

RRB

Railway Recruitment Board

Junior Engineer

CBT 1: 2026

Computer Based Test - Stage 1

- **Mathematics**
- **General Intelligence & Reasoning**

Comprehensive Theory with
Solved Examples, Practice Sets & Previous Years Questions





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RRB-Junior Engineer : Mathematics and General Intelligence & Reasoning

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Preface

Railway Recruitment Board-Junior Engineer has always been preferred by Engineers due to job stability. Indian Railways is one of the biggest Government employers in India. With the exam being just a few months away, it is time for the candidates planning to appear for the exam to pull up their socks and start their RRB-JE preparation.

The RRB-JE exam is conducted in two stages as shown in table given below.



Papers	Subject	Maximum Marks	Duration
CBT-1 : Objective type	(i) Mathematics	30 Marks	90 Minutes
	(ii) General Intelligence and Reasoning	25 Marks	
	(iii) General Awareness	15 Marks	
	(iv) General Science	30 Marks	
	Total	100 Marks	
CBT-2 : Objective Type	(i) General Awareness	15 Marks	120 Minutes
	(ii) Physics and Chemistry	15 Marks	
	(iii) Basics of Computers and Applications	10 Marks	
	(iv) Basics of Environment and Pollution Control	10 Marks	
	(v) Technical Abilities (viz, CE, ME, EE, EC, CS etc)	100 Marks	
	Total	150 Marks	
Note: There shall be negative marking for incorrect answers in CBTs. Each question carries 1 mark and 1/3rd of the marks allotted for each question shall be deducted for each wrong answer. Candidates shortlisted in Stage 1 are called for Stage 2.			

MADE EASY has taken due care to provide complete solution with accuracy. Apart from Railway Recruitment Board-Junior Engineer, this book is also useful for Public Sector Examinations and other competitive examinations for engineering graduates.

I have true desire to serve student community by providing good source of study and quality guidance. I hope this book will prove as an important tool to succeed in RRB-JE and other competitive exams. Any suggestion from the readers for improvement of this book is most welcome.

With Best Wishes

B. Singh (Ex. IES)

CMD, MADE EASY

Exam Syllabus

(Computer Based Test-First Stage)

Mathematics: Number systems, BODMAS, Decimals, Fractions, LCM and HCF, Ratio and Proportion, Percentages, Mensuration, Time and Work, Time and Distance, Simple and Compound Interest, Profit and Loss, Algebra, Geometry, Trigonometry, Elementary Statistics, Square Root, Age Calculations, Calendar & Clock, Pipes & Cistern.

General Intelligence and Reasoning: Analogies, Alphabetical and Number Series, Coding and Decoding, Mathematical operations, Relationships, Syllogism, Jumbling, Venn Diagram, Data Interpretation and Sufficiency, Conclusions and Decision Making, Similarities and Differences, Analytical reasoning, Classification, Directions, Statement – Arguments and Assumptions etc.

General Awareness: Knowledge of Current affairs, Indian geography, culture and history of India including freedom struggle, Indian Polity and constitution, Indian Economy, Environmental issues concerning India and the World, Sports, General scientific and technological developments etc.

General Science: Physics, Chemistry and Life Sciences (up to 10th Standard CBSE syllabus).



Contents

RRB-JE CBT-1

Section-A

Mathematics 1-246

1. Number Systems	1
2. BODMAS.....	17
3. Decimals.....	20
4. Fractions.....	23
5. LCM and HCF	28
6. Ratio and Proportion	34
7. Percentages.....	55
8. Mensuration.....	71
9. Time and Work.....	91
10. Time and Distance	102
11. Simple and Compound Interest	121
12. Profit and Loss	132
13. Algebra	144
14. Geometry	149
15. Trigonometry.....	165
16. Elementary Statistics.....	168
17. Square Root.....	172
18. Age Calculations.....	175
19. Calendar and Clock	179
20. Pipes and Cisterns.....	185
21. Miscellaneous.....	190

Section-B

General Intelligence & Reasoning... 247-398

1. Analogies	247
2. Alphabetical and Number Series.....	251
3. Coding and Decoding.....	256
4. Mathematical Operations	261
5. Relationships	265
6. Syllogism.....	275
7. Jumbling	286
8. Venn Diagram.....	290
9. Data Interpretation and Sufficiency.....	295
10. Conclusions and Decision Making.....	331
11. Similarities and Differences.....	340
12. Analytical Reasoning	342
13. Classification	348
14. Directions.....	352
15. Statement-Arguments and Assumptions	359
16. Miscellaneous.....	364

