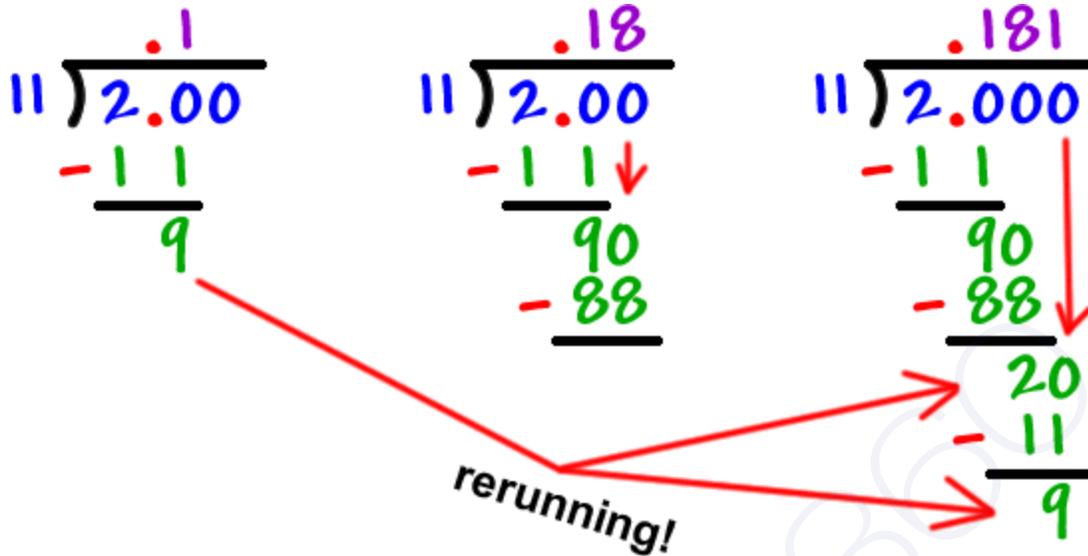**Non-terminating repeating (recurring) decimal numbers:**

So far, in all the examples converting fractions to decimals, the division resulted in a remainder of zero. This is not always the case. Let's see what happens when we convert the fraction $\frac{2}{11}$ to a decimal.

Example: $\frac{2}{11}$

Solution:

Here 11 cannot be written in the form of $2^n \cdot 5^n$

$$\frac{2}{11} = 0.181818\ldots = 0.\overline{18}$$

The remainder never becomes zero.

Operations on Natural Numbers

Addition: To add two or more natural numbers, we simply add them together. For example, 2 + 3 = 5.

Subtraction: To subtract one natural number from another, we subtract the smaller number from the larger. For example, 7 - 4 = 3.

Multiplication: To multiply two or more natural numbers, we simply multiply them together. For example, 4 * 5 = 20.

Division: To divide one natural number by another, we find how many times the divisor can fit into the dividend. For example, 12 ÷ 3 = 4.

Operations on Whole Numbers

- Addition: Similar to natural numbers, we add two or more whole numbers by adding them together.
- Subtraction: We can subtract one whole number from another by subtracting the smaller number from the larger.
- Multiplication: Similar to natural numbers, we multiply two or more whole numbers together.

- Division: We can divide one whole number by another by finding how many times the divisor can fit into the dividend.

Operations on Integers

Addition: When adding two or more integers, we consider their signs. The rules for adding integers are:

- If the signs are the same (positive or negative), we add their absolute values and keep the same sign.
- If the signs are different, we subtract the absolute value of the smaller number from the absolute value of the larger number and use the sign of the larger number.

Subtraction: Subtraction of integers follows similar rules as addition.

Multiplication: The rules for multiplying integers are:

- If the signs are the same, the product is positive.
- If the signs are different, the product is negative.

Division: The rules for dividing integers include:

- If the signs are the same, the quotient is positive.
- If the signs are different, the quotient is negative.

Operations on Rational Numbers

- Addition and Subtraction: To add or subtract rational numbers, we must have the same denominator. Once we have the same denominator, we can add or subtract the numerators and keep the common denominator.
- Multiplication: When multiplying rational numbers, we multiply the numerators together and the denominators together.
- Division: Dividing rational numbers is similar to multiplying, except we multiply the first number by the reciprocal of the second number.

Operations on Complex Numbers

- Addition and Subtraction: To add or subtract complex numbers, we add or subtract their real parts separately and their imaginary parts separately.
- Multiplication: When multiplying complex numbers, we use the distributive property and combine like terms.

- Division: To divide complex numbers, we multiply both the numerator and denominator by the conjugate of the denominator, and simplify the result.

Tips and Tricks:

- For natural and whole numbers, practice mental calculations to improve speed.
- Understand the rules for adding, subtracting, multiplying, and dividing integers and rational numbers thoroughly.
- Memorize the rules for operations on complex numbers and practice solving examples to become proficient.
- Work on previous year management entrance exam questions related to these operations to get familiar with the type of questions asked.

EXAMPLE:

Q. What is the value of (3/4) + (-7/8)?

Solution: To add these rational numbers, we need the same denominators.

Step 1: Find the least common multiple (LCM) of 4 and 8, which is 8.
Step 2: Rewrite the fractions with the common denominator:

(3/4) + (-7/8) = (3/4) * (2/2) + (-7/8) * (1/1) = 6/8 + (-7/8)

Step 3: Add the numerators together and keep the common denominator:

6/8 + (-7/8) = (6 - 7)/8 = -1/8 So, (3/4) + (-7/8) = -1/8.

When preparing for competitive exams, it's essential to understand the interplay between different mathematical concepts. One such integration is between surds, indices, and logarithms. These problems test a student's ability to fluidly move between the realms of exponents and logarithms while understanding the nuances of surds.

Foundation Building Questions:

1. If $\log_2 x = 3 \text{ and } x = a\sqrt{b}$, find the values of a and b .

Solution:

Using the properties of logarithms:

$$x = 2^3 = 8$$

Therefore, a = 2 and b = 4 (since 8 = $2\sqrt{4}$).

2. Solve for $y : y^{\log_{10} 2} = 8$

Solution:

Using properties of surds and logarithms:

$$y^{\log_{10} 2} = 2^3$$

Taking log on both sides:

$$\log_{10} y \times \log_{10} 2 = 3 \log_{10} 2$$
$$\log_{10} y = 3$$

Thus, y = 1000.

Tips and Tricks:

1. Fluid Transitions: Understand the relationships between surds, indices, and logarithms to effortlessly switch between them.

2. Factorization: Sometimes, expressing numbers as products of their prime factors can simplify surd-logarithm problems.

3. Common Bases: If possible, express everything in terms of a common base. This can significantly simplify many problems.

4. Graphical Approach: Understanding the graphical representations of logarithmic and exponential functions can provide insights into their relationship and solutions to related problems.

5. Use Log Properties: Remember properties such as

$$\log_b(mn) = \log_b m + \log_b n \text{ and } \log_b\left(\frac{m}{n}\right) = \log_b m - \log_b n$$

to simplify expressions.

6. Practice Complex Problems: The key to mastering integrated problems is to expose yourself to a mix of problems that blend these concepts in various ways.

In conclusion, integrated problems of surds, indices, and logarithms test a student's holistic understanding of these mathematical concepts. It's not just about knowing each concept in isolation but understanding how they interact with each other. With consistent practice, students can master these integrated problems, ensuring they're well-prepared for related questions in their entrance exams

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Simple and Compound Interest

Definition: Simple Interest (SI) is the interest earned or paid on the original principal during a specific period.

Formula:

$$SI = \frac{P \times R \times T}{100}$$

Where,

P = Principal (initial amount)

R = Rate of interest per annum (in %)

T = Time period (usually in years)

Tip 1: Always make sure your time and rate units match. If the rate is given per annum, your time should also be in years.

Foundation Building Questions:

Question: A sum of ₹4000 is lent out at simple interest for 2 years at 5% per annum. Find the interest earned at the end of 2 years.

Solution:

Using the formula:

$$SI = \frac{P \times R \times T}{100}$$
$$SI = \frac{4000 \times 5 \times 2}{100}$$
$$SI = 400$$

So, the interest earned at the end of 2 years is ₹400.

Tip 2: In questions where you're asked to find the time or rate, rearrange the SI formula to isolate the variable you need to find. For instance, if you need to find time, the formula becomes:

$$T = \frac{100 \times SI}{P \times R}$$

Tip 3: If you're given SI for a certain period and asked about another period, remember that SI remains proportional to time. For instance, if SI for 2 years is ₹200, then SI for 3 years would be ₹300 (assuming the rate and principal remain constant).

Solved Example:

Question: An amount of ₹5000 is lent out at a simple interest rate of 3% per annum. How much time will it take for the interest to amount to ₹450?

Solution:

Using the formula:

$$T = \frac{100 \times SI}{P \times R}$$
$$T = \frac{100 \times 450}{5000 \times 3}$$
$$T = 3$$

So, it will take 3 years for the interest to amount to ₹450.

Tip 4: For quick calculations, familiarize yourself with common percentages and their decimal equivalents. For instance, 5% is 0.05, and 7% is 0.07. This can help you calculate SI faster.

Remember, practice makes perfect. The more questions you solve related to SI, the quicker and more accurate you'll become.

Definition: Compound Interest (CI) refers to the interest that accumulates on both the initial principal and the accumulated interest from previous periods.

Formula:

$$A = P \left(1 + \frac{R}{100}\right)^T$$

Where,

A = Total amount after T years

P = Principal (initial amount)

R = Rate of interest per annum (in %)

T = Time period (in years)

The Compound Interest (CI) is given by:

$$CI = A - P$$

Tip 1: Always be clear about the compounding frequency - annually, semi-annually, quarterly, or monthly. Adjust the rate and time accordingly. If compounding is semi-annually, divide R by 2 and multiply T by 2.

Foundation Building Questions:

Question: A sum of ₹10,000 is invested at 10% per annum compounded annually. What will be the amount after 3 years?

Solution:

Using the formula:

$$A = P\left(1 + \frac{R}{100}\right)^T$$
$$A = 10,000\left(1 + \frac{10}{100}\right)^3$$
$$A = 10,000(1.1)^3$$
$$A = 13,310$$

So, the amount after 3 years will be ₹13,310.

Tip 2: To quickly calculate CI for two years at rate R%, use the formula:

\CI = P \times R\% \times (1 + R\%) \

This is particularly handy for quick calculations and objective exams.

Tip 3: When dealing with multiple compounding periods in a year, always adjust the time and rate. For example, for quarterly compounding over 2 years at 8% p.a., R becomes 2% (i.e., 8/4) and T becomes 8 (i.e., 2 X 4).

Application of Previous Concept (Simple Interest)

Remember that for the first year, Simple Interest and Compound Interest are the same. This understanding can help speed up calculations for certain problems.

Example:

Question: An amount of ₹15,000 is lent out at a compound interest rate of 6% per annum compounded semi-annually. What is the interest earned after 2 years?

Solution:

First, adjust for semi-annual compounding:

$$R = 6/2 = 3\% \text{and} T = 2 \times 2 = 4.$$

Using the CI formula:

$$A = P\left(1 + \frac{R}{100}\right)^T$$
$$A = 15,000\left(1 + \frac{3}{100}\right)^4$$
$$A = 16,813.81$$

CI = A - P

CI = ₹16,813.81 - ₹15,000

= ₹1,813.81

Interest earned is ₹1,813.81.

Tip 4: In questions involving both SI and CI, compute the SI for the entire period first. Then, calculate the CI for the period minus the SI to find the additional interest due to compounding.

By continually practicing, not only do you familiarize yourself with the formulas, but you also develop shortcuts and strategies to tackle any kind of problem on this topic in management entrance exams.

When interest is compounded more frequently than annually, it means the interest earned in one period is added to the principal for the calculation of interest in the next period.

Formula:

$$A = P \left(1 + \frac{R}{n}\right)^{nT}$$

Where,

A = Total amount after T years

P = Principal (initial amount)

R = Rate of interest per annum (in %)

T = Time period (in years)

n = Number of compounding periods in a year (e.g., n=2 for half yearly, n=4 for quarterly)

Tip 1: A key thing to remember is the role of 'n'. It affects both the rate of interest and the time period. Always adjust these according to the frequency of compounding.

Foundation Building Questions:

Question: A principal amount of ₹5,000 is invested at 8% per annum compounded quarterly. What will be the compound interest earned after 2 years?

Solution:

Given, R = 8% and T = 2 years, and since it's compounded quarterly, n=4.

Adjusting for quarterly compounding:

$$\text{Rate} : R' = \frac{R}{n} = \frac{8}{4} = 2\%$$

$$\text{Time} : T' = T \times n = 2 \times 4 = 8$$

Using the formula:

$$A = P\left(1 + \frac{R'}{100}\right)^{T'}$$
$$A = 5,000\left(1 + \frac{2}{100}\right)^{8}$$
$$A = 5,831.41$$

Compound Interest, CI = A - P

CI = ₹5,831.41 - ₹5,000 = ₹831.41

Tip 2: When transitioning from yearly to half-yearly or quarterly compounding, interest grows slightly faster due to more frequent addition to the principal. It's a tiny effect, but it accumulates over large sums and long durations.

Application of Previous Concepts (Simple & Compound Interest)

For the first year, both SI and CI are the same, regardless of the compounding frequency. From the second year onwards, CI starts surpassing SI due to its compound nature.

Solved Example:

Question: ₹10,000 is invested at 6% per annum compounded half-yearly. How much more will be the interest earned in two years when compared to simple interest?

Solution:

For SI:

$$SI = \frac{P \times R \times T}{100} = \frac{10,000 \times 6 \times 2}{100} = 1,200$$

For CI with half-yearly compounding, n=2:

$$\text{Rate}: R' = \frac{R}{n} = \frac{6}{2} = 3\%$$

$$\text{Time}: T' = T \times n = 2 \times 2 = 4$$

Using the CI formula:

$$A = P\left(1 + \frac{R'}{100}\right)^{T'}$$

$$A = 10,000\left(1 + \frac{3}{100}\right)^{4}$$

A = ₹11,268.13

Compound Interest, (CI = A - P = ₹11,268.13 - ₹10,000 = ₹1,268.13)

Difference between CI and SI = ₹1,268.13 - ₹1,200 = ₹68.13

Tip 3: When tackling problems where both SI and CI are involved, always calculate SI first. Since it's straightforward, it often helps anchor the more complicated CI calculations.

Tip 4: For quick estimations, remember that the difference between CI and SI for two years is. This difference gives the additional interest gained by compounding compared to simple interest.

Regular practice and understanding the intricacies of compound interest are crucial. The nuances of different compounding frequencies can often lead to errors, so being cautious and practicing regularly will help you master these problems.

Time, Speed and Distance

Formula:

$$S = \frac{D}{T}$$

Where:

- S stands for Speed

- D stands for Distance

- T stands for Time

Detailed Explanation:

1. Speed refers to how fast an object is moving.

2. Distance refers to how much ground an object has covered, regardless of its starting or ending point.

3. Time is the duration for which an object moves.

This relation can be rearranged into:

$$D = S \times T$$

$$T = \frac{D}{S}$$

Foundation Building Questions :

Question: A car covers a distance of 120 km in 2 hours. What is its speed?

Solution:

Using the formula:

$$S = \frac{D}{T}$$

Given:

 - D = 120 km

 - T = 2 hours

Plugging in the values:

Answer: The speed of the car is 60 km/hr.

Tips and Tricks:

1. Units Matter: Ensure that units of speed, distance, and time are consistent. For example, if you're given speed in km/h and time in minutes, convert time to hours before proceeding.

2. Reciprocal Nature: If speed doubles, the time taken to cover a constant distance is halved. If speed is halved, the time taken is doubled for the same distance.

3. Shortcut for conversion between m/s to km/hr and vice versa:

- To convert from km/hr to m/s, multiply by $\dfrac{5}{8}$

- To convert from m/s to km/hr, multiply by $\dfrac{18}{5}$

Remember, practice is key when it comes to quantitative aptitude. The more you work on these formulas and their applications, the more intuitive and easy they'll become during the actual exams.

Explanation:

Train problems are a popular subset of time, speed, and distance problems in competitive exams. These problems can involve one or more trains, crossings, bridges, platforms, and even other moving or stationary objects.

The most common scenarios are:

1. A train crossing a stationary object (e.g., a pole, a person).

2. A train crossing another moving object (e.g., another train, a person walking).

3. A train crossing a platform, bridge, or tunnel.

The basic principle remains the same: use the relation S = DT , but with a clear understanding of what constitutes the 'distance' in each scenario.

Foundation Building Questions :

Question: A train 400 meters long is moving at a speed of 20 m/s. How long does it take to cross a 200 meters long platform?

Solution:

Total distance to be covered by the train = Length of the train + Length of the platform

 D = 400 + 200 = 600 metres

Given speed, S = 20 m/s

Time taken:

$$T = \frac{D}{S} = \frac{600 \text{metres}}{20 \text{ m/s}} = 30 \text{ seconds}$$

Answer: The train takes 30 seconds to cross the platform.

Tips and Tricks:

1. Identify the 'Distance': The total distance a train needs to cover to cross an object or another train is the sum of their lengths. This is crucial, especially when crossing platforms or another train.

2. Direction Matters: If two trains are moving in opposite directions, their relative speed increases (sum of their speeds). If they move in the same direction, their relative speed is the difference in their speeds.

3. Unit Consistency: Ensure all given units are consistent. Use conversion techniques from Concept 5 if necessary.

4. Use Previous Concepts: Concepts of relative speed, i.e., Concept 6 and Concept 7, are frequently required in train problems. Make sure you're comfortable with those concepts.

5. Shortcut for Stationary Objects: When a train crosses a stationary object (like a pole or a standing person), the distance it covers is equal to its own length.

6. Visual Representation: Draw a simple sketch to understand the problem better, especially if multiple objects or distances are involved.

Problems on trains test a student's ability to quickly and accurately apply concepts of time, speed, and distance, often in combination. As with all TSD problems, practice is essential. Ensure you're familiar with various types of problems and scenarios to tackle them confidently in exams.

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Boats and Streams

Explanation:

In problems related to boats and streams, the speed of water (stream or current) affects the effective speed of the boat. The two main scenarios are:

1. Upstream: When the boat moves against the current, its effective speed is decreased.

   Effective speed of the boat in upstream = Speed of boat - Speed of stream

2. Downstream: When the boat moves with the current, its effective speed is increased.

Effective speed of the boat in downstream = Speed of boat + Speed of stream

Foundation Building Questions :

Question: A boat covers a certain distance downstream in 5 hours but takes 7 hours to cover the same distance upstream. If the speed of the stream is 3 km/h, find the speed of the boat in still water.

Solution:

Let the speed of the boat in still water be b km/h.

Downstream speed = b + 3 km/h

Upstream speed = b - 3 km/h

Let's assume the distance covered is d.

Given:

$$\frac{d}{b+3} = 5 \text{(i)}$$

$$\frac{d}{b-3} = 7 \text{(ii)}$$

From (i): d = 5(b + 3)

Substitute d in (ii):

5(b + 3) = 7(b - 3)

5b + 15 = 7b - 21

2b = 36

b = 18 km/h

Answer: The speed of the boat in still water is 18 km/h.

Tips and Tricks:

1. Understand the Direction: Ensure you know if the boat is moving upstream or downstream to apply the right effective speed formula.

2. Consistent Units: Ensure that all speeds (boat and stream) are given in consistent units. Convert if necessary using techniques from Concept 5.

3. Relative Speeds: These problems are essentially about relative speeds. The boat's speed is either added to or subtracted from the stream's speed, similar to the principles in Concept 6 and Concept 7.

4. Diagrammatic Representation: A simple sketch showing the direction of the boat and stream can help visualize the problem better.

5. Effective Speed is Key: Always remember that the boat's actual speed when moving in water will always be its effective speed (either upstream or downstream), which considers the stream's impact.

Boat and Stream problems test the understanding of relative speed in a practical scenario. Familiarity with the concepts of upstream and downstream, and ample practice with various problem types, will prepare students to tackle these questions confidently.

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Time and Work

Definition: Total work refers to the complete task or job that needs to be accomplished. In questions related to time and work, it's crucial to understand the entire scope of the work because all further calculations, be it regarding time or the number of workers required, will revolve around this concept.

Solved Examples

If A can complete a work in 5 days and B in 10 days, how long will they take to complete the work together?

Solution:

1. Find the Total Work: Instead of taking the work as abstract, let's quantify it. A common method is to take the LCM (Least Common Multiple) of the days taken by the workers. LCM of 5 and 10 is 10.

Thus, let's assume the total work is 10 units.

2. Find Work Done Per Day:

- A completes the work in 5 days, so A's 1-day work = 10 units / 5 days = 2 units/day

- B completes the work in 10 days, so B's 1-day work = 10 units / 10 days = 1 unit/day

3. Combined Work:

If A and B work together, in a day they will complete = A's 1-day work + B's 1-day work

= 2 units + 1 unit = 3 units/day

4. Time to Complete Together:

Total work / Combined 1-day work = 10 units / 3 units/day = 3⅓ days or 3 days and 1/3 of a day.

Tips and Tricks:

1. Quantify the Work: Always start by quantifying the total work. This makes it easier to understand and calculate further. The LCM method is highly effective in doing so.

2. Uniform Work: Assume the work is uniform across days unless stated otherwise. For example, if A can complete a job in 5 days, it means A does 1/5 of the job each day.

3. Break it Down: Breaking down the total work into daily tasks can provide clarity on the progress and help in identifying bottlenecks or efficiencies.

To truly master this concept, it's imperative to practice with multiple questions from previous years. This helps in understanding the varied ways in which questions can be framed and the nuances that can be introduced in the problems.

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Mixtures

Definition:

The Rule of Alligation is a method of finding the ratio in which two or more ingredients at given prices must be mixed to produce a mixture of a desired price. This rule is especially useful in solving problems related to mixtures.

Formula:

If two ingredients are mixed in a ratio x:y , then

$$\frac{(\text{Cheaperquantity} \times \text{Dearquantity})}{(\text{Dearprice} - \text{Meanprice})} = x$$

$$\frac{(\text{Dearquantity} \times \text{Cheaperquantity})}{(\text{Meanprice} - \text{Cheaperprice})} = y$$

Foundation Building Questions:

Question: Two types of rice (Type A and Type B) are mixed in the respective ratio of 1 : 2. One kg of rice of Type A costs Rs. 15 and one kg of rice of Type B costs Rs. 20. Find the cost price of the mixed variety of rice per kg.

Solution:

Using the Rule of Alligation:

        Type A (Rs. 15/kg)   Type B (Rs. 20/kg)

            | |

            | |

         Mean Price

            |

            |

       (Using Alligation)

            |

      | |

   Rs. 15 - x   Rs. x - 20

      | |

      | |

      1   2

From the above:

2(15 - x) = x - 20

Solving for x, we get:

x = Rs. 16.67per kg (This is the average price for the mixture).

Answer: The cost price of the mixed variety of rice per kg is Rs. 16.67.

Tips and Tricks:

1. Visualization:Draw the Allegation chart (as shown above) to visualize the problem. This will simplify the calculation process.

2. Remember the Ratio:The Rule of Alligation will give you the ratio in which two varieties are mixed. This can be useful in determining quantities or costs.

3. Use with Averages:If you know the weighted average price of two mixtures when combined, you can use the alligation method to determine the ratio in which they were mixed.

4. Reverse Calculation:Sometimes, knowing the final mixture price and one ingredient's price, you can use the alligation method to find the other ingredient's price.

5. Alligation and Percentages:Alligation can also be used in problems involving percentages, especially when two solutions of different concentrations are mixed together.

Remember, the Rule of Alligation is a powerful shortcut to solve mixture problems quickly. It saves time by eliminating the need for lengthy algebraic equations. Always draw the chart and note the values systematically to avoid confusion.

Geometry and Mensuration

Area of 2-d objects

Rectangle: A *rectangle* is a parallelogram that has all four angles equal to $90°$.
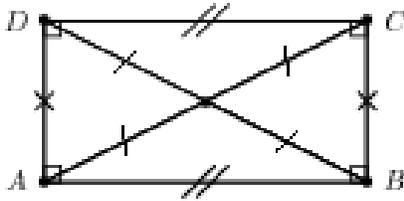
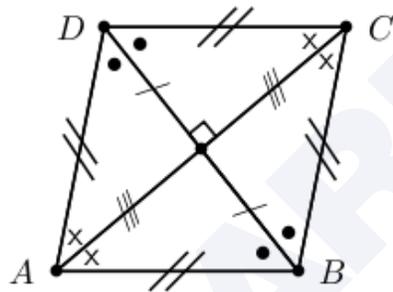A summary of the properties of a rectangle is:

- Both pairs of opposite sides are parallel.
- Both pairs of opposite sides are of equal length.
- Both diagonals bisect each other.
- Diagonals are equal in length.
- All angles at the corners are right angles.

Area of rectangle = Length × Breadth

Length of the rectangle = AB

Length of the Breadth = BC

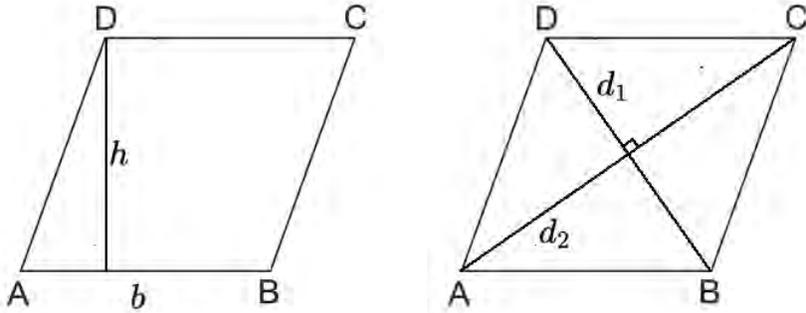**Rhombus:** A *rhombus* is a parallelogram that has all four sides of equal length.

A summary of the properties of a rhombus is:

- Both pairs of opposite sides are parallel.
- All sides are equal in length.
- Both pairs of opposite angles are equal.
- Both diagonals bisect each other at $90°$.
- Diagonals of a rhombus bisect both pairs of opposite angles.

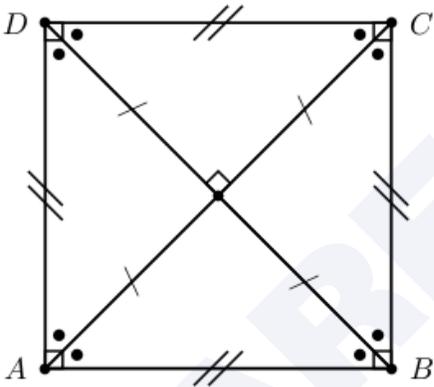Area of rhombus when base and height are given

Area = Base × Height

Area of rhombus when the length of diagonals are given

$$\text{Area of rhombus} = \frac{1}{2} \times d_1 \times d_2$$

Here, d_1 and d_2 are diagonals of the rhombus.

Square: A *square* is a rhombus that has all four angles equal to 90°.

A summary of the properties of a square is:

- Both pairs of opposite sides are parallel.
- All sides are equal in length.
- All angles are equal to 90° .
- Both pairs of opposite angles are equal.
- Both diagonals bisect each other at 90° .
- Diagonals are equal in length.
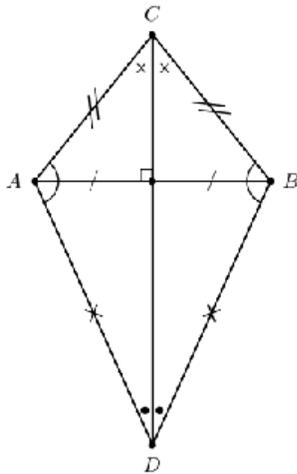- Diagonals bisect both pairs of opposite angles (ie. all 45°).

Area of square = a × a = a²

a = side of a square.

If diagonal, d of a square is given, then

$$\text{Area of square} = \frac{1}{2} \times d \times d = \frac{1}{2} \times d^2$$

Kite: A *kite* is a quadrilateral with two pairs of adjacent sides equal. Quadrilateral ABCD is a kite, in which AC = CB and AD = DB

A summary of the properties of a kite is:

- Two pairs of adjacent sides are equal in length.
- One pair of opposite angles are equal where the angles are between unequal sides.
- One diagonal bisect the other diagonal and one diagonal bisect one pair of opposite angles.
- Diagonals intersect at right-angles.

$$\text{Area of kite} = \frac{1}{2} \times d_1 \times d_2$$

Here, d_1 and d_2 are diagonals of the kite.

Volume of a Right Circular Cylinder
The Essence of Volume

Volume represents the amount of space that an object occupies. For a right circular cylinder, it's the space between its bases and within its curved surface.

Formula:

1. Volume (V) of a Right Circular Cylinder = πr2h

  - Where:

    - r is the radius of the base.

    - h is the height of the cylinder.

Foundation Building Questions:

> A factory produces cylindrical cans that store a beverage. If each can has a radius of 3 cm and a height of 10 cm, how much beverage (in cubic cm) can each can hold?

Solution:

Using the formula for volume:

$$\begin{aligned} V &= \pi r^2 \text{ h} \\ &= \pi \times 3^2 \text{ cm} \times 10 \text{ cm} \\ &= 90\pi \text{cm}^3 \\ &\approx 282.74 \text{ cm}^3. \end{aligned}$$

The can can hold approximately 282.74cm^3 of beverages.

Example Question
Consider a cylindrical water tank standing on a square base of 20 cm. The tank itself has a height of 50 cm and a radius of 10 cm. If the tank is full of water, determine the volume of the water. Now, if the square base is a shallow pool of height 5 cm, how much more water can it hold?

Solution:

Step 1: Volume of Cylindrical Tank

$$\begin{aligned} V &= \pi r^2 \text{ h} \\ &= \pi \times 10^2 \text{ cm} \times 50 \text{cml} \\ &= 5000\pi \text{cm}^3 \\ &\approx 15708.33 \text{ cm}^3 \end{aligned}$$

Step 2: Volume of the Shallow Pool (considering it as a prism)

V = Area of Base × height

$$= 20\text{cm} \times 20\text{cm} \times 5\text{cm}$$

$$= 2000\text{cm}^3.$$

Total Volume of Water = Volume of Tank + Volume of Shallow Pool

$$= 15708.33 \ \text{cm}^3 + 2000 \ \text{cm}^3$$
$$= 17708.33 \ \text{cm}^3.$$

The square base or shallow pool can hold an additional 2000 cm3 of water.

Tips and Tricks:

1. Visualization: Think of the volume of the cylinder as multiple circular discs stacked on top of each other. Each disc's area is πr2, and there are 'h' of them.

2. Relate to the Real World: Cylindrical tanks, cans, and containers are everywhere. Relating problems to real-world scenarios helps in understanding and remembering.

3. Units Matter: Ensure the units for radius and height are the same. The volume will be in cubic units.

4. Combined Shapes: For structures with multiple shapes (like a cylinder and a prism), calculate the volume of each shape separately and then sum up.

5. π in Calculations: Use π as 3.14 or 22/7 for speedy calculations unless provided otherwise.

6. Applications: This concept is especially crucial when determining capacity or space utilization in storage, logistics, or manufacturing industries.

Note: The illustrative questions provided are hypothetical. For a thorough preparation, always refer to the official previous year question papers.