Section-C

Previous Solved Papers399-552

1. RRB-JE Solved Paper (27-08-2015)	399	13. RRB-JE Solved Paper (16-12-2024), Shift-3	489
2. RRB-JE Solved Paper (28-08-2015)	405	14. RRB-JE Solved Paper (17-12-2024), Shift-1	498
3. RRB-JE Solved Paper (24-05-2019), Shift-1	411	15. RRB-JE Solved Paper (17-12-2024), Shift-2	507
4. RRB-JE Solved Paper (24-05-2019), Shift-2	419	16. RRB-JE Solved Paper (17-12-2024), Shift-3	516
5. RRB-JE Solved Paper (24-05-2019), Shift-3	426	17. RRB-JE Solved Paper (18-12-2024), Shift-1	526
6. RRB-JE Solved Paper (25-05-2019), Shift-1	433	18. RRB-JE Solved Paper (18-12-2024), Shift-2	535
7. RRB-JE Solved Paper (26-05-2019), Shift-1	441	19. RRB-JE Solved Paper (18-12-2024), Shift-3	544
8. RRB-JE Solved Paper (26-05-2019), Shift-2	449	20. RRB-JE Solved Paper (19-02-2026), Shift-1	553
9. RRB-JE Solved Paper (26-05-2019), Shift-3	457	21. RRB-JE Solved Paper (19-02-2026), Shift-2	562
10. RRB-JE Solved Paper (28-05-2019), Shift-1	464	22. RRB-JE Solved Paper (19-02-2026), Shift-3	571
11. RRB-JE Solved Paper (16-012-2024), Shift-1	471	23. RRB-JE Solved Paper (20-02-2026), Shift-1	580
12. RRB-JE Solved Paper (16-012-2024), Shift-2	480	24. RRB-JE Solved Paper (20-02-2026), Shift-2	589
		25. RRB-JE Solved Paper (20-02-2026), Shift-3	598
		26. RRB-JE Solved Paper (25-02-2026), Shift-3	607



Number Systems

CHAPTER

1



Learning Objectives

After completion of this chapter, you should have a thorough understanding of the following:

- Digits and Numbers
- Arithmetical Operations
- Index form
- Arithmetic Progression
- Geometric Progression
- Important formulae
- Kinds of questions which are asked in RRB-JE
- Methods of solving.



Introduction to the topic

With respect to preparation for the RRB-JE Examination, Number System has been seen to be one of the important topics in the Mathematics part of CBT-1 with a total of 3 questions in the last conducted exam. This chapter will give you a clear understanding of the definitions and the concepts, and help you develop a keen insight about different kinds of Number System questions asked in the RRB-JE.

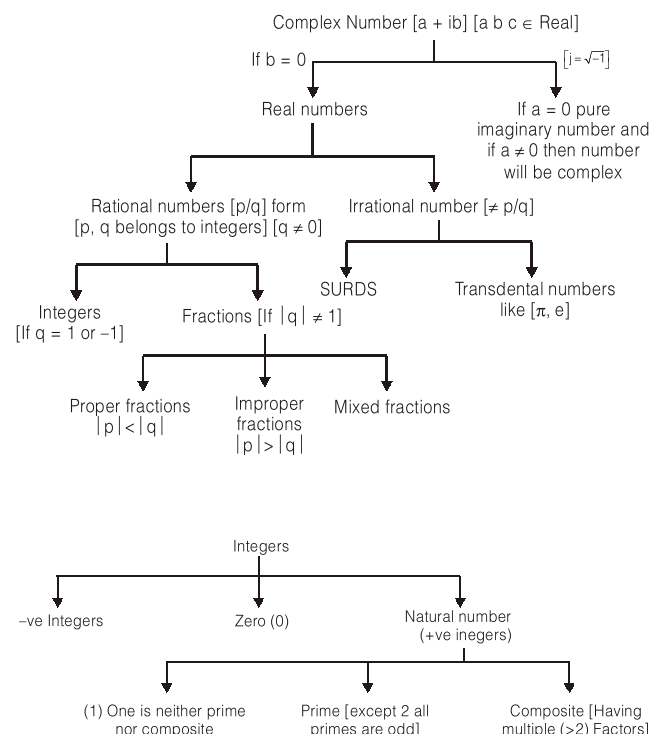


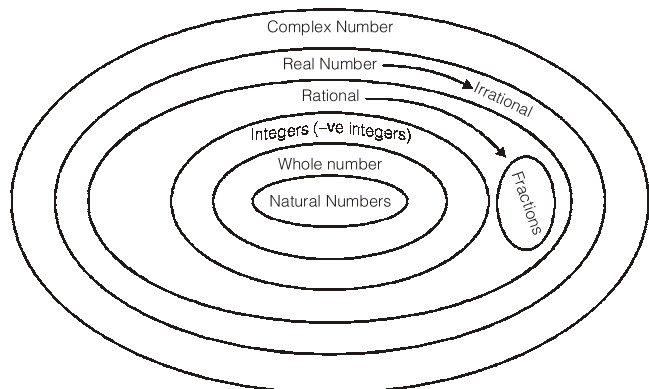
Type of Questions

Question asked from this topic are based on concepts: Digits and Numbers, Arithmetical Operations, Index form, Arithmetic Progression, Geometric Progression.

In Quantitative Aptitude (QA), Number System is one of the module which is of critical importance. We can consider this module as the back bone as well as basic foundation and building block for QA as well as for reasoning. Applications of concepts of numbers can be easily found in puzzles, reasoning based questions, number series and many more reasoning areas. This is why it is our suggestion to students to understand the concepts discussed in the module thoroughly alongwith understanding of applications.

1. Classifications of Numbers





Our main focus in this module of numbers is on **real number system**. However in context, of imaginary number only following property is important.

Imaginary Numbers

$$i = \sqrt{-1} \Rightarrow i^{4K+1} \equiv \sqrt{-1} \equiv i$$

$$i^2 = -1 \Rightarrow i^{4K+2} \equiv -1 \equiv i^2$$

$$i^3 = -i \Rightarrow i^{4K+3} \equiv -i \equiv i^3$$

$$i^4 = 1 \Rightarrow i^{4K} \equiv 1 \equiv i^4$$

Question: What is the value of expression

$$\frac{i^{12} + i^{13} + i^{14} + i^{15}}{i^{18} + i^{19} + i^{20} + i^{21}} ?$$

- (a) i^2 (b) -1
(c) $1/i^2$ (d) None of these

Ans. (d)

Solution:

$$\frac{i^{12}(1+i+i^2+i^3)}{i^{18}(1+i+i^2+i^3)}$$

If we commit a mistake of cancelling out common terms in numerator and denominator options a, b, c all one correct hence my answer should be (d) but

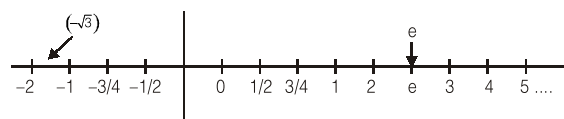
$$\begin{aligned} \text{expression } 1 + i + i^2 + i^3 \\ = 1 + i + (-1) + (-i) = 0 \end{aligned}$$

hence expression in question leading to undetermined

form $\left[\frac{0}{0}\right]$ hence correct answer is option (d).

Real Number System

Entire real numbers group of rational and irrational numbers combined forms the set of real number, which is represented by symbol $\rightarrow R$. All real numbers can be represented as points on a real number line.



Rational Number

All the numbers in p/q ($q \neq 0$) form are rational numbers [p, q are integers] set of rational number is represented by $\rightarrow Q$.

Rational Numbers Follow

Following forms of representations.

(a) Terminating decimal forms

for example 0.125

$$\Rightarrow 0.125 = \frac{125}{1000} = \Rightarrow \text{Rational}$$

(b) Nonterminating but recurring decimal forms.

(i) For example

$$Q = 0.37373737 \dots$$

$$100Q = 37.373737 \dots$$

$$99Q = 37 \Rightarrow Q = 37/99 \Rightarrow \text{rational}$$

(ii) For example

$$Q = 0.37292929 \dots$$

$$100Q = 37.292929 \dots$$

$$10000Q = 3729.292929 \dots$$

$$9900Q = (3729 - 37)$$

$$Q = \left(\frac{3729 - 37}{9900} \right)$$

$$= \frac{p}{q} \text{ form} \Rightarrow \text{rational}$$

Fraction

All rational numbers in which $|q| \neq 1$ comprise the set of fractions.

Proper Fractions

If $|p| < |q|$

then fraction is proper fraction. Value of proper fraction is always in between $(-1 \text{ to } +1)$

$$[-1 < p/q < 1]$$

Improper Fraction

If $|p| > |q|$

then fraction is improper fraction value of improper fraction is < -1 or more than $(>) 1$

Mixed Fraction

Just a modified form if improper fraction.

$$\text{Eg. } \underbrace{\frac{13}{4}}_{\text{Improper fraction}} \Rightarrow \underbrace{3\frac{1}{4}}_{\text{equivalent mixed fraction}}$$

2. Integers

The set of all rational numbers in p/q form [$|q| = 1$] is called as integers. It is denoted by

$$I = \{ \dots -3, -2, -1, 0, 1, 2, 3, \dots \}$$

It includes.