Surface Area and Volume of Frustum of Cone

Frustum Formulas Recap:

1. Curved Surface Area (CSA) of Frustum $= \pi(r_1 + r_2) \ |$

  - r_1 is the radius of the smaller base.

  - r_2 is the radius of the larger base.

- l is the slant height of the frustum.

2. Volume (V) of the Frustum $= (1/3)\pi h(r_1^2 + r_2^2 + r_1 r_2)$

   - h is the height of the frustum.

3. Total Surface Area (TSA) of Frustum $= \pi(r_1 + r_2)\,l + \pi r_1^2 + \pi r_2^2$

Foundation Building Questions:

> A toy is designed in the shape of a frustum with a height of 15 cm. The diameters of its two circular ends are 20 cm and 36 cm. Calculate the surface area and volume of the toy.

Solution:

Given:

r_1 = 10 cm

r_2 = 18 cm

h = 15 cm

Using Pythagoras:

$$I = \sqrt{h^2 + (r_2 - r_1)^2} = \sqrt{(15^2 + 8^2)} = \sqrt{289} = 17 \text{ cm}$$
$$\text{CSA} = \pi(r_1 + r_2)\,l$$
$$= \pi(10 + 18)(17)$$
$$= 28\pi \times 17$$
$$= 476\pi \text{cm}^2$$

$$\text{Volume} = (1/3)\pi h\left(r_1^2 + r_2^2 + r_1 r_2\right)$$
$$= (1/3)\pi \times 15(100 + 324 + 180)$$
$$= 1/3 \times 15 \times 604\pi$$
$$= 3020\pi \text{cm}^3$$

$$\text{TSA} = \pi(r_1 + r_2)\,l + \pi r_1^2 + \pi r_2^2$$
$$= 476\pi + 100\pi + 324\pi$$
$$= 900\pi \text{cm}^2$$

Example Question

If from the above toy, a cylindrical hole of radius 6 cm and depth 12 cm is carved out from its center, what will be the new volume?

Solution:

Volume of the Cylindrical Hole:

$$V = \pi r^2 h$$
$$= \pi \times 6^2 \times 12$$
$$= 432\pi \text{cm}^3$$

New Volume = Original Volume - Volume of the hole

$$= 3020\pi - 432\pi$$
$$= 2588\pi \text{cm}^3$$

Tips and Tricks:

1. Revisiting Basics: Always remember that a frustum is derived from a cone. The properties and formulas for a frustum are simply modified from those of a cone.

2. Pythagoras for Slant Height: The slant height can be found using the Pythagorean theorem, treating the frustum as a right triangle.

3. Holes & Carvings: In problems where portions of the frustum are removed, always subtract that portion's volume/area from the total.

4. Sketch for Clarity: Drawing a quick sketch of the frustum, marking the known dimensions, can make solving problems easier.

5. Units Check: Always ensure the units used are consistent across the problem.

6. Integration with Other Shapes: In more complex problems, a frustum can be combined with other geometries like cylinders, spheres, etc. Be ready to interplay between different formulas.

Surface Area and Volume of Hemisphere

Hemisphere Formulas Recap:

1. Surface Area (including the base) of a Hemisphere $= 3\pi r^2$

2. Curved Surface Area of a Hemisphere $= 2\pi r^2$

3. Volume of a Hemisphere $= \dfrac{2}{3}\pi r^3$

Where r is the radius of the hemisphere.

Example Question

A hemispherical bowl of internal radius 6 cm contains water. This water is filled into a cylindrical bottle of radius 3 cm. Find the height of the water level in the cylindrical bottle.

Solution:

Given:

- Radius of the hemisphere (bowl), r = 6 cm

- Radius of the cylindrical bottle, r' = 3 cm

Volume of the Hemisphere (bowl)

$$= \dfrac{2}{3}\pi r^3$$

$$= \dfrac{2}{3}\pi \left(6^3\right)$$

$$= \dfrac{2}{3}\pi (216)$$

$$= 144\pi \,\text{cm}^3$$

The volume of the hemisphere (water) will be equal to the volume of the water in the cylindrical bottle.

$$\text{Volume of Cylinder } = \pi r^2 h$$
$$\Rightarrow\!> 144\pi = \pi \left(3^2\right) h$$
$$\Rightarrow h = \dfrac{144}{9}$$
$$\Rightarrow h = 16 \text{ cm}$$

The height of the water level in the cylindrical bottle is 16 cm.

Application-Based Question:

> If the water from the cylindrical bottle is now poured into a cone of a base radius of 3 cm, find the height of the cone.

Solution:

Given:

- Radius of cone, r" = 3 cm

- Volume of water (from the cylindrical bottle) $= 144\pi \text{cm}^3$

Volume of Cone $= \frac{1}{3}\pi r^2 h$

Using the formula:

$$=> 144\pi = \frac{1}{3}\pi \left(3^2\right) h'$$
$$=> h' = \frac{144}{3}$$
$$=> h' = 48 \text{ cm}$$

The height of the cone will be 48 cm.

Tips and Tricks:

1. Visualization: Always try to imagine the shape and its dimensions. This helps in avoiding silly mistakes, especially in mensuration problems.

2. Conservation of Volume: In problems where a shape's contents are transferred to another, the volume remains the same.

3. Common Radius Problems: In many problems, the radius remains the same (as seen above). This simplifies the problem and allows you to equate volumes or areas directly.

4. Units: Always double-check the units. It's common to make mistakes if the units for radius and height are different.

5. Integration of Shapes: Be ready to work with problems that integrate multiple shapes (like hemispheres, cones, and cylinders) together. Know how to move between these concepts fluidly.

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Ratio

Definition:

A ratio is a comparison between two quantities, showing the relative size of one quantity to another. It is often expressed in the form `a:b`, where "a" and "b" are the two quantities.

Converting Ratio to Percentage:

Given a ratio `a:b`, the percentage representation of "a" in terms of the whole (a+b) is given by:

$$\text{Percentage of a} = \frac{a}{a+b} \times 100\%$$

Converting Ratio to Decimal:

Given a ratio `a:b`, the decimal representation of "a" in terms of the whole (a+b) is:

$$\text{Decimal of a} = \frac{a}{a+b}$$

Foundation Building Questions:

Question:

The number of male employees in a company is in the ratio 7:3 to the number of female employees. If the number of male employees is 105, find the percentage of female employees.

Solution:

Given ratio of male to female employees = 7:3

Number of male employees = 7x

Number of female employees = 3x

Given 7x = 105

=> x = 15

Number of female employees $= 3x = 3 \times 15 = 45$

Total employees $= 105 + 45 = 150$

Percentage of female employees $= (45/150) \times 100\% = 30\%$

Tips and Tricks:

1. Cross-Multiplication: This method is handy to quickly compare two ratios. If you have two ratios a:b and c:d, you can compare them by looking at the products ad and bc. If ad > bc, then the ratio a:b is greater.

2. Unitary Method: If you have the ratio and one of the actual values, always find the value of 1 unit first (as shown in the previous year question's solution). It simplifies calculations and can be applied uniformly to most problems.

3. Percentage and Decimal: Remember, ratios give a relationship between two parts. Percentages and decimals give the proportion of one part to the whole. Switching between these can provide insights into many questions.

4. Break Down Complex Ratios: If given a complex ratio such as 2:3:4, and you know the total or one part, break it down into simpler ratios (with respect to one part) to make calculations more straightforward.

When studying and practicing, make sure to regularly solve problems from previous years. This helps in understanding the pattern and nature of questions, making the actual exam more approachable.

Discount

Where any two out of Profit or loss percent, markup percent and discount percent, is given and other variables are asked

This concept involves solving problems where a mix of profit/loss percentage, mark-up percentage, and discount percentage are provided, and you are required to derive other details such as the cost price (CP), selling price (SP), or marked price (MP).

Understanding the Relations:

- Marked Price (MP) is the price labeled on the product.

- Selling Price (SP) is the final price after discount.

- Cost Price (CP) is the original cost of the item.

Formulas:

- Mark-Up = $\left(\dfrac{(MP - CP)}{CP} \times 100\%\right)$

- Discount = $\left(\dfrac{(MP - SP)}{MP} \times 100\%\right)$

- Profit = $\left(\dfrac{(SP - CP)}{CP} \times 100\%\right)$

- Loss = $\left(\dfrac{(CP - SP)}{CP} \times 100\%\right)$

Foundation Building Questions:

Question 1 :

A dealer marked the price of an article 40% above the cost price. He then allows a discount of 10%. If the selling price is Rs.540, find the cost price.

Solution:

Given, Mark-Up = 40%, Discount = 10%, SP = Rs.540

$$MP = \left(\dfrac{SP}{1 - \frac{\text{Discount}}{100}} = \dfrac{540}{0.9} = Rs.600\right)$$

$$CP = \left(\dfrac{MP}{1 + \frac{\text{Mark-Up}}{100}} = \dfrac{600}{1.4} = Rs.428.57\right)$$

Question 2 :

A shopkeeper sells an item at a profit of 20%. If he had bought it 25% cheaper and marked it up by 15%, then sold it at a 10% discount, what would have been the profit percent?

Solution:

Let's assume CP = Rs.100

So, SP = Rs.120 (profit of 20%)

New CP = Rs.75 (25% cheaper)

New MP = $(\dfrac{100+15}{100} \times 75 = \text{Rs.86.25})(15\% \text{mark} - \text{up})$

New SP after 10% discount = $(\dfrac{100-10}{100} \times 86.25 = \text{Rs.77.62})$

New profit percent = $(\dfrac{(77.62-75)}{75} \times 100\% = 3.49\%)$

Tips and Tricks related to this concept:

1. Work Systematically: Since the problem statement may involve various variables, working systematically through the given information is essential.

2. Use Assumptions Wisely: In certain scenarios, assuming a suitable value for CP or MP can simplify calculations. Always keep track of assumptions to ensure accuracy in the final step.

3. Utilize Known Relations: Depending on what's given, use the equations and relationships between CP, MP, SP, mark-up, profit, and discount strategically.

4. Relevance of Previous Concepts: The understanding of mark-up, discount, profit, and loss from earlier concepts will play a significant role in solving these problems.

Example Question

In solving these problems, you'll often need to employ concepts and formulas from previous chapters:

- Apply successive discounts when multiple discounts are present (Concept 4).

- Use profit and loss percentages to find SP and CP (Concept 1).

- Sequentially apply the formulas and work through the given variables to derive unknown quantities.

Remember, practice and clarity in concepts will enable you to tackle complex problems involving a mix of these variables. Making assumptions where necessary and being systematic in your approach will ensure accuracy and efficiency.

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Probability

First we learn some important elementary technical terms related to probability and discuss some examples concerning these.

Random Experiment

An experiment is called random experiment if it satisfies the following two conditions:

1. It has more than one possible outcome.
2. It is not possible to predict the outcome in advance.

An experiment whose all possible outcomes are known but the outcome in one experiment cannot be predicted with certainty.

For example, when a coin is tossed it may turn up a head or a tail (so we know the possible outcomes), but we are not sure which one of these results will actually be obtained.

Sample Space

A possible result of a random experiment is called its outcome and the set of all possible outcomes of a random experiment is called Sample Space. Generally, sample space is denoted by S.

Each element of the sample space is called a sample point. In other words, each outcome of the random experiment is also called a sample point.

1. Rolling of an unbiased die is a random experiment in which all the possible outcomes are 1, 2, 3, 4, 5 and 6. Hence, the sample space for this experiment is, S = {1, 2, 3, 4, 5, 6}.

2. When two coin is tossed simultaneously, then possible outcomes are

- Heads on both coins = (H,H) = HH
- Head on first coin and Tail on the other = (H,T) = HT
- Tail on first coin and Head on the other = (T,H) = TH
- Tail on both coins = (T,T) = TT

Thus, the sample space is S = {HH, HT, TH, TT}

Event

The set of outcomes from an experiment is known as an Event.

When a die is thrown, sample space S = {1, 2, 3, 4, 5, 6}.

Let A = {2, 3, 5}, B = {1, 3, 5}, C = {2, 4, 6}

Here, A is the event of occurrence of prime numbers, B is the event of occurrence of odd numbers and C is the event of occurrence of even numbers.

Also, observe that A, B and C are subsets of S.

Now, what is Occurrence of an event ?

From the above example, an experiment of throwing a die. Let E denote the event " a number less than 4 appears". If any of '1' or '2' or '3' had appeared on the die then we say that event E has occurred.

Thus, the event E of a sample space S is said to have occurred if the outcome ω of the experiment is such that $\omega \in E$. If the outcome ω is such that $\omega \notin E$, we say that the event E has not occurred.

Mutually Exclusive Events
Two or more than two events are said to be mutually exclusive if the occurrence of one of the events excludes the occurrence of the other

Independent Events
Events can be said to be independent if the occurrence or non-occurrence of one event does not influence the occurrence or
non-occurrence of the other.

Simple Event

If an event has only one sample point of a sample space, it is called a simple (or elementary) event.

1. When a coin is tossed, sample space S = {H, T}

   The event of an occurrence of a head = A = {H}

   The event of an occurrence of a tail = B = {T}

   Here, A and B are simple events.

2. When a coin is tossed two times, sample space S = {HH, HT, TH, TT}

   The event of an occurrence of two head = A = {HH}

   The event of an occurrence of two tail = B = {TT}

   Here, A and B are simple events.

Compound Event

If an event has more than one sample point, it is called a Compound event.

For example, in the experiment of "tossing a coin thrice" the events

> A: 'Exactly one tail appeared'
>
> B: 'At Least one head appeared'
>
> C: 'Atmost one head appeared' etc.

are all compound events.

The subsets of S associated with these events are

> S = {HHH, HHT, HTT, HTH, THH, THT, TTH, TTT}
>
> A = {HHT, HTH, THH}
>
> B = {HTT, THT, TTH, HHT, HTH, THH, HHH}
>
> C = {TTT, THT, HTT, TTH}

Each of the above subsets contain more than one sample point, hence they are all compound events

Impossible and Sure Events

Consider the experiment of rolling a die. The associated sample space is

S = {1, 2, 3, 4, 5, 6}

Let E be the event " the number appears on the die is greater than 7".

Clearly no outcome satisfies the condition given in the event, i.e., no element of the sample space ensures the occurrence of the event E.

Thus, the event E = φ is an impossible event.
Now let us take up another event F "the number that turns up is less than 7".

Clearly, F = {1, 2, 3, 4, 5, 6} = S i.e., all outcomes of the experiment ensure the occurrence of the event F. Thus, the event F = S is a sure event.

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Polynomials

Exponents are an integral part of mathematics and serve to simplify mathematical expressions and equations. Understanding the fundamental rules of exponents is vital for simplifying and solving a variety of mathematical problems.

Basic Rules of Exponents:

1. Product of Powers Rule:

When multiplying like bases, add the exponents.

$$a^m \times a^n = a^{m+n}$$

2. Quotient of Powers Rule:

When dividing like bases, subtract the exponents.

$$\frac{a^m}{a^n} = a^{m-n}$$

3. Power of a Power Rule:

When raising a power to another power, multiply the exponents.

$$(ab)^m = a^m \times b^m$$

4. Power of a Product Rule:

When a product is raised to a power, raise each factor to that power.

$$(ab)^m = a^m \times b^m$$

5. Power of a Quotient Rule:

When a quotient is raised to a power, raise both the numerator and the denominator to that power.

$$\left(\frac{a}{b}\right)^m = \frac{a^m}{b^m}$$

6. Zero Exponent Rule:

Any non-zero number raised to the power of zero is 1.

$$a^0 = 1(\text{ where } (a \neq 0))$$

7. Negative Exponent Rule:

$$a^{-m} = \frac{1}{a^m}$$

Foundation Building Questions:

1. Simplify: $3^4 \times 3^2$

Solution:

Using the product of powers rule:

$$3^4 \times 3^2 = 3^{4+2} = 3^6 = 729$$

2. Evaluate: $\left(\frac{5^3}{5^2}\right)$.

Solution:

Using the quotient of powers rule:

$$\frac{5^3}{5^2} = 5^{3-2} = 5^1 = 5$$

3. If $(2^x)^3 = 2^6$ find (x).

Solution:

Using the power of a power rule:

$$2^{3x} = 2^6$$

So, 3x = 6

Thus, x = 2 .