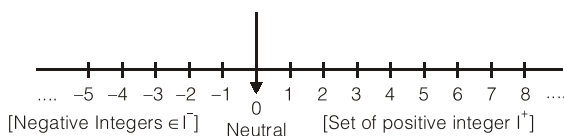
Negative Integers

$$I^- = \{ \dots -7, -6, -5, -4, -3, -2, -1 \}$$

Positive Integers

$$I^+ = \{ 1, 2, 3, \dots \}$$

Note: Status of 0 (zero) is neutral neither positive nor negative.



Natural Numbers

All counting numbers or set of positive integers is considered as set of natural numbers. It denoted by set $[N \text{ or } I^+]$

$$N = \{ 1, 2, 3, 4, \dots \}$$

Whole Number

Set of all nonnegative integers are considered as whole number; it is denoted by set $W = \{ 0, 1, 2, 3, 4, \dots \}$

Note: If terms “numbers” is used without any qualifier than it means natural number hence forth.

3. Even Numbers & Odd Numbers

1. Even Numbers

All numbers divisible by 2 considered as even numbers.

Note: Property evenness is applicable in entire integral number line. Hence $[-2, -4, -6, \dots]$ are even integers but they are not even numbers.

2. Odd Number

All numbers not divisible by 2 one odd.

$[1, 3, 5, 7, \dots]$ are odd numbers.

$[\dots -5, -3, -1 \dots]$ are odd integers.

Properties of numbers based on even & odd

$$\text{Even} + \text{Even} = \text{Even}$$

$$\text{Odd} + \text{Odd} = \text{Even}$$

$$\text{Odd} + \text{Odd} + \text{Odd} = \text{Odd}$$

$$\text{Odd} \times \text{Odd} = \text{Odd}$$

$$\text{Odd} \times \text{Even} = \text{Even}$$

$$\text{Even} \times \text{Even} = \text{Even}$$

$$(\text{Even})^{\text{Odd}} \Rightarrow \text{Even}$$

$$(\text{Odd})^{\text{Even}} \Rightarrow \text{Odd}$$

$$(\text{Even})^{\text{Odd}} \Rightarrow \text{Even}$$

$$(\text{Odd})^{\text{Odd}} \Rightarrow \text{Odd}$$

These properties can be used extensively to find out alternative method to get answers quickly with the help of options. Here are few examples.

Ex.1 There are two, 2-digit numbers ab and cd , ba is the another two digit number prepared by reversing the digits of ab , if $ab \times cd = 493$, $ba \times cd = 2059$, what is value 'g' sum of $(ab + cd) = ?$

$$(a) \ 43$$

$$(b) \ 45$$

$$(c) \ 47$$

$$(d) \ 46$$

Sol. (d)

Value 'g' = $ab \times cd$ is odd.

It means ab and cd both are odd.

Hence there sum must be even, only one option is there which even. Hence answer is option d.

Ex.2 I have multiple gift vouchers of value, Rs. 101, 107, 111, 121, 131, 141, 151, 171. I have to pick exactly 10 vouchers to make payment of Rs. 1121. In how many ways I can do that?

$$(a) \ \text{one}$$

$$(b) \ \text{two}$$

$$(c) \ \text{more than two}$$

$$(d) \ \text{none of these}$$

Sol. (d)

Reasoning is very simple, if I'll add 10, odd numbers their sum will be always even. Hence there is not way to accomplish this.

4. Prime Number & Composite Numbers

Prime Numbers

Number which are perfectly divisible either by 1 or by itself only are called prime number. Then 25 prime number are there which are less than 100. 2 is the only even prime number. # All prime numbers greater than 5 can be expressed as $(6K \pm 1)$ ($K \in N$) form but all the numbers in form of $(6K \pm 1)$ form are not necessarily prime.

Composite Numbers

All the numbers which can be factorized into multiple prime numbers are called composite number.

P.S. Number (1) one is neither prime nor composite.

How to check whether given number is prime or not?

1. Take the square root of number
2. Consider the prime numbers, starting from 2 to till number. Take all prime numbers upto this square root value or nearest higher integer.
3. If number is divisible by any of these prime numbers. Then number is composite.

Learn it by example:

Suppose I want to check, is 629 prime or not?

Square root of 627 is just more than 25. Then prime no. till 25 are 2, 3, 7, 5, 11, 13, 17, 19, 23, 29.

629 is not divisible by 2, 3, 5, 7, 11, 13 but is divisible by 17.

Hence it is not prime number

One more example: 179

Square root of 179 is more than 13. Hence I need to check divisibility of 179 against 2, 3, 5, 7, 11, 13, 17

179 is not divisible by either of these hence it is a prime number.

5. Test of Divisibility

1. Divisibility by 2

A number is divisible by 2 if the unit digit is zero or divisible by 2.

Eg.: 22, 42, 84, 3872 etc.

2. Divisibility by 3

A number is divisible by 3 if the sum of digit in the number is divisible by 3.

Eg.: 2553

Here $2 + 5 + 5 + 3 = 15$, which is divisible by 3 hence 2553 is divisible by 3.

3. Divisibility by 4

A number is divisible by 4 if its last two digit is divisible by 4.

Eg.: 2652, here 52 is divisible by 4 so 2652 is divisible by 4.

Eg.: 3772, 584, 904 etc.

4. Divisibility by 5

A number is divisible by 5 if the units digit in number is 0 or 5.

Eg.: 50, 505, 405 etc.

5. Divisibility by 6

A number is divisible by 6 if the number is even and sum of digits is divisible by 3.

Eg.: 4536 is an even number also sum of digit $4 + 5 + 3 + 6 = 18$ is divisible by 3.

Eg: 72, 8448, 3972 etc.

6. Divisibility by 8

A number is divisible by 8 if last three digit of it is divisible by 8.

Eg.: 47472 here 472 is divisible by 8 hence this number 47472 is divisible by 8.

7. Divisibility by 9

A number is divisible by 9 if the sum of its digit is divisible by 9.

Eg.: 108936 here $1+0+8+9+3+6$ is 27 which is divisible by 9 and hence 108936 is divisible by 9.

8. Divisibility by 10

A number is divisible by 10 if its unit digit is 0.

Eg.: 90, 900, 740, 34920 etc.

9. Divisibility by 11

A number is divisible by 11 if the difference of sum of digit at odd places and sum of digit at even places is either 0 or divisible by 11.

Eg.: 1331, the sum of digit at odd place is $1+3$ and sum of digit at even places is $3+1$ and their difference is $4 - 4 = 0$. so 1331 is divisible by 11.

6. Factors of Composite Number

Composite numbers are the numbers which can be factorised into prime factors, or simply we can say that composite number are those numbers which are not prime.

For eg.: 8 is a composite number since it can be factorised into

$$8 = 2 \times 2 \times 2$$

Similarly 9 is also a composite number, i.e.

$$9 = 3 \times 3$$

Composite number $= P_1^{\lambda_1} \times P_2^{\lambda_2} \times P_3^{\lambda_3} \dots P_n^{\lambda_n}$ here, $P_1, P_2,$

$P_3 \dots P_n$ are distinct prime numbers and $\lambda_1, \lambda_2,$

$\dots \lambda_n$ are their respective powers.

Factors of composite number =

$$(\lambda_1 + 1) \cdot (\lambda_2 + 1) \dots (\lambda_n + 1)$$

For eg.: $18 = 2 \times 3 \times 3 = 2^1 \times 3^2$

Factors of $18 = (1 + 1) \times (2 + 1) = 2 \times 3 = 6$

Clearly it contains six factors 1, 2, 3, 6, 9 and 18

Factors of other Composite numbers $6 = 2^1 \times 3^1$

Factors = $(1 + 1) \times (1 + 1) = 4 = 1, 2, 3$ and 6

$$72 = 2 \times 2 \times 2 \times 3 \times 3 = 2^3 \times 3^2$$

Factors = $(3 + 1) \times (2 + 1) = 12$

Ex.3 Find the factors of composite number 360

Sol. $360 = 2 \times 2 \times 2 \times 3 \times 3 \times 5$
 $= 2^3 \times 3^2 \times 5^1$

Factors = $(3 + 1) (2 + 1) (1 + 1) = 24$.

7. Counting Number of Trailing Zeros

Sometimes we come across problems in which we have to count number of zeros at the end of factorial of any number. For example

Number of zero at the end of $10!$

$$10! = 10 \times 9 \times 8 \times 7 \times 6 \times 5 \times 4 \times 3 \times 2 \times 1$$

Here basically we have to count number of fives, because multiplication of five by any even number will result in 0 at the end of final product. In $10!$ we have 2 fives thus total number of zeros are 2.

Short Cut:

Counting number of zeros at the end of $n!$

Value will be $\frac{n}{5} + \frac{n}{5^2} + \frac{n}{5^3} + \frac{n}{5^4} \dots$

The integral value of this sum will be the total number of zeros.

Ex. 4 Number of zeros at the end of $100!$

Sol. $\frac{100}{5} + \frac{100}{5^2} + \frac{100}{5^3} +$

integral value will be

$$20 + 4 = 24 \text{ zeros}$$

Ex.5 Number of zeros at the end of $126!$

Sol. $\frac{126}{5} + \frac{126}{5^2} + \frac{126}{5^3} + \frac{126}{5^4}$

integral value will be

$$25 + 5 + 1 = 31 \text{ zeros.}$$

8. Cyclicity

Cyclicity of a number is used mainly for the calculation of unit digits.