Tips and Tricks:

1. Internalize the Rules: Understand and memorize these basic rules. They form the foundation for more advanced algebraic manipulations.

2. Practice with Different Bases: While practicing, use a variety of bases, not just the commonly used ones. This will ensure you're comfortable with any given problem.

3. Beware of Negative Bases: The rules apply differently when the base is negative, especially concerning odd and even exponents.

4. Visualize with Small Numbers: If you're unsure about a rule, test it with small numbers to visualize and confirm its correctness.

5. Link to Logarithms: As exponents and logarithms are inversely related, sometimes converting an exponential equation into a logarithmic one can simplify its solution.

6. Consistent Practice: The more you work with exponents, the more intuitive the rules become. Regular practice is the key.

In conclusion, the basic rules of exponents are foundational in algebra and play a crucial role in simplifying and solving mathematical problems. A thorough understanding of these rules, combined with consistent practice, will prepare students for the variety of problems they'll encounter in their entrance exams and beyond.

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Probability

Let A and B are two events associated with a sample space S. The set A ∩ B denotes the event that both A and B have occurred. In other words, A ∩ B denotes the simultaneous occurrence of the events A and B. The event A ∩ B is also written as AB.

The probability of event AB or A ∩ B can be obtained by using the conditional probability.

From the conditional probability of event A given that B has occurred is denoted by P(A|B) and is given by

$$P(A|B) = \frac{P(A \cap B)}{P(B)}, P(B) \neq 0$$

Using this result, we can write

$$P(A \cap B) = P(B) \cdot P(A|B) \qquad \dots (1)$$

Also, we know that

$$P(B|A) = \frac{P(B \cap A)}{P(A)}, P(A) \neq 0$$

or $\qquad P(B|A) = \frac{P(A \cap B)}{P(A)}, P(A) \neq 0 \quad (\because A \cap B = B \cap A)$

Thus, $\qquad P(A \cap B) = P(A) \cdot P(B|A) \qquad \dots (2)$

Combining (1) and (2), we get

$$P(A \cap B) = P(A) \cdot P(B|A)$$
$$= P(B) \cdot P(A|B) \quad (\text{provided } P(A) \neq 0 \text{ and } P(B) \neq 0)$$

The above result is known as the multiplication rule of probability.

Multiplication rule of probability for more than two events

If A, B and C are three events associated with sample space, then we have

P(A ∩ B ∩ C) = P(A) P(B|A) P(C|A ∩ B)

= P(A) P(B|A) P(C|AB)

Similarly, the multiplication rule of probability can be extended for four or more events.

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LCM and HCF

Highest Common Factor (HCF):

The HCF of two or more numbers is the largest positive integer that divides them without leaving a remainder. It is also known as the Greatest Common Divisor (GCD). HCF is used to solve problems related to dividing objects into smaller equal groups.

Least Common Multiple (LCM):

The LCM of two or more numbers is the smallest multiple that is evenly divisible by all of the given numbers. LCM is useful when solving problems that involve finding the least number of repetitions required for multiple events to synchronize or repeat together.

Tips and Tricks for HCF and LCM:

Finding HCF: Euclidean Algorithm

To find the HCF of two numbers, use the Euclidean algorithm:

- Divide the larger number by the smaller number.

- If the remainder is zero, the smaller number is the HCF.

- If the remainder is not zero, replace the larger number with the smaller number and the remainder as the new smaller number.

- Repeat the process until the remainder becomes zero, then the last non-zero remainder is the HCF.

Finding LCM: Prime Factorization Method

To find the LCM of two or more numbers, use the prime factorization method:

- Express each number as a product of prime factors.

- Take the highest power of each prime factor that appears in any of the numbers. - Multiply all the selected prime factors together to obtain the LCM.

Example:

Question: Find the HCF and LCM of 18 and 24.

Explanation:

Step 1: Find the prime factors of 18: $18 = 2 \times 3^2$

Step 2: Find the prime factors of 24: $24 = 2^3 \times 3$

HCF: The common prime factors are 2 and 3, so the HCF is $2 \times 3 = 6$.

LCM: The highest powers of prime factors in 18 and 24 are 2^3 and 3^2. So, the LCM is $2^3 \times 3^2 = 72$. Therefore, the GCF of 18 and 24 is 6, and the LCM is 72.

Solved Examples:

Question 1: Find the HCF and LCM of 15 and 25.

Explanation:

Step 1: Find the prime factors of 15: 15 = 3 × 5

Step 2: Find the prime factors of 25: 25 = 5² HCF:

The only common prime factor is 5, so the HCF is 5.

LCM: The highest powers of prime factors in 15 and 25 are 3 and 5². So, the LCM is 3 × 5² = 75. Therefore, the GCF of 15 and 25 is 5, and the LCM is 75.

Question 2: Three numbers, A, B, and C, have HCF 5 and LCM 150. If A = 25, find B and C.

Explanation: Since A = 25 and the HCF is 5, we can express B and C as B = 5x and C = 5y, where x and y are coprime. Given that the LCM of A, B, and C is 150, we can calculate the LCM using the HCF and individual numbers.

LCM(A, B, C) = (HCF × A × B × C) / (5 × 25) = 150

Simplifying, we get B × C = 375.

To find two numbers whose product is 375, we can use trial and error.

In this case, B = 15 and C = 25 satisfy the conditions.

Therefore, B = 15 and C = 25.

Introduction:

- HCF (Highest Common Factor) is the greatest number that divides two given numbers without leaving any remainder.
- LCM (Least Common Multiple) is the smallest number that is divisible by both the given numbers.

Understanding HCF:

HCF can be found by using the factorization method, where both numbers are expressed as a product of their prime factors.

For example, let's find the HCF of 24 and 36:

The prime factorization of 24 is 2 × 2 × 2 × 3 = 2³ × 3.

The prime factorization of 36 is 2 × 2 × 3 × 3 = $2^2 × 3^2$.

Comparing the two factorizations, the common factors are 2 × 2 × 3 = 12.

Therefore, the HCF of 24 and 36 is 12.

Understanding LCM:

LCM can also be found using the factorization method, where both numbers are expressed as a product of their prime factors.

For example, let's find the LCM of 24 and 36:

The prime factorization of 24 is 2 × 2 × 2 × 3 = $2^3 × 3$.

The prime factorization of 36 is 2 × 2 × 3 × 3 = $2^2 × 3^2$.

The LCM is obtained by taking the highest power of each prime factor that appears in the factorization.

Therefore, the LCM of 24 and 36 is $2^3 × 3^2 = 72$.

Relation between HCF and LCM:

HCF × LCM = Product of the two numbers

Using the previous example, we had HCF = 12 and LCM = 72. The product of the numbers 24 and 36 is 24 × 36 = 864.

So, 12 × 72 also equals 864. Hence, the relation is verified.

Tips and Tricks:

If two numbers are co-prime (i.e., their HCF is 1), then their LCM is simply the product of the numbers.

In other cases, use prime factorization to find the HCF and LCM of the numbers.

Solved Example:

Question: The product of two numbers is 4320 and their HCF is 12. Find their LCM.

Solution: We know that HCF × LCM = Product of the two numbers.

12 × LCM = 4320, so LCM = 4320/12 = 360.

Percentage

Understanding Fractions:

- A fraction represents a part of a whole.
- It consists of a numerator and a denominator, separated by a slash (/).
- The numerator represents the number of parts we have, and the denominator represents the total number of equal parts.

Example: In the fraction 3/5, 3 is the numerator and 5 is the denominator. It means we have 3 out of 5 equal parts.

Understanding Decimals:

- Decimals are another way to represent fractional numbers.
- They are based on the base-10 system and consist of a whole number part and a decimal part.
- The decimal point separates the whole number part from the decimal part.

Example: In the decimal number 0.75, 0 is the whole number part and 75 is the decimal part. It can be read as "point seven five" or "seventy-five hundredths."

Understanding Percents:

- Percentages are fractions or decimals expressed out of 100.
- The symbol "%" is used to represent percentages.
- Percentages are useful for comparing different proportions or quantities.

Example: 50% is equal to 1/2 or 0.5.

Converting Fractions to Percentages:

- To convert a fraction to a percentage, multiply the fraction by 100.

Example: Convert 3/4 to a percentage.

$$3/4 = (3/4) * 100 = 75\%$$

Converting Decimals to Percentages:

- To convert a decimal to a percentage, multiply the decimal by 100.

Example: Convert 0.6 to a percentage.

$$0.6 \times 100 = 60\%$$

Relation between Fraction and Percentage		
Sr. No.	Fraction	Percentage
1	½	50%
2	1/3	33.33%
3	¼	25%
4	1/5	20%
5	1/6	16.66% = 16%
6	1/7	14.28 % = 14 %
7	1/8	12.5 % = 12%
8	1/9	11.11% = 11%
9	1/10	10% =
10	1/11	9.09% = 9%
11	1/12	8.33 % = 8%
12	1/13	7.69% = 7%
13	1/14	7.14 % = 7%
14	1/15	6.67 % = 6 %
15	1/16	6.25 % = 6%
16	1/17	5.88 % = 5%
17	1/18	5.55% = 5 %
18	1/19	5.26 % = 5%

19	1/20	5%

Converting Percentages to Fractions:

- To convert a percentage to a fraction, write the percentage as a fraction with a denominator of 100 and simplify, if possible.

Example: Convert 25% to a fraction.

$$25\% = 25/100 = 1/4$$

Converting Percentages to Decimals:

- To convert a percentage to a decimal, divide the percentage by 100.

Example: Convert 80% to a decimal.

$$80\% = 80/100 = 0.8$$

Tips and Tricks:

- To find a certain percentage of a number, multiply the number by that percentage.

Example: What is 25% of 80?

$$25\% \text{ of } 80 = (25/100) \times 80 = 0.25 \times 80 = 20$$

- To find the percentage change between two numbers, use the formula:

Percentage change = [(New Value - Old Value) / Old Value] * 100

Example: If the price of a product increased from Rs. 100 to Rs. 120, the percentage change is:

Percentage change $= [(120 - 100)/100] \times 100 = 20\%$

- To find x% of y, we multiply y by x/100.
- The formula is: (x/100) * y = (xy/100)
- For example, to find 25% of 80, we use the formula: (25/100) * 80 = 20

- This concept is widely used in various management entrance exams to test the candidates' ability to calculate percentages and solve word problems.

Word Problems Example:

Question 1: Find 30% of 250.

Solution: (30/100) * 250 = (30 * 250)/100 = 75

Question 2: Ram scored 80% in his exam, out of a total of 500 marks. Calculate his score.

Solution: (80/100) * 500 = (80 * 500)/100 = 400

Tips and Tricks:

- Remember that calculating percentages involves multiplying the percentage value by the total value and dividing by 100.
- It is helpful to convert percentages into fractions or decimals for easier calculations.
- When solving word problems related to finding a certain percentage of a value, identify the percentage and the value correctly to apply the formula accurately.
- Practice previous year's management entrance exam questions to gain familiarity with different types of problems and boost your problem-solving speed.
- Clearly understand the language of the problem and visualize the scenario before attempting to solve it.
- Pay attention to units, especially when dealing with financial or quantitative data.
- Develop shortcuts for percentages like 10%, 20%, 25%, etc. to save time during exams.

A concept of successive change relates to the calculation of changes in a particular value over a consecutive period of time. It involves understanding how a certain quantity has increased or decreased in percentage terms over a series of steps or iterations.

Understanding Percentage Increase/Decrease

Percentage increase or decrease can be calculated using the formula:

Percentage Change = (Final Value - Initial Value) / Initial Value * 100.

This formula helps us determine the percentage change between two values.

Applications of Successive Change Concept

The concept of successive change finds applications in various fields such as finance, economics, and business management. It is particularly crucial for analyzing trends, growth rates, and making projections based on past data.

Example 1: Percentage Increase

Let's consider a scenario where the sales of a company have increased from Rs. 50,000 in 2018 to Rs. 60,000 in 2019, and further to Rs. 75,000 in 2020. We can find the percentage increase in sales for each year as follows:

2019: Percentage Increase = ((60,000 - 50,000) / 50,000) * 100 = 20%

2020: Percentage Increase = ((75,000 - 60,000) / 60,000) * 100 = 25%

Example 2: Percentage Decrease

Suppose the population of a town was 10,000 in 2015, 8,000 in 2016, and 6,000 in 2017. The percentage decrease in population for each year can be calculated as:

2016: Percentage Decrease = ((8,000 - 10,000) / 10,000) * 100 = -20%

2017: Percentage Decrease = ((6,000 - 8,000) / 8,000) * 100 = -25%

Tips and Tricks for Calculating Successive Changes:

- When dealing with successive increases or decreases, always consider the initial base value for calculations.

- To calculate the total cumulative percentage change, add up the individual percentage changes.

- It is essential to be attentive while interpreting negative percentage changes. A negative percentage indicates a decrease, whereas a positive percentage indicates an increase.

Solved Examples:

Question 1: The price of a product increased by 20% in the first week, then decreased by 15% in the second week. What is the net percentage change in the price of the product over two weeks?

Solution:

Percentage Increase in the first week = 20%

Percentage Decrease in the second week = 15%

Net Percentage Change = (20 - 15) / (1 + (20/100)) * (1 - (15/100)) * 100 = 4.55%

Question 2: The population of a city was 1,20,000. It increased by 8% in the first year and decreased by 10% in the second year. Find the population after two years.

Solution:

Population after the first year = 1,20,000 + (8/100) * 1,20,000 = 1,29,600

Population after the second year = 1,29,600 - (10/100) * 1,29,600 = 1,16,640 Therefore, the population after two years is 1,16,640.

These examples and solutions highlight the practical usage of the concept of successive change for solving problems in management entrance exams. Understanding this concept can significantly help in tackling related questions efficiently.

Average

Definition:

The weighted average (or weighted mean) is an average in which each quantity in the dataset is assigned a weight. These weights determine the relative importance of each quantity on the average.

Mathematically:

$$\text{Weighted Average} = \frac{\sum(\text{Value} * \text{Weight})}{\text{Total Weight}}$$

Foundation Building Questions:

Question: In a class of 30 students, 20 students scored an average of 75 marks in a test, while the rest scored an average of 65 marks. What is the weighted average of the class?

Solution:

1. Calculate the total marks for the first group of students.

   Total marks of 20 students = 20 75 = 1500

2. Calculate the total marks for the second group of students.

Total marks of 10 students = 10 65 = 650

3. Calculate the combined total marks.

Total marks of 30 students = 1500 + 650 = 2150

4. Divide by the total number of students to get the weighted average.

Weighted Average = 215030 = 71.67

Answer: The weighted average of the class is 71.67 marks.

Tips and Tricks:

1. Difference between Simple and Weighted Average: Remember, the simple average gives equal importance to every value, while the weighted average considers the importance (or weight) of each value.

2. Break it Down: For large datasets, break down the dataset into smaller chunks, find the average of each chunk, and then find the weighted average.

3. Use Previous Average Concept: If you have a set with an average and a new set is added (like the example above), you can use the weighted average concept to find the new average without calculating everything from scratch

E.g., using the previous concept:

Average of first group = 75, Weight = 20

Average of second group = 65, Weight = 10

Weighted average = (2075 + 1065) / 30 = 2150 / 30 = 71.67

4. Use in Combination Problems: Weighted average is particularly useful in problems where different entities combine, like mixtures, which will be a later topic.

5. Balance the Excess and Deficit: If one group's average is above the overall average, then another group's average has to be below the overall average by a proportional amount considering the weights to balance it out.