1. Cyclicity of 1.

In 1^n , unit digit will always be 1.

2. Cyclicity of 2.

$$2^1 = 2$$

$$2^2 = 4$$

$$2^3 = 8$$

$$2^4 = 16$$

$$2^5 = 32$$

$$2^6 = 64$$

$$2^7 = 128$$

$$2^8 = 256$$

After every four intervals it repeats so cycle of 2 is 2, 4, 8, 6.

Ex.6 Unit digit of 2^{323}

Sol. Here 2, 4, 8, 6 will repeat after every four interval till 320 next digit will be 2, 4, 8. So unit digit of 2^{323} will be 8.

Ex.7 Find unit digit of $12^{12} \times 22^{22}$

Sol. Unit digit of 12^{12} will be 6 and 22^{22} will be 4. So unit digit of $12^{12} \times 22^{22}$ will be

$$6 \times 4 = 24 \text{ ; } \text{4 Ans.}$$

3. Cyclicity of 3.

$$3^1 = 3$$

$$3^2 = 9$$

$$3^3 = 27$$

$$3^4 = 81$$

$$3^5 = 243$$

$$3^6 = 729$$

$$3^7 = 2187$$

$$3^8 = 6561$$

After every four intervals 3, 9, 7 and 1 are repeated. So cycle of 3 is 3, 9, 7, 1.

Ex.8 Find unit digit of 133^{133} .

Sol. Cycle of 3 is 3, 9, 7, 1 which repeats after every four intervals till 133^{132} . So next unit digit will be 3.

4. Cyclicity of 4.

$$4^1 = 4$$

$$4^2 = 16$$

$$4^3 = 64$$

$$4^4 = 256$$

Cycle is 4, 6, i.e.

Unit digit of 4^n depends on value of n .

If n is odd unit digit is 4 and if n is even digit is 6.

Sol. (b)

It is given that LCM = 12 times HCF

also LCM + HCF = 403

So, $13 \text{ HCF} = 403 \Rightarrow \text{HCF} = 31$

LCM = 372 also we know that HCF

 $\text{HCF} \times \text{LCM} = \text{Number}(1) \times \text{Number}(2)$ $31 \times 372 = 93 \times N_2 \therefore N_2 = 124$ **Q.21** I have to spend $\frac{1}{10}$ of my income on house rent, $\frac{1}{10}$ of remainder on conveyance $\frac{1}{3}$ of further remainder on children's education after which I have Rs. 648 left over. What is my income?

(a) Rs. 1200

(b) Rs. 1400

(c) Rs. 1700

(d) None of these

Sol. (a)

One alternate method

Let I have x rupeesAfter spending $\frac{1}{10}$ of it on house rent I have $\frac{9x}{10}$. Now out of $\frac{9x}{10}$ I spent $\frac{1}{10}$ of it i.e., $\frac{9}{100}x$ on conveyance so remainder will be

$$\frac{9}{10}x - \frac{9}{100}x = \frac{81x}{100}$$

Further I spent $\frac{1}{3}$ of $\frac{81x}{100}$ i.e. $\frac{27x}{100}$ into childreneducation now I have $\frac{54x}{100}$,

$$\text{So, } \frac{54x}{100} = 648, x = 1200$$

Q.22 A man had two sons. To the elder he gave $\frac{5}{11}$ ofhis property, to the younger $\frac{5}{11}$ of remainder, the rest to the widow. Find the Share of the sons if the widow gets Rs. 3600.

(a) Rs. 1200, 1000

(b) Rs. 6000, 2000

(c) Rs. 7500, 1000

(d) None of these

Sol. (d)

Younger son gets

$$3600 \times \left(\frac{1}{1 - \frac{5}{11}} \right) \times \frac{5}{11} = \text{Rs. 3000}$$

Elder son gets

$$3000 \times \left(\frac{1}{1 - \frac{5}{11}} \right) = \text{Rs. 5500}$$

Previous RRB-JE Questions**Q.1** If a number is divisible by 899, the remainder will be 63. If same number is divisible by 29, the remainder will be

(a) 10

(b) 5

(c) 4

(d) 2

[RRB (JE) 2014]**Sol. (b)**Let quotient be x .

$$\therefore \text{Number} = 899x + 63 = 29(31x + 2) + 5$$

 $\therefore$ It is clear that if number is divided by 29, the remainder will be 5.**Q.2** Unit's place digit in $962 \times 357 \times 133$ is

(a) 2

(b) 3

(c) 7

(d) 0

[RRB (JE) 2014]**Sol. (a)**Unit's place digit in $962 \times 357 \times 133$ $=$ Unit's place digit in $2 \times 7 \times 3$ $=$ Unit's place digit in 14×3 $=$ Unit's place digit in 4×3 $=$ Unit's place digit in $12 = 2$ **Q.3** What is the sum of the first 17 terms of an arithmetic progression if the first term is -20 and last term is 28 ?