Remember, a weighted average is a more generalized form of the average. It's crucial to identify when to use simple average vs. weighted average based on the problem statement.

Linear Equations

Introduction:

A linear equation in two variables is represented by the equation:

$$[ax + by + c = 0]$$

Where:

$-(x) \text{and} (y)$ are variables.

$-(a), (b), \text{and} (c)$ are constants and $(a) \text{and} (b)$ cannot both be zero.

The solution to this equation is an ordered pair (x,y) that satisfies the equation.

Method to Solve:

To solve such equations, you can use any of the following methods:

1. Substitution Method: Solve one of the equations for one variable in terms of the other variable. Then substitute this expression into the other equation.

2. Elimination Method: Multiply or divide one or both of the equations to eliminate one of the variables.

3. Graphical Method: Plot both lines on a graph. The point of intersection will be the solution.

Foundation Building Questions:

Question:

Given the equations:

1) $(2x + 3y = 6)$

2) $(x - 4y = 5)$

Find the values of $(x) \text{and} (y).$

Solution:

Using the Elimination Method:

Multiplying the second equation by 2, we get:

$(2x - 8y = 10)$ ... (i)

Subtracting (i) from the first equation, we get:

$(11y = -4)$

So, $(y = -4/11)$

Substituting the value of \(y \) in the first equation:

$(2x + 3(-4/11) = 6)$

Solving, we get $(x = 35/11)$.

So, the solution is $(x = 35/11) \text{and} (y = -4/11)$.

Tips and Tricks:

1. Quick Visualization: Before diving into calculations, do a quick mental check. If you can visualize the lines representing the equations, you might be able to predict if they intersect, are parallel, or coincide.

2. Zero Coefficients: If one of the coefficients is zero, it simplifies the equation significantly. For example, if $(b = 0)$ in $(ax + by + c = 0)$, the equation becomes a function of (x) only.

3. Consistent System: If two lines are represented by two different linear equations and they intersect at one point, it's a consistent system. If they're parallel, it's inconsistent.

4. Eliminate Wisely: In the elimination method, choose the variable which has coefficients closer in magnitude in both equations. This way, the elimination process becomes simpler.

5. Verify Solutions: Once you've found the values of (x) and (y), quickly plug them back into the original equations to confirm they satisfy both.

Remember, consistent practice and solving various types of problems related to this concept will enhance your understanding and speed in solving them during the actual exam.

PRACTICE TEST - 1

Q1. If the cost price of 12 pens is equal to the selling price of 8 pens, the gain percent is?

A]   50%
B]   40%
C]   20%
D]   30%

Q2. Tarun got 30% concession on the labeled price of an article and sold it for Rs. 8750 with 25% profit on the price he bought. What was the labeled price?

A]   10000
B]   12000
C]   15000
D]   16000

Q3. Find the Remainder of $\dfrac{78^{193}}{97}$

A] 97

B] 193

C] 41

D] None

Q4. Find the simple interest earned on Rs.20000 for 2 years at 10% p.a.

A] Rs.4500
B] Rs.2000
C] Rs.4000
D] Rs.6000

Q5. If Rs.2000 amounts to Rs.2500 in 2 years at simple interest, what is the rate of interest per annum?

A] 8%
B] 37.5%
C] 25%
D] 12.5%

Q6. Excluding stoppages, the speed of a bus is 54kmph and including stoppages, it is 45kmph. For how many minutes does the bus stop per hour?

A] 9

B] 10

C] 12

D] 20

Q7. In a flight of $600\text{ km},$ an aircraft was slowed down due to bad weather. Its average speed for the trip was

reduced by 200 km/hr and the time of flight increased by 30 minutes. The duration of the flight is:

A] 1 hour

B] 5 hour

C] 6 hour

D] 7 hour

Q8. A boat goes a certain distance at 30 km/hr and comes back the same distance at 60 km/hr. What is the average speed (in km/hr) for the total journey?

A] 45
B] 40
C] 35
D] 50

Q9. X can do a piece of work in 20 days working 7 hours a day. The work is started by X and on the second day one man whose capacity to do the work is twice that of X, joined. On the third day another man whose capacity is thrice that of X, joined and the process continued till the work was completed. In how many days will the work be completed, if everyone works for four hours a day?

A]   5 days

B]   8 days

C]   6 days

D]   4 days

Q10. There are two solutions of sulphuric acid (acid + water) with concentration of 50%   and 80% respectively. They are mixed in a certain ratio to get a 62% sulphuric acid   solution. This solution is mixed with 6 liters of water to get back 50% of the solution. How much of the 80% solution has been used in the entire process?

A] 15 liters
B] 12 Liters
C] 10 Liters
D] None of these

Q11. The ratio of two numbers is 2:5. Their LCM is 120. Determine the second number.

A] 24

B] 45

C] 60

D] 85

Q12. The present worth of Rs. 1404 due in two equal half-yearly installments at 8% per annum simple interest is:

A] Rs. 1500
B] Rs. 1325
C] Rs. 1450
D] Rs. 1250

Q13. A card is drawn from a deck of 52 cards. Find the probability of getting a king or a heart or a red card.

A] 6/13
B] 7/13
C] 1/13
D] 2/13

Q14. Find the Remainder of $\dfrac{3^{1002}}{33}$

A] 1

B] 3

C] 9

D] 33

Q15. Find the Remainder of $\dfrac{100!}{101}$

A] 1

B] 0

C] 101

D] None of these

Q16. No. of zeros at the end of $(45!)^{450}$

A] 10

B] 450

C] 10^{45}

D] 4500

Q17. No. of zeros at the end of (31)! × (42)! × (100!)

A] 48

B] 16

C] 6

D] 40

Q18 Two numbers, both greater than 29, have GCD = 29 and LCM = 4147. The sum of the numbers is:

A] 669

B] 696

C] 766

D] 767

Q19. During the first year, the population of the town increased by 4% and during the second year it diminished by 4%. If at the end of the second year its population was 24960, what was its population at the beginning of the first year?

A] 24960

B] 25200

C] 24000

D] 25000

Q20. If 97% of the students are present in a class and 18 students are absent, find the total number of students in the class.

A] 800

B] 600

C] 700

D] 575

PRACTICE TEST - 2

_____

Q1. A milkman has 20 liters of milk. If he mixes 5 liters of water, which is freely available, in 20 liters of pure milk. If the cost of pure milk is Rs. 18 per liter, then the profit of the milkman, when he sells all the mixture at Â cost price, is:

A]   25%
B]   30%
C]   45%
D]   20%

Q2. By mixing two qualities of pulses in the ratio 2: 3 and selling the mixture at the rate of Rs 22 per kilogram, a shopkeeper makes a profit of 10 %. If the cost of the smaller quantity be Rs 14 per kg, the cost per kg of the larger quantity is:

A]   Rs 24
B]   Rs 23
C]   Rs 22
D]   Rs 21

Q3. What is the unit digit in the product (684 x 759 x 413 x 676)?

A] 6

B] 8

C] 2

D] None of thesE

Q4. A sum of money is lent at a certain rate of interest at compound interest. If, instead the same amount was lent at simple interest the interest for the first two years reduces by Rs.160 and that for the first three years reduces by Rs.488. Find the sum

A]   Rs.52000
B]   Rs.64000
C]   Rs.32000

D]   Rs.12000

Q5. The difference between the compound interest and simple interest on a certain sum at 12% per annum for 2 years is Rs.126.72. Find the sum.

A]   Rs.8800
B]   Rs.7800
C]   Rs.8000
D]   Rs.8500

Q6. If a person walks at 14 km/hr instead of 10 km/hr, he would have walked 20 km more. The actual distance traveled by him is:

A] 50 km

B] 56 km

C] 70 km

D] 80 km

Q7. A train can travel 50 \% faster than a car. Both start from point A at the same time and reach point B away from A at the same time.   On the way, however, the train lost about 12.5 minutes while stopping at the stations. The speed of the car is:

A] 100 kmph

B] 120 kmph

C] 210 mph

D] 200kmph

Q8. 2.A boat goes a certain distance at 30 km/hr and comes back the same distance at 60 km/hr. What is the average speed (in km/hr) for the total journey?

A] 45
B] 40
C] 35
D] 55

Q9. Ram completes 60% of a task in 15 days and then takes the help of Rahim and Rachel. Rahim is 50% as efficient as Ram is and Rachel is 50% as efficient as Rahim is. In how many more days will they complete the work?

A] 40/7

B] 20/7

C] 30/7

D] 10/7

Q10. Three taps A, B and C can fill a tank in 12, 15 and 20 hours respectively. If A is open all the time and B and C are open for one hour each alternately, the tank will be full in:

A] 7 hour

B] 5 hour

C] 3 hour

D] 4 hour

Q11. Two solutions of 90% and 97% purity are mixed resulting in 21 liters of mixture of 94 % purity. How much is the quantity of the first solution in the resulting mixture?

A] 15 liters
B] 12 liters
C] 9 liters
D] 6 liters

Q12. Length of one side of a parallelogram is 10 cm, then the length of its adjacent side, when perimeter of parallelogram given as 50 cm is

A] 15cm
B] 12cm
C] 10cm
D] 16cm

Q13.A medicine capsule is in the shape of a cylinder of diameter 1 cm with two hemispheres stuck to each of its ends. The length of the entire capsule is 2 cm. The capacity (in cm³) of the capsule is

A] 0.31
B] 1.31
C] 2.31
D] 4.05

Q14. If the height of a bucket in the shape of frustum of a cone is 16 cm and the diameters of its two circular ends are 40 cm and 16 cm then its slant height is

A] 20
B] 15
C] 25
D] 30

Q15. The speed of three cars is in the ratio of 2 : 3 : 4. What is the ratio among the times taken by these cars to travel the same distance?

A] 6:4:3

B] 6:5:4
C] 1:2:3
D] 3:4:6

Q16.If the true discount on s sum due 2 years hence at 14% per annum be Rs. 168, the sum due is:

A] Rs. 768
B] Rs. 760
C] Rs. 785
D] Rs. 750

Q17. Seven persons are to be seated in a row. The probability that two particular persons sit next to each other is

A] 1/3

B] 1/2
C] 2/7
D] 1/4

Q18. Three numbers are chosen from 1 to 20. Find the probability that they are not consecutive

A] 187/190
B] 2/5
C] 3/4
D] 188/190

Q19. What is the unit digit in the product $(3547)^{153} \times (251)^{72}$?

A] 1

B] 3

C] 7

D] None of these

Q20. What is the unit digit in $\{(264)^{102} + (264)^{103}\}$?

A] 0

B] 1

C] 2

D] 4

PRACTICE TEST - 3

_____

Q1. In the land of the famous milkman Merghese Durian, a milkman sells his buffalo for Rs. 720 at some profit. Had he sold his buffalo at Rs. 510, the quantum of the loss incurred would have been double that of the profit earned. What is the cost price?

A]   650
B]   750
C]   1350
D]   1250

Q2.A Camera shop allows a discount of 10% on the advertised price of a camera. What price must be marked on the camera, that costs him Rs. 600, so that he makes a profit of 20%?

A]   720
B]   800
C]   750
D]   350

Q43.Find the reminder when 47^{100} is divided by 100

A] 1

B] 41

C] 61

D] 81

Q4.Find the effective rate of interest if the normal rate of interest is 10% p.a. and the interest is compounded every six months.

A] 21.5%
B] 10.25%
C] 5.25%
D] 10%

Q5.Find the compound interest on Rs. 8000 at 4% per annum for 2 years compounded annually

A] R 652.80`
B] R 452.80
C] R 652.80
D] R 552.80

Q6.In covering a distance of 30 km, Abhay takes 2 hours more than Sameer. If Abhay doubles his speed, then he would take 1 hour less than Sameer. Abhay's speed is:

A] 5 kmph

B] 10 kmph

C] 12 kmph

D] 8 kmph

Q7.Robert is traveling on his cycle and has calculated to reach point A at 2 P.M. if he travels at 10 kmph, he will reach there at 12 noon if he travels at 15 kmph. At what speed must he travel to reach A at 1 P.M.?

A] 8 kmph

B] 12 kmph

C] 10 kmph

D] 14 8 kmph

Q8.A man's speed with the current is 15 km/hr and the speed of the current is 2.5 km/hr. The man's speed against the current is:

A] 12.5 km/hr
B] 5.5 km/hr
C] 6.5 km/hr
D] 10 km/hr

Q9.A, B and C can do a piece of work in 20, 30 and 60 days respectively. In how many days can A do the work if he is assisted by B and C on every third day?

A] 12 days
B] 15 days
C] 10 days
D] 25 days

Q10.There are two containers: the first contains 500ml of alcohol, while the second contains 500 ml of water. Three cups of alcohol from the first container is removed and is mixed well in the second container. Then three cups of this mixture is removed and is mixed in the first container. Let 'A' denote the proportion of water in the first container and 'B' denote the proportion of alcohol in the second container. Then A,

A] A > B
B] A < B
C] A = B
D] Cannot be determined

Q11.The marks scored by a student in three subjects are in the ratio of 4 : 5 : 6. If the candidate scored an overall aggregate of 60% of the sum of the maximum marks and the maximum marks in all three subjects is the same, in how many subjects did he score more than 60%?

A] 1

B] 2

C] 3

D] None of the subjects

Q12.Rs. 20 is the true discount on Rs. 260 due after a certain time. What will be the true discount on the same sum due after half of the former time, the rate of interest being the same?

A) Rs. 10.40
B) Rs. 10
C) Rs. 20
D) Rs. 25

Q13.Find the last two digits of the number 78^{87}

A] 12

B] 32

C] 52

D] 72

Q14.Find the last two digits of 7^{4034}

A] 09

B] 29

C] 49

D] 69

Q15. What are the numbers of factors of 3^6 x 6^3 ?

A] 28

B] 40

C] 36

D] 30

Q16..What is the sum of the factors of 221?

A] 222

B] 251

C] 252

D] 262

Q17. What is the unit digit of (7^{400}) (9^{300})?

A] 1

B] 3

C] 7

D] 9

Q18. On a table there are 8 identical tea-cups, 7 identical coffee-mugs and 5 distinct wine-glasses. In how many ways can a person select at least 1 item from the table ?

A] 2303

B] 2003

C] 2600

D] 2500

Q19. If the Product of two numbers is 3192 and LCM is 56 then their HCF is:

A] 58
B] 59
C] 56
D] 57

Q20. Out of the 75 students enrolled in the Economics class, 12% did not qualify to take the final examination on account of lack of attendance. Of those who qualified to take the test, 9.09% absented themselves from the exam. Two-third of those who took the exam passed the examination. 75% of those who passed secured a first class in the paper. How many students who pass the exam scored less than first class?

A] 15

B] 10

C] 12

D] None of these

PRACTICE TEST - 4

_____

Q1. The percentage profit earned by selling an article for Rs. 1920 is equal to the percentage loss incurred by selling the same article for Rs. 1280. At what price should the article be sold to make 25% profit?

A]   3000
B]   2000
C]   4000
D]   2500

Q2. The cost price of 20 articles is the same as the selling price of x articles. If the profit is 25%, then the value of x is:

A]   16
B]   15
C]   12
D]   14

Q3. Remainder when (1! + 2! + 3! + ... + 4000!) is divided by 7

A] 7

B] 1

C] 5

D] None of these

Q4. Find the present value (in Rs.) of Rs.3000 due after 5 years at 10% p.a. simple interest.

A] 1500
B] 1800
C] 2000
D] 2500

Q5. A sum of money invested at simple interest amounts to Rs 2480 at the end of four years and Rs.4080 at the end of eight years. Find the principal.

A] Rs.2040
B]Rs. 1480
C] Rs.1240
D] Rs.880

Q6.A man completes a journey in 10 hours. He travels the first half of the journey at the rate of 21 km/hr and second half at the rate of 24 km/hr. Find the total journey in km.