(a) 68

(b) 156

(c) 142

(d) 242

[RRB (JE) 2015]**Sol. (a)**Here, first term $= -20$ and last term $= 28, n = 17$

$$\therefore \text{Required sum} = n \frac{(\text{First term} + \text{last term})}{2}$$

$$= \frac{17}{2} (-20 + 28) = 68$$

Q.4 By adding the same constant to each of $31, 7, -1$ a geometric progression results. The common ratio is

(a) 13

(b) $2\frac{1}{3}$ (c) -12

(d) None of these

[RRB (JE) 2015]

Sol. (d)

A sequence is said to be in GP if the ratio of a term to its preceding term is constant. In 31, 7, -1. If we add 5, by hit and trial method, the sequence formed is 36, 12, 4 which is in GP

$$\text{Common ratio} = \frac{123}{36} = \frac{4}{12} = \frac{1}{3}$$

Q.5 What is the sum of the first 12 terms of an arithmetic progression if the first term is -19 and last term is 36?

- (a) 192 (b) 230
(c) 102 (d) 214

[RRB (JE) 2014]

Sol. (c)

Here first term

$$= -19 \text{ and last term} = 36$$

$$n = 12$$

$$\therefore \text{Required sum} = n \left(\frac{\text{First term} + \text{Last term}}{2} \right)$$

$$= 12 \left(\frac{-19 + 36}{2} \right) = 12 \times \frac{17}{2} = 102$$

Q.6 If 7 times of the seventh term of an Arithmetic Progression (AP) is equal to 11 times its eleventh term, then the 18th term of the AP will be,

- (a) 1 (b) 0
(c) 2 (d) -3

[RRB (JE) 2015]

Sol. (b)

According to the question,

$$7 \times \text{seventh term} = 11 \times \text{eleventh term}$$

$$7 \times [a + (7 - 1)d] = 11 \times [a + (11 - 1)d]$$

$$7 \times [a + 6d] = 11 \times [a + 10d]$$

$$a(18 - 1)d = 0$$

Hence, 18th term of AP = 0



PRACTICE SET : QUESTIONS

Q.1 $\sqrt{3\sqrt{80} + \frac{3}{9+4\sqrt{5}}} = ?$

- (a) $\sqrt{3\sqrt{5}}$ (b) 3
(c) $3\sqrt{3}$ (d) $3 + 2\sqrt{5}$

Q.2 x and y are integers and if $\frac{x^2}{y^3}$ is even integer

then which of the following must be an even integer?

- (a) $x - y$ (b) $y + 1$
(c) $\frac{x^2}{y^4}$ (d) xy

Q.3 What is the tens' digit of the sum of the first 50 terms of 1, 11, 111, 1111, 11111, 111111,.....?

- (a) 2 (b) 4
(c) 5 (d) 8

Q.4 If $81^y = \frac{1}{27^x}$, in terms of y , $x = ?$

- (a) $\frac{3y}{4}$ (b) $-\frac{3y}{4}$
(c) $\frac{4y}{3}$ (d) $-\frac{4y}{3}$

Q.5 If $\frac{1}{n+1} < \frac{1}{31} + \frac{1}{32} + \frac{1}{33} < \frac{1}{n}$; then $n = ?$

- (a) 9 (b) 10
(c) 11 (d) 12

Q.6 If one integer is greater than another integer by 3, and the difference of their cubes is 117, what could be their sum?

- (a) 11 (b) 7
(c) 8 (d) 9

Q.7 Which of these has total 24 positive factors?

- (a) $2^{15} \times 3^3$ (b) $2^7 \times 12^3$
(c) $2^6 \times 3^4$ (d) 63×55

Q.8 Two numbers, x and y are such that when divided by 6, they leave remainder 4 and 5 respectively. Find the remainder when $x^3 + y^3$ is divided by 6?

- (a) 2 (b) 3
(c) 4 (d) 5

Q.9 What is the remainder when $N = (1! + 2! + 3! + \dots + 1000!)^{40}$ is divided by 10?

- (a) 1 (b) 3
(c) 7 (d) 8

Q.10 Set A is formed by selecting some of the numbers from the first 100 natural numbers such that the HCF of any two numbers in the set A is 5, what is the maximum number elements that set A can have?