A] 220 km

B] 224 km

C] 200 km

D] 240 km

Q7.The ratio between the speeds of two trains is 7 : 8. If the second train runs 400 km in 4 hours, then the speed of the first train is:

A] 12.5 km/hr

B] 27 km/hr

C] 20 km/hr

D] 87.5 km/hr

Q8. A train is running at a speed of 116 km/h. The distance covered by the train in meters in 18 seconds is:

A] 580 meters
B] 480 meters
C] 280 meters
D] 380 meters

Q9. P, Q and R can do work in 20, 30 and 60 days respectively. How many days does it take to complete the work if P does the work and he is assisted by Q and R on every third day?

A]   15 days

B]   10 days

C]   25 days

D]   45 days

Q10.A large tanker can be filled by two pipes A and B in 60 minutes and 40 minutes respectively. How many minutes will it take to fill the tanker from an empty state if B is used for half the time and A and B fill it together for the other half?

A] 15 min
B] 20 min
C] 30 min
D] 40 min

Q11. In what ratio should water be mixed with soda costing Rs. 12 per liter so as to make a profit of 25% by selling the diluted liquid at Rs. 13.75 per liter?

A] 10 : 1
B] 11 : 1
C] 1 : 11
D] 12 : 1

Q12. A quadrilateral is a parallelogram if

A] both pair of opposite angles are equal

B] the diagonals bisect each other

C] both pairs of opposite sides are equal

D] All of the above

Q13.The internal and external diameters of a hollow hemispherical vessel are 20 cm and 28 cm respectively. Find the cost of painting the vessel all over at 35 paise per cm².

A] Rs 756.80
B] Rs 766.80
C] Rs 750.80
D] Rs 740.80

Q14. The surface areas of two spheres are in the ratio 25 : 16. The ratio of their volumes is

A] $\dfrac{125}{64}$

B] $\dfrac{64}{27}$

C] 120/7
D] 135/11

Q15.A, B and C play cricket. A's runs are to B's runs and B's runs are to C's as 3:2. They got 342 runs. How many runs did A make?

    A] 162

    B] 108

    C] 72

    D] None of these

Q16. The simple interest and the true discount on a certain sum for a given time and at a given rate are Rs. 85 and Rs. 80 respectively. The sum is:

A] Rs. 1800
B] Rs. 1200
C] Rs. 1360
D] Rs. 1300

Q17. If the letters of the word ASSASSINATION are arranged at random. Find the Probability that no two A's are coming together.

A] 1/26
B] 5/26
C] 15/26
D] 3/26

Q18. Suppose an integer from 1 through 1000 is chosen at random, find the probability that the integer is a multiple of 2 or a multiple of 9.

A] 0.556
B] 0.545
C] 0.123
D] 0.245

Q19. Find the Remainder of $\dfrac{7^{8400000}}{342}$

A] 0

B] 1

C] 49

D] 341

Q20. For how many values of n will n! end with 24 zeros?

A] 1

B] 24

C] 5

D] can't be determined

PRACTICE TEST - 5

_____

Q1. A man bought an article and sold it at a gain of 5 %. If he had bought it at 5% less and sold it for Re 1 less, he would have made a profit of 10%. The C.P. of the article was

A]   Rs 200
B]   Rs 300
C]   Rs 400
D]   Rs 100

Q2. In a certain store, the profit is 320% of the cost. If the cost increases by 25% but the selling price remains constant, approximately what percentage of the selling price is the profit.

A]   70%
B]   40%
C]   30%
D]   20%

Q3. The product of 10 consecutive even numbers is always divisible by

A] 2^{10}

B] $3 (2^9)$

C] $2^{10} \times 10!$

D] None of these

Q4. A certain sum of money increased by 72.8% at a certain rate in three years with interest being compounded annually. If the same sum is lent at simple interest at the same rate of interest, in how many years would it become four times itself?

A]   15 years
B]   5 years
C]   10 years

D]   25 years

Q5. The difference between the interest earned under compound interest, interest being compounded annually and simple interest for two years on the same sum and at the same rate of interest is Rs.25.60. Find the sum if the rate of interest is 8% p.a.

A]   Rs.4000
B]   Rs.2000
C]   Rs.3000
D]   Rs.5000

Q6..A person crosses a 600 m long street in 5 minutes. What is his speed in km per hour?

A] 5
B] 7
C] 9
D] 7.2

Q7. An airplane covers a certain distance at a speed of 240 kmph in 5 hours to cover the same distance in $1\frac{2}{3}$ hours, it must travel at a speed of:

A] 300 kmph
B] 360 kmph
C] 400 km h
D] 720 kmph

Q8.To cover a certain distance at a speed of 60 km/h, a train takes 15 hours. If it covers the same distance in 12 hours, what will its speed be?

A] 9
B] 10
C] 5
D] 12

Q9. A can do work in 18 days. When he had work for 2 days, B joined him. If they complete the remaining work in 4 more days . In how many days B alone finishes the whole work?

A] 6 days.

B] 5 days.

C] 10 days.

D]   8 days.

Q10. There are two mixtures of honey and water, the quantity of honey in them being 25% and 75 % of the mixture. If 2 gallons of the first are mixed with three gallons of   the second, what will be the ratio of honey to water in the new mixture?

A] 11 : 2
B] 11 : 9
C] 9 : 11
D] 2 : 11

Q11.ABCD is a rhombus, then the measure of $\angle$ CDB is

A] 30°
B] 60°
C] 40°
D] 50°

Q12. The monthly salaries of two persons are in the ratio of 4:7. If each receives an increase of Rs.25 in the salary, the ratio is altered to 3: 5. Find their respective salaries.

A] 120 & 210

B] 80 & 140

C] 180 & 300

D] 200 & 350

Q13. The true discount on Rs. 1760 due after a certain time at 12% per annum is Rs. 160. The time after which it is due is:

A] 6 months
B] 8 months
C] 5 months
D] 10 months

Q14. In a game two players, A and B take turns in throwing a pair of fair dice starting with player A and a total of scores on the two dice, in each throw is noted. A wins the game if he throws a total of 6 before B throws a total of 7 and B wins the game if he throws a total 7 before A throws a total six. The game stops as soon as either of the players wins. The probability of A winning the game is:

A] $\dfrac{31}{61}$

B] $\dfrac{5}{6}$

C] $\dfrac{30}{61}$

D] 1

Q15. What is the largest number which divides 97 and 65 leaving remainders of 7 and 5 respectively?

A] 60

B] 30

C] 15

D] 10

Q16. What is the largest number that divides 23, 37 and 79 leaving the same remainder in each case?

A] 2

B] 7

C] 12

D] 14

Q17. What is the last remainder when 223 is successively divided by 4, 5 and 6?

A] 5

B] 0

C] 3

D] 1

Q18. Which of the following leaves no remainder when divided by 100?

A] $11^{10} - 1$

B] $10^8 - 10$

C] $4^6 - 3^6$

D] $5^6 - 5^2$

Q19. The value of p(2) of the polynomial is

A] 3
B] -3
C] 2
D] -2

Q20. Which of the following is the smallest five digit number which when divided by 8, 11 and 24 leaves a remainder of 5 in each case?

A] 10301
B] 10125
C] 10061
D] 10037

ANSWER KEY

PRACTICE TEST -1

1	2	3	4	5	6	7	8	9	10
A	A	D	C	D	B	A	B	A	C
11	12	13	14	15	16	17	18	19	20
C	B	B	C	D	D	D	B	D	B

PRACTICE TEST -2

1	2	3	4	5	6	7	8	9	10
A	A	B	B	A	A	B	B	A	A
11	12	13	14	15	16	17	18	19	20
C	A	B	A	A	A	C	B	C	A

PRACTICE TEST -3

1	2	3	4	5	6	7	8	9	10
A	B	A	B	A	A	B	D	B	C
11	12	13	14	15	16	17	18	19	20
A	A	A	C	B	C	A	B	D	B

PRACTICE TEST - 4

1	2	3	4	5	6	7	8	9	10
B	A	C	C	D	B	D	A	A	C
11	12	13	14	15	16	17	18	19	20
C	A	A	A	A	C	C	A	B	C

PRACTICE TEST - 5

1	2	3	4	5	6	7	8	9	10
A	A	A	A	A	D	D	A	A	B
11	12	13	14	15	16	17	18	19	20
B	D	D	C	B	D	A	D	B	D

SOLUTIONS

_____

PRACTICE TEST - 1

1-A

$$\text{Profit \%} = \left(\frac{4}{8}\right) \times 100 = 50\,\%$$

2-A

Let MP = 100

CP = 70

S = 70 × 1.25 = 87.5

Now 87.5 % = 8750

MP = 100% = 10000

3-D

$78^{193}/97$

$78^{1}/97 = 78$

4-C

S.I = (2000 x 2 x 10) /100 = 4000

Or S.I = RT% of P = 10 x 2 %P of P i.e 20 % of

= 20/100 x 20000 = 4000.

5-D

I = A-P

= 2500 -2000 = 500

500 /2000 x 100 = 25 %

Interest for 2 years = 25 %

Interest for 1 years = 25% /2 = 12.5 %

6-B

Due to stoppages, it covers 9 km less.

Time taken to cover $9 \text{ km} = \left(\dfrac{9}{54} \times 60\right) \text{ min} = 10 \text{ min.}$

7-A

Let the duration of the flight be x hours.

Then, $\dfrac{600}{x} - \dfrac{600}{x + (1/2)} = 200$

$\Rightarrow \dfrac{600}{x} - \dfrac{1200}{2x+1} = 200$

$\Rightarrow x(2x+1) = 3$

$\Rightarrow 2x^2 + x - 3 = 0$

$\Rightarrow (2x+3)(x-1) = 0$

$\Rightarrow x = 1\text{hr.} \quad [\text{neglecting the -ve value of } x]$

8-B

Given: Speed of boat is 30 km/hr and 60 km/hr for same distance.

So, Average speed = $\dfrac{2xy}{x+y}$ (for same distance)

Putting the values x = 30 and y = 60

Average speed = $\dfrac{2\times30\times60}{30+60}$ ⇒ $\dfrac{3600}{90}$

Average speed = 40

9-A

Since X takes 20 days working 7 hours a day to complete the work, the number of day-hours required to complete this work would be 140 day-hours. Like in the two problems above, this is going to be constant throughout. So, W = 140 day-hours.

Amount of work done in the 1st day by X = 1 day × 4 hours = 4 day-hours
2nd day, X does again 4 day-hours of work. The second person is twice as efficient as X so he will do 8 day-hours of work. Total work done on the second day = 8 + 4 = 12 day-hours. Amount of work completed after two days = 12 + 4 = 16 day-hours.

3rd day, X does 4 day-hours of work. Second Person does 8 day-hours of work. Third person who is thrice as efficient as X does 12 day-hours of work. Total work done on 3rd day = 4 + 8 + 12 = 24 day-hours Amount of work completed after 3 days = 16 + 24 = 40

day-hours

Similarly on 4th day the amount of work done would be 4 + 8 + 12 + 16 = 40 day-hours

Work done on the 5th day = 4 + 8 + 12 + 16 + 20 = 60 day-hours

Total work done after 5 days = 4 + 12 + 24 + 40 + 60 = 140 day-hours = W. So it takes 5 days to complete the work.

10-C

50   80

62   = 3:2

18   12

3x/2x+6 = 1/1 = 3x = 2x+6

x = 6

Quantity of 80 % solution = 6X2 = 12 L

11-C

2 : 5 = 120

2x : 5x = 120

10x = 120

x = 12

Second number is 60

12-B

Required sum = P.W. of Rs. 702 due 6 months + P.W. of Rs. 702 due 1 year hence

$$= \text{Rs.} \left[\left(\frac{100 \times 702}{100 + 8 \times \frac{1}{2}} \right) + \left(\frac{100 \times 702}{100 + (8 \times 1)} \right) \right]$$

$$= \text{Rs.} \ (675 + 650)$$

$$= \text{Rs.} \ 1325.$$

13-B

We know that, in a deck,

Total no. of cards = 52

No. of kings = 4

No. of heart cards = 13

& total no. of red cards = 13 + 13 = 26

Thus, favorable outcomes = 4 + 13 + 26 – 13 – 2

$$= 28$$

Now,

Probability = no. of favorable outcomes / total no. of outcomes

= 28 / 52

 = 7/13

14-C
$3^{1002}/33$

$3^{10*100+1}/11=3$
$3*3=9$

15-D
100!/101

(p-1)!/p= (p-1) (p= prime number)

56-D
$45!^{450}$
45/5=9

9+1=10
$(10 \text{ zeros})^{450}$
10*450=4500

57-D
31!*42!*100!
7+9+24=40

58-B
Product of numbers = 29 * 4147.
Let the numbers be 29a and 29b.
Then, 29a * 29b = (24 * 4147)
=> ab = 143.
Now, co-primes with product 143 are (1, 143) and (11, 13).
So, the numbers are (29 * 1, 29 * 143) and (29 * 11, 29 * 13).
Since both numbers are greater than 29, the suitable pair is (29 * 11, 29 * 13)
i.e., (319, 377).
Required sum = (319 + 377) = 696.

59-D
24960=initial*(104/100)*(96/100)
Initial population= 25000

60-B
Absent students= (100-97)%= 18
3%=18
100%=600

PRACTICE TEST -2

46-A

Total cost of pure milk = $20 \times 18 = 360$

Now 5 litres of water added and sell at CP

Then SP= $25 \times 18 = 450$

P%= $\left(\frac{90}{360}\right) \times 100 = 25\%$

47-A

Cost Price of 5 kg = Rs.(14*2 + x*3) = (28 + 3x).

Sell price of 5 kg = Rs. (22x5) = Rs. 110.

[{110 - (28 + 3x)}/(28 + 3x)]* 100 =10

[82-3x/28 + 3x]= 1 / 10

820 - 30x = 28 +3x

33x = 792

x = 24

48-B
684*759*413*676
4*9*3*6=648
Last digit =8

49-B
B is the difference B/w 2 years of interest So B = 160
Difference B/w 3 years of C.I and S.I
= 3B+C = 488
160 x 3 + C = 8
C is calculated on 8
= rate = 8 /160 x 100 = 5%
A = 160/5 x 100 = 3200
P = 3200 / 5 x 100
P = 64000 Rs.

50-A

Difference B/W C.I and S.I = P (r/100) ^{2}

126.72 = p (12/100)^2

P = 8800

51-A

Let the actual distance traveled be x km.
Then,

$$\frac{x}{10} = \frac{x+20}{14}$$

$$\Rightarrow 14x = 10x + 200$$

$$\Rightarrow 4x = 200$$

$$\Rightarrow x = 50 \text{ km}.$$

52-B

Let the speed of the car be x \mathrm{kmph}.

Then, speed of the train $= \frac{150}{100}x = \left(\frac{3}{2}x\right)$ kmph.

$$\therefore \frac{75}{x} - \frac{75}{(3/2)x} = \frac{125}{10 \times 60}$$

$$\Rightarrow \frac{75}{x} - \frac{50}{x} = \frac{5}{24}$$

$$\Rightarrow x = \left(\frac{25 \times 24}{5}\right) = 120 \text{kmph}.$$

53-B

Given: Speed of boat is 30 km/hr and 60 km/hr for same distance.

So, Average speed = $\frac{2xy}{x+y}$ (for same distance)

Putting the values x = 30 and y = 60

Average speed = $\frac{2 \times 30 \times 60}{30+60}$ ⇒ $\frac{3600}{90}$

Average speed = 40

54-A

Ram completes 60% of the task in 15 days.
i.e., he completes 4% of the task in a day.

Rahim is 50% as efficient as Ram is.
Therefore, Rahim will complete 2% of the task in a day.

Rachel is 50% as efficient as Rahim is
Therefore, Rachel will complete 1% of the task in a day.

Together, Ram, Rahim and Rachel will complete 4 + 2 + 1 = 7% of the work in a day.
They have another 40% of the task to be completed.

Therefore, they will take 40/7 more days to complete the task.

55-A

Part filled by pipe A in 1 hour = 1/12

Part filled by pipe B in 1 hour = 1/15

Part filled by pipe C in 1 hour = 1/20
In first hour, A and B is open
In second hour, A and C is open
then this pattern goes on till the tank fills

Part filled by pipe A and pipe B in 1 hour = 1/12+1/15=9/60=3/20

Part filled by pipe A and pipe C in 1 hour = 1/12+1/20=8/60=2/15

Part filled in 2 hour = 3/20+2/15=17/60

Part filled in 6 hour =17/60×3=17/20 Remaining part = (1−17/20)=3/20

Now, 6 hours are over and only 3/20 part needed to be filled. At this 7th hour, A and B is open Time taken by pipe A and B to fill this 3/20 part = 1 hour
Total time taken = 6 hour + 1 hour = 7 hour

56-C

```
    90                    47
      \                  /
       \                /
        94            = 3:4
       /                \
      /                  \
    3                      4
```
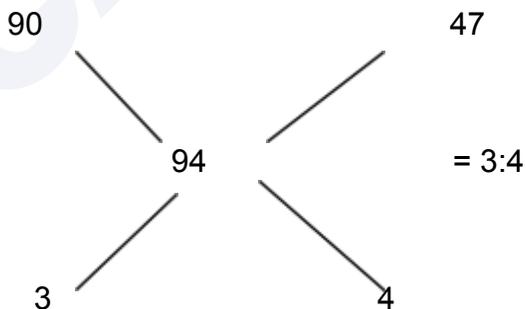
First solution = 3/7 x 21 = 9L

57-A

From the concept, the opposite side of a parallelogram is equal.
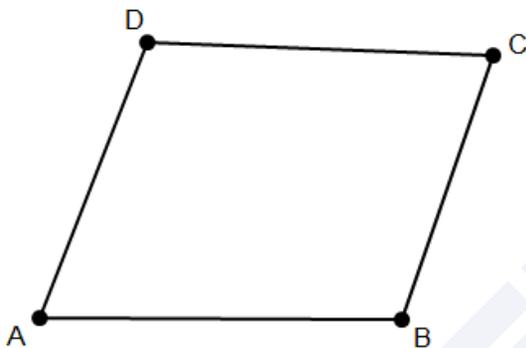
Let ABCd is parallelogram, AB = 10 cm and AB and BC are adjacent side

AB = CD and AD = BC (opposite sides)

AB+BC+CD+DA = 50

10+BC+10+DA = 50

BC+DA+20=30

BC=15

BC = DA = 15 cm

58-B

Radius of the capsule = $\dfrac{1}{2}$ cm = 0.5 cm

Let the length of cylindrical part be x cm

Then, $0.5 + x + 0.5 = 2 \Rightarrow x + 1 = 2 \Rightarrow x = 1cm$

Capacity of the capsule $= \left(\frac{2}{3}\pi r^3 \times 2\right) + \pi r^2 h$

$$= \frac{4}{3} \times \frac{22}{7} \times (0.5)^3 + \frac{22}{7} \times (0.5)^2 \times 1$$

$$= \left(\frac{4}{3} \times \frac{22}{7} \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2}\right) + \left(\frac{22}{7} \times \frac{1}{2} \times \frac{1}{2}\right)$$

$$= \frac{11}{21} + \frac{11}{14} = \left(\frac{22 + 33}{42}\right) = \frac{55}{42} = 1.31 cm^3$$

59-A

$$l = \sqrt{h^2 + (R-r)^2} = \sqrt{(16)^2 + (20-8)^2} \ cm$$

$$= \sqrt{256 + 144} cm = \sqrt{400} cm = 20 \ cm$$

60-A

Ratio of time = 1/2 : 1/3 : ¼

 = 6 : 4: 3

61-A

$$\text{P.W.} = \frac{100 \times \text{T.D.}}{R \times T} = \frac{100 \times 168}{14 \times 2} = 600.$$
$$\therefore \text{Sum} = (\text{P.W.} + \text{T.D.}) = \text{Rs. } (600 + 168) = \text{Rs. } 768.$$

62-C

7 persons are to be seated in a row   ….. (given)

Let us consider 2 persons as 1 group since 2 person sit next to each other

Thus, we have to arrange 6 persons,

Thus, the no. of arrangement = 2! X 6!

Thus, total no. of arrangement of 7 persons = 7!

Now,

Probability = no. of favorable outcomes/ total no. of outcomes

= 2! X 6! / 7!

= 2 x 1 x 6! / 7 x 6!

= 2/ 7

Thus, option C is the correct answer.

63-B

The set has 3 consecutive nos. from 1 to 20,

Thus, it is – (1,2,3), (2,3,4), (3,4,5), …….. , (18,19,20)

Now, if we consider 3 nos. as a single digit, there will be 18 nos.

Now, choosing 3 nos. out of 20 can be done in $^{20}C_3$ ways

This, $n(S) = {}^{20}C_3$

Required event – the 3 nos. chosen must be consecutive, thus,

P (nos. are consecutive) = 18/ $^{30}C_3$

$$= \frac{18}{\frac{20!}{3!(20-3)!}}$$

$$= \frac{18}{\frac{20 \times 19 \times 18 \times 17!}{3 \times 2 \times 1 \times 17!}}$$

$$= \frac{18}{\frac{20 \times 19 \times 18}{6}}$$

$$= \frac{6}{20 \times 19}$$

$$= \frac{3}{190}$$

Now,

P (nos. that are not consecutive) = 1 – 3/190

= 190 – 3/ 190

$$= 187 / 190$$

Thus, option B is the correct answer.

64-C

$3547^{153}*251^{72}$

$7^{153}*1^{72}$

$7*1$

65-A

$264^{102}*264^{103}$

$4^{102}+4^{103}$

$6+6*4=30=0$

66-D

$4^{11}*7^{5}*11^{2}$

$2^{22}*7^{5}*11^{2}$

$22+5+2$

29

67-C

$2^{31/5}$

$2^{3}/5=3$

68-D

Value and Zero of a Polynomial -

Zero of a Polynomial:

A number 'k' is said to be the zero of a polynomial p(x), if on replacing each x in the polynomial by 'k' the value of the polynomial comes out to be zero.

The vale of a polynomial, $p(x) = x^2 – 3x – 4$ at x = -1 is 0,

$$p(-1) = (-1)^2 - \{3 \times (-1)\} - 4 = 0$$

Also, note that, $p(4) = 4^2 - (3 \times 4) - 4 = 0.$

As p(–1) = 0 and p(4) = 0, –1 and 4 are called the zeroes of the quadratic polynomial $x^2 – 3x – 4$.

Zeros of a Linear Polynomial.

For example, if k is a zero of p(x) = 3x + 4, then p(k) = 0 gives us 3k + 4 = 0, i.e., k = -4/3.

If k is a zero of p(x) = ax + b, then p(k) = ak + b = 0, i.e. k = -b/a.

So, the zero of the linear polynomial ax + b is $\dfrac{-b}{a} = \dfrac{-(\text{ Constant term })}{\text{Coefficient of } x}$.

Thus, the zero of a linear polynomial is related to its coefficients.

-

Finding a zero of p(x), is the same as solving the equation p(x) = 0

Now, 2x + 1 = 0 gives us x = -½

So, x = -½ is a zero of the polynomial 2x + 1

69-C
$2^{96}/96$
=> $32*2^{91}/32*3=2^3/3=2$
=> $2*32= 64$

70-B
Let digit ' 1 ' is repeated; so, set of digits will be $1, 1, 9, 5, 4$

Number of numbers formed $= 5! \div 2 = 60$

Similarly for other digits; number of numbers formed $= 60$ for each case.

Total numbers formed $= 4 \times 60 = 240$

71-A

2	24		2	30		2	42
2	12		3	15		3	21
2	6		5	5		7	7
3	3			1			1
	1						

∴   Factors of 24 = 2 × 2 × 2 × 3 = $(2^3 × 3^1)$

Factors of 30 = 2 × 3 × 5 = $(2^1 × 3^1 × 5^1)$

Factors of 42 = 2 × 3 × 7 = $(2^1 × 3^1 × 7^1)$

∴   The product of common prime factors with the least powers = $2^1 × 3^1 = 6$

72-A

At the 1st step, use any two of three numbers.

$$1785 \overline{)1995}(1$$
$$\underline{1785}$$
$$210\overline{)1785}(8$$
$$\underline{1680}$$
$$105\overline{)210}(2$$
$$\underline{210}$$
$$X$$

∴   HCF for 1785 and 1995 = 105

At the 2nd step, use obtained HCF 105 and the 3rd given number 3381.

$$105\overline{)3381}(3$$
$$\underline{315}$$
$$231$$
$$210$$
$$21\overline{)105}(5$$
$$\underline{105}$$
$$X$$

73-A

$5^{1000}/26$

$5^1/26$=remainder 5

$5^2/26$=remainder 25

$5^3/26$=remainder 21

$5^4/26$=remainder 1

Cyclicity of 5 is 4

0 remainder means last term of cycle

Remainder=1

74-D

Let population a=9x,   b=8x, c=3x

Total literate population=(80/100)*9x+70/100*8x+90/100*3x= 15.5x

Literate population %=15.5x/20 x=77.5%

75-B

Final population= 64000*(105/100)*(105/100)*(105/100)

74088

_____

PRACTICE TEST - 3

41-A

SP = 720

New SP = 510

Difference = 720 - 510

Now P : L = 1 : 2

$P = 200 \times \left(\dfrac{1}{3}\right) = 700$

Then CP = 720 - 70 = 650

42-B

CP = 600

SP = 600 × 1.20 = 720

.9 × MP = 720

MP = 800

43-A

$47^{100}/100$

$= (-1+10)^{50}$

⇨   1-500=-499

⇨   -499+1000=501

⇨   1

44-B

for this take 100 as principal

R = 10 % and half yearly rate will be 5 %

5+5+0.25 = 10.25

45-A

Here, P = R 8000, R = 4%, Time = 2 years

Now, according to the formula,

Amount = $P\left(1 + \frac{R}{100}\right)^n$ = $8000\left(1 + \frac{4}{100}\right)^2$ = 8000 X $\frac{26}{25}$ X $\frac{26}{25}$ = R 8652.80

∴CI = R (8652.80 – 8000) = R 652.80

46-A

Let Abhay's speed be $x \text{ km/hr.}$

Then, $\frac{30}{x} - \frac{30}{2x} = 3$

$$\Rightarrow 6x = 30$$
$$\Rightarrow x = 5 \text{ km/hr.}$$

47-B

Let the distance traveled by x km.

Then, $\dfrac{x}{10} - \dfrac{x}{15} = 2$

$$\Rightarrow 3x - 2x = 60$$
$$\Rightarrow x = 60 \text{ km.}$$

Time taken to travel $60 \text{ km} at 10 \text{ km/hr} = \left(\dfrac{60}{10}\right) \text{hrs} = 6\text{hrs.}$

So, Robert started 6 hours before 2 P.M. i.e., at 8 A.M.

$\therefore$ Required speed $= \left(\dfrac{60}{5}\right) \text{kmph.} = 12\text{kmph.}$

48-D

Man's rate in still water $= (15 - 2.5)\text{km/hr} = 12.5 \text{ km/hr.}$

Man's rate against the current $= (12.5 - 2.5)\text{km/hr} = 10 \text{ km/hr.}$

49-B

A's 2 day's work $= \left(\dfrac{1}{20} \times 2\right) = \dfrac{1}{10}.$

(A+B+C) 's 1 day's work $= \left(\dfrac{1}{20} + \dfrac{1}{30} + \dfrac{1}{60}\right) = \dfrac{6}{60} = \dfrac{1}{10}.$

Work done in 3 days $= \left(\dfrac{1}{10} + \dfrac{1}{10}\right) = \dfrac{1}{5}.$

Now, $\dfrac{1}{5}$ work is done in 3 days.

\therefore Whole work will be done in (3×5) =15 days.

50-C

Let the capacity of each = 100 ml

So 300 ml removed and poured into second

First vessel = 200 ml alcohol

Second = 500 ml water+ 300 ml A

Ratio = 5:3

Proportion of alcohol = 3/8

If 300 ml removed from second = 300 x 5/8 = 187.5 ml water

= 112.5 ml alcohol

Now poured so vessel = 200 + 112.5 = 312.5 A

= 187.5 ml

Hence ratio = 5:3 proportion of water = 3/8

So A= B

51-A

Let max. Marks in each of these subjects be 100

so candidate scored aggregate of (60/100)* 300= 180 marks

Let marks scored be 4x, 5x & 6x

then 4x + 5x+6x = 180

x= 12

therefore marks scored by candidates are 48, 60 & 72

Hence candidates have scored more than 60% in 1 subject.

52-A

S.I. on Rs. (260-20) for a given time = Rs. 20.

S.I. on Rs. 240 for half the time = Rs. 10 .

T.D. on Rs. 250= Rs. 10.

\therefore T.D. on Rs. 260= Rs. $\left(\dfrac{10}{250} \times 260 \right) = Rs.10.40$

53-A

1. $78^{87}/100$
    ⇨ $(78^2*78^{85})/100 = (39^2*78^{85})/25$
    ⇨ $14*14*3^{85}/25$
    ⇨ $14*14*3^5/25$
    ⇨ $14*14*18/25 = 3528/25 = 3$
    ⇨ $3*4= 12$

54-C

$7^{4034}/100$

$7^2/100 = 49$

55-B

3^6*6^3

⇨ 3^9*2^3

⇨ $(9+1)(3+1)$

⇨ 40

56-C

Sum of the factors of 221=

221=> 221,1,13,17

Sum => 221+1=222+13+17= 252

57-A

$7^{400}*9^{300}$

⇨ $((7)^4)^{100}*((9)^2)^{150}$

⇨ $1^{100}*1^{150}=1$

58-B

The total number of ways he can do his selections from 8 identical tea-cups = 9 ways

(no selection – 1 way, 1 selection – 1 way, 2 selections – 1 way, ………, 8 selections – 1 way)

Similarly, the total number of ways he can do his selections from 7 identical coffee-mugs = 8 ways

(no selection – 1 way, 1 selection – 1 way, 2 selections – 1 way, ……… 7 selections – 1 way)

Also the number of ways he can do his selection from 5 distinct wine-glasses $= 2^5 \text{ways}$

So from the table the number of ways he could make his selection

$$= 9 \times 8 \times 2^5 \text{ ways } = 2304 \text{ ways.}$$

But not selecting any item is not permitted.

Hence, the number of ways he could make his selection of at least 1 item from the table $= 2304 - 1 \times 1 \times 5C_0 = 2304 - 1 = 2303$

59-D
LCM X HCF = 3192
56 X HCF = 3192
Therefore,
 HCF= 3192/56 = 57

60-B
Step 1: Calculate the number of students who did not qualify for the final examination due to lack of attendance.
12% of 75 students did not qualify, so:

(12/100) * 75 = 0.12 * 75 = 9 students

Step 2: Calculate the number of students who qualified to take the test.
Since 9 students did not qualify, the number of students who qualified is:

75 - 9 = 66 students

Step 3: Calculate the number of students who absented themselves from the exam.
9.09% of those who qualified absented themselves, so:

(9.09/100) * 66 = 0.0909 * 66 ≈ 6 students (rounded to the nearest whole number)

Step 4: Calculate the number of students who took the exam.
The number of students who took the exam is the total number who qualified minus those who absented themselves:

66 - 6 = 60 students

Step 5: Calculate the number of students who passed the examination.
Two-thirds of those who took the exam passed, so:

(2/3) * 60 = 40 students

Step 6: Calculate the number of students who secured a first class in the paper.
75% of those who passed secured a first class, so:

(75/100) * 40 = 0.75 * 40 = 30 students

Step 7: Calculate the number of students who passed but did not secure a first class.
This is the total number who passed minus those who secured a first class:

40 - 30 = 10 students

So, the answer is B] 10 students who passed the exam but did not secure a first class.

_____

PRACTICE TEST - 4

46-B

Diff = 1920 - 1280 = 640

CP lies b/w both SP's

$$CP = 1280 + \frac{640}{2} = 1600$$

New SP = 1600 × 1.25 = 2000

47-A

$$P\% = \left(\frac{diff}{SP}\right) \times 100$$

$$25 = \left(\frac{(20-x)}{x}\right) \times 100$$

$$x = 16$$

48-C

(1!+2!+3!+…..+4000!)/7

(1+2-1+3+1+6)/7 =5

49-C

A = 3000

T = 5 years

R = 10 %

Interest for 5 years at 10 % rate is equal to the 50 % of P and amount will be 150 % of P

3000 is 150 %

3000/150 X 100 = 2000

i.e 100 % is equal to the P which is 2000 Rs .

50-D

Amount after 4 years = 2480 Rs.

Amount after 8 years = 4080 Rs.

Difference = 1600

Because interest is S.I , so it is equal for every year

P = A – I

2480 – 1600 = 880

51-B

$$\frac{(1/2)x}{21} + \frac{(1/2)x}{24} = 10$$

$$\Rightarrow \frac{x}{21} + \frac{x}{24} = 20$$

$$\Rightarrow 15x = 168 \times 20$$

$$\Rightarrow x = \left(\frac{168 \times 20}{15}\right) = 224 \text{ km}.$$

52-D

Let the speed of two trains be $7x$ and $8x$ km/hr.

Then, $8x = \left(\frac{400}{4}\right) = 100$

$$\Rightarrow x = \left(\frac{100}{8}\right) = 12.5$$

$\therefore$ Speed of first train $= (7 \times 12.5)$km/hr $= 87.5$ km/hr.

53-A

Given: Speed of train is 116 km/h.

$\Rightarrow (116 \times \frac{5}{18}) = \frac{580}{18}$ m/s.

The distance covered in 18 Sec. = speed × time

$\Rightarrow \frac{580}{18} \times 18 = 580$ meter

54-A

Amount of work P can do in 1 day = 1/20

Amount of work Q can do in 1 day = 1/30

Amount of work R can do in 1 day = 1/60

P is working alone and every third day Q and R is helping him

Work completed in every three days = 2 × (1/20) + (1/20 + 1/30 + 1/60) = 1/5

So work completed in 15 days = 5 × 1/5 = 1

hence, the work will be done in 15 days

55-C

Part filled by (A+B) in 1 minute $= \left(\frac{1}{60} + \frac{1}{40}\right) = \frac{1}{24}$.

Suppose the tank is filled in x minutes.

Then, $\frac{x}{2}\left(\frac{1}{24} + \frac{1}{40}\right) = 1$

$\Rightarrow \frac{x}{2} \times \frac{1}{15} = 1$
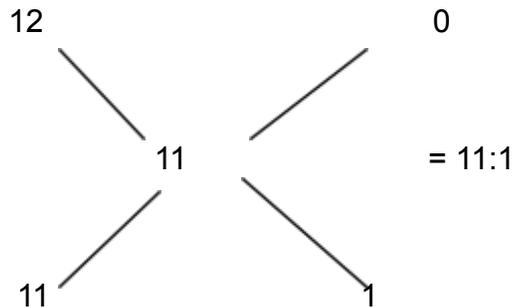
$\Rightarrow x = 30$ min

56-C

S.P = 13.75

P = 25 %

S.P = C.P x 125/100

13.75 = C.P x 125/100

C.P = 11 Rs.

12   0

\   /

11   = 11:1

/   \

11   1

W: S = 1:11

57-A

Types of Quadrilaterals - (Part 1) -

Parallelogram : A quadrilateral in which both pairs of opposite sides are parallel is called a parallelogram.
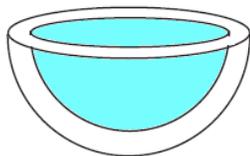
A summary of the properties of a parallelogram is:

Both pairs of opposite sides are parallel (AB || CD and AD || BC).

Both pairs of opposite sides are equal in length (AB = CD and AD = BC).

Both pairs of opposite angles are equal.

Both diagonals bisect each other (i.e. they cut each other in half).

58-A

Outer radius of the vessel, R = 14 cm.

Inner radius of the vessel, r = 10 cm.

Area of the outer surface $= (2\pi R^2)$ sq units
$$= (2\pi \times 14 \times 14) cm^2 = (392\pi) cm^2$$

Area of the inner surface $= (2\pi r^2)$ sq units
$$= (2\pi \times 10 \times 10) cm^2 = (200\pi) cm^2$$

Area of the ring at the top $= \pi (R^2 - r^2)) squnits$
$= \pi [(14)^2 - (10)^2] cm^2$
$= \pi (14 + 10)(14 - 10) cm^2 = (96\pi) cm^2$

Total area to be painted $= (392\pi + 200\pi + 96\pi) cm^2 = (688\pi) cm^2$

cost of painting $= Rs \left(688\pi \times \dfrac{35}{100} \right) = Rs \left(688 \times \dfrac{22}{7} \times \dfrac{35}{100} \right)$

cost of painting $= Rs \dfrac{3784}{5} = Rs\ 756.80$

59-A

$$\frac{4\pi R^2}{4\pi r^2} = \frac{25}{16} \Rightarrow \frac{R^2}{r^2} = \frac{25}{16} \Rightarrow \frac{R}{r} = \sqrt{\frac{25}{16}} = \frac{5}{4}$$

$$\Rightarrow \frac{R^3}{r^3} = \frac{5^3}{4^3} = \frac{125}{64} \Rightarrow \frac{\frac{4}{3}\pi R^3}{\frac{4}{3}\pi r^3} = \frac{125}{64}$$

60-A
A:B = 3:2 = 9:6
B : C = 3 : 2 = 6 : 4 (making B equal)
So, A : B : C = 9 : 6 : 4
the runs made by A = (9/19) * 342 = 162

61-C

$$\text{Sum} = \frac{\text{S.I.} \ x \ \text{T.D.}}{(\text{S.I.}) - (\text{T.D.})} = \frac{85 \times 80}{(85 - 80)} = Rs.\ 1360$$

62-C
Given word: ASSASINATION

Total no. of letters in the word = 13

Viz., 3 A's, 4 S's, 2 I's, 1 T & 1 O

No. of ways in which these letters can be arranged –

n(S) = 13! / 3! 4! 2! 2!

No two A's are coming together,

Then the word becomes-

S	S	S	S	I	N	T	I	O	N

No. of ways of arranging except A = 10! / 4! 2! 2!Now,

There are 11 vacant places

Total no. of A's in ASSASINATION = 3

Thus, the 3 A's can be placed in $^{11}C_3$ ways

= 11! / 3! (11 – 3)!

= 11! / 3! 8!

No. of ways when 2 A's are not together

= 11! / 3! 8! x 10! / 4! 2! 2! x 3! 4! 2! 2!/ 13!

= 11! X 10 x 9 x 8! / 8! x 13 x 12 x 11!

= 10 x 9 / 13 x 12

= 15 / 26

63-A
Given: we have integers 1, 2, …….. , 1000

No. of outcomes, n(S) = 1000

No. of the integers that are multiples of 2 –

2, 4, 6, 8, …… , 1000.

Let us consider 'p' as the no. of integers,

Now, $a_p = a + (p - 1)d$

On substituting the values, we get,

$2 + (p - 1)2 = 1000$

$2 + 2p - 2 = 1000$

Thus, $p = 1000/2$

Thus, $p = 500$

Thus, no. of the integers that are multiples of 2 = 500

No. of the integers that are multiples of 9 –

9, 18, 27, 35, …… , 999.

Let us consider 'n' as the no. of integers,

Now, $a_n = a + (n - 1)d$

On substituting the values, we get,

$9 + (n - 1)9 = 999$

$9 + 9n - 9 = 999$

Thus, $n = 999/9$

Thus, $n = 111$

Thus, no. of the integers that are multiples of 9 = 111

Now, let m be the no. of multiples common for both 2 & 9, viz. 18, 36, ……., 990.

Thus, the mth term will be 990

Now, $a_m = a + (m - 1)d$

We know that, $a = 2$ & $d = 9$

Substituting the respective values, we get,

18 + (m – 1)18 = 990

18 + 18m – 18 = 990

Thus, m = 990/18

Thus, m = 55

Now, the no. of multiples of 2 or 9 will be,

No. of multiples of 2 + no. of multiples of 9 – No. of multiples of both 2 & 9

= 500 + 111 – 55

= 556

= n(E)

Required probability = No. of favorable outcomes/ Total no. of outcomes

= n(E) / n(S)

= 556 / 1000

= 0.556

64-B
$7^{8400000}/342$
($P^n/p-1=1$ remainder)
$1^{2800000}/342=1$

65-C
n! end with 24 zeros
when n= 100, 101, 102,103,104

66-B
698547^{698543}
$7^3=343=3$

_____

PRACTICE TEST - 5

41-A

CP = 100   SP = 105

New CP = 95   New SP = 104.5

Difference = .5%

Then 0.5% = 1

CP 100% = 200

42-A

Let CP = 100   SP = 420

New CP = 125

Then Profit% at SP = $\left(\dfrac{295}{420}\right) \times 100 = 70\,\%$ (approx)

43-A

The product of 10 even number must be multiple of 10 multiple of 2
hence divisible by 2^{10}

44-A

let p = 100 then rate
C.I = P [1+ R/100] ^{T} – P

72.8 = 100 [1 + R/100]^3 – 100

If a sum of is getting 4 times then the sum gets 300 % interest So , P to 4P = 20 x X =
300
X = 15 years

45-A

Difference between S.I and C.I = 25.60 Rs.

Because B is calculated A at same rate at which A is calculated On P

i.e 8%

so B is 8 % of A , then A

= (25.60/8) x 100 = 320

And A is 8 % of p then P = 320 / 8 = 4000 Rs.

46-D

Speed =2 m/sec.

Converting m/sec to km/hr= $2 \times \dfrac{18}{5}$ = 7.2 km/hr.

47-D

Distance = (240 x 5) = 1200 km.

Speed = 1200/(5/3) km/hr.

$$\therefore \qquad \text{Requied Speeed} = 1200 \times \frac{18}{5} = 720 km/hr$$

48-A

Let the speed of boat in still water be a km/hour and speed of water be b km/hour.

As per first given condition:

$\Rightarrow \frac{4}{(a-b)} + \frac{4}{(a+b)} = 1$

Let $\frac{1}{(a-b)} = x$ and $\frac{1}{(a+b)} = y$

$\Rightarrow 4x + 4y = 1$

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

As per second given condition:

$\Rightarrow \frac{3}{(a-b)} + \frac{5}{(a+b)} = \frac{55}{60}$

$\Rightarrow 3x + 5y = \frac{11}{12}$

By putting the value of y from equation (1) we get:

$\Rightarrow 3x + 5(\frac{1}{4} - x) = \frac{11}{12}$

$\Rightarrow 2x = \frac{5}{4} - \frac{11}{12}$

$\Rightarrow x = \frac{1}{6} \Rightarrow (a-b) = 6$ ------(2)

By putting the value of x in equation (1)

$\Rightarrow y = \frac{1}{4} - \frac{1}{6}$

$\Rightarrow y = \frac{1}{12} \Rightarrow (a+b) = 12$ ------(3)

From equation 2 and 3,

$\Rightarrow 2a = 18 \Rightarrow a = 9$

So, the speed of boat in still water is 9.

49-A

work done by A in 1 day = 1/ 18

Number of days A work = 2+4= 6 therefore, total work done by A =6x1/18 = 1/3

The remaining 2/3 work is done by B in 4 days and hence complete work done by B will be

4x(3/2) = 6 days.

50-B

H: W   H: W

1: 3   3: 1

2 gallon   3 gallon

1/2, 3/2   9/4, 3/4

Ratio = ½ + 9/4: 3/2 + ¾

11/4: 9/4

11:9

51-B

We have ∠ A = ∠ C = 60° (opposite angle of parallelogram are equal)

Let, ∠ CDB = x

In triangle CDB we have

CD = BC (side of rhombus are equal)

So, ∠ CDB = ∠ DBC = x

therefore, ∠ CDB + ∠ DBC + 60° = 180°

2x = 120°

x = 60°

∠ CDB = 60°

52-D

Let salaries be 4x & 7x
So, (4x + 25)/(7x + 25) = 3/5
= > x = 50
4*50 : 7*50
200 :350
4 : 7

53-D

$$P.W. = Rs. (1760-160) = Rs. 1600. \therefore S.I. on Rs. 1600 \, at \, 12\% \, is \, Rs. 160. \therefore$$
$$Time = \left(\frac{100 \times 160}{1600 \times 12}\right) = \frac{5}{6} \, \text{years} = \left(\frac{5}{6} \times 12\right) \, \text{months} = 10 \, \text{months}.$$

54-C

$$P(\text{Sum }6) = \frac{5}{36}$$
$(1,5), (5,1), (2,4), (4,2), (3,3)$
$$P(\text{Sum }7) = \frac{6}{36} = \frac{1}{6}$$
$(1,6), (6,1), (2,5), (5,2), (3,4), (4,3)$

If A represents total of 6 for A, A' represents total which is other than 6, B represents total of 7 for B, and B' represents when it is not 7

A wins when A, $A'B'A$, $A'B'A'B'A$, ...

$$\therefore P(\text{A wins}) = \frac{5}{36} + \frac{31}{36} \times \frac{5}{6} \times \frac{5}{36} + \frac{31}{36} \times \frac{5}{6} \times \frac{31}{36} \times \frac{5}{6} \times \frac{5}{36} + \ldots$$
$$= \frac{\frac{5}{36}}{1 - \frac{31}{36} \times \frac{5}{6}} = \frac{30}{61}$$

55-B
97-7=90, 65-5=60
HCF of 90 and 60= 30

56-D
HCF of (37-23), (79-37), (79-23)
HCF of 14,42 and 56= 14

57-A
4 223
       5 55 3
       6 11 0
         1 5

       Remainder= 5

58-D
$5^6 - 5^2$

⇨   ---00-25
⇨   ---00
⇨   Divisible by 100

59-B

Value and Zero of a Polynomial -

If p(x) is a polynomial in x, and if k is any real number, then the value obtained by replacing x by k in p(x), is called the value of p(x) at x = k, and is denoted by p(k).

So, If p(x) is a polynomial in the form of : $a_0 + a_1x + a_2x^2 + a_3x^3 + \ldots + a_nx^n$ with $a_n \neq 0$, then value of the polynomial p(x) for a real value at x=k will be given by $p(k) = a_0 + a_1 \times (k) + a_2 \times (k)^2 + a_3 \times (k)^3 + \ldots\ldots + a_n \times (k)^n$.

For example, consider the polynomial p(x) = x^2 – 3x – 4. Then the value of p(2) will be -6. (How?)

Value is obtained by replacing x by 2 in the expression x^2 – 3x – 4,

Another example:

$$\text{Let } p(x) = 2x^2 - 3x + 5. \text{ Then,}$$
$$p(2) = \{2 \times 2^2 - 3 \times 2 + 5\} = (8 - 6 + 5) = 7$$
$$p(-1) = \{2 \times (-1)^2 - 3 \times (-1) + 5\} = (2 + 3 + 5) = 10$$

-

$$p(2) = 2 \times 2 - 2 \times 2 - 3 = -3$$

60-D

LCM of 8,11,24=264

      Number= 264*a+5

      A=37+1=38

      Number= 264*38+5=10037

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