- (a) 7 (b) 8
(c) 9 (d) 10

- Q.11** Let x and y be positive integers such that x is prime and y is composite. Then,
 (a) $y - x$ cannot be an even integer
 (b) $\frac{x+y}{x}$ cannot be an even integer
 (c) $(x+y)$ cannot be even.
 (d) None of the above statements are true
- Q.12** Let $N = 1421 \times 1423 \times 1425$. What is the remainder when N is divided by 12?
 (a) 0 (b) 9
 (c) 3 (d) 6
- Q.13** When a four digit number is divided by 85 it leaves a remainder of 39. If the same number is divided by 17 the remainder would be ?
 (a) 2 (b) 5
 (c) 7 (d) 9
- Q.14** Integers 34041 and 32506 when divided by a three-digit integer n leave the same remainder. What is n ?
 (a) 289 (b) 367
 (c) 453 (d) 307
- Q.15** A box contains 100 tickets, numbered from 1 to 100. A person picks out three tickets from the box, such that the product of the numbers on two of the tickets yields the number on the third ticket. Which of the following tickets can never be picked as third ticket?
 (a) 10 (b) 12
 (c) 25 (d) 26
- Q.16** N is a natural number, then how many values of N are possible such that $\frac{6N^3 + 3N^2 + N + 24}{N}$ is also a Natural Number?
 (a) 6 (b) 7
 (c) 8 (d) 9
- Q.17** What is the unit digit of $39^{53} \times 27^{23} \times 36^{12}$?
 (a) 2 (b) 4
 (c) 6 (d) 8
- Q.18** How many number of zeros are there if we multiply all the prime numbers between 0 and 200.
 (a) 1 (b) 2
 (c) 3 (d) 4
- Q.19** A man wrote all the natural numbers starting from 1 in a series. What will be the 50th digit of the number?
 (a) 1 (b) 2
 (c) 3 (d) 4
- Q.20** $N = n(n+1)(n+2)(n+3)(n+4)$; where n is a natural number. Which of the following statement/s is/are true?
 1. Unit digit of N is 0.
 2. N is perfectly divisible by 24.
 3. N is perfect square.
 4. N is odd.
 (a) 3 only (b) 3 and 4 only
 (c) 1 only (d) 1 and 2 only
- Q.21** How many factors of $N = 12^{12} \times 14^{14} \times 15^{15}$ are multiple of $K = 12^{10} \times 14^{10} \times 15^{10}$?
 (a) $2 \times 4 \times 5$ (b) $3 \times 5 \times 6$
 (c) $8 \times 7 \times 4 \times 5$ (d) $9 \times 8 \times 6 \times 5$
- Q.22** In a certain base $137 + 254 = 402$ then
 What is the sum of $342 + 562$ in that base
 (a) 904 (b) 1014
 (c) 1104 (d) 1024

Solutions: Number Systems

1. (c)

Method (i) $\sqrt{3\sqrt{80} + \frac{3}{9+4\sqrt{5}}}$ using rationalization

$$= \sqrt{3\sqrt{80} + \frac{3}{9+4\sqrt{5}} \times \left(\frac{9-4\sqrt{5}}{9-4\sqrt{5}} \right)}$$

$$= \sqrt{3\sqrt{80} + \frac{(3 \times 9 - 3 \times 4\sqrt{5})}{9^2 - (4\sqrt{5})^2}}$$

$$= \sqrt{3\sqrt{80} + \frac{27 - 12\sqrt{5}}{81 - 80}}$$

$$= \sqrt{3\sqrt{16 \times 5} + 27 - 12\sqrt{5}}$$

$$= \sqrt{3 \times 4 \times \sqrt{5} + 27 - 12\sqrt{5}}$$

$$= \sqrt{12\sqrt{5} + 27 - 12\sqrt{5}}$$

$$= \sqrt{27} = 3\sqrt{3}$$

RRB-Junior Engineer

Solved Paper

(25-02-2026 : Shift -3)

PAPER **26**

- Q.1** Simar starts from Point A and drives 10 km towards south. He then takes a right turn, drives 7 km, turns right and drives 12 km. He then takes a right turn and drives 9 km. He takes a final right turn, drives 2 km and stops at Point P. How far (shortest distance) and towards which direction should he drive in order to reach Point A again? (All turns are 90 degree turns only unless specified.)
(a) 2 km to the west (b) 3 km to the west
(c) 2 km to the east (d) 3 km to the east
- Q.2** A tap can fill a cistern in 32 hours, while another tap can empty the full cistern in 64 hours. If the cistern is initially empty and both taps are opened together, find the time (in hours) required to fill one-fourth of the cistern.
(a) 64 (b) 48
(c) 32 (d) 16
- Q.3** The list price of a refrigerator is ₹15,000. It is sold to a retailer after two successive discounts of 32% and 40%. The retailer wants to earn a profit of 45% on his cost after allowing a 49% discount (on its new list price) to the customer. At what price should he list the refrigerator?
(a) 17,400 (b) 17,412
(c) 17,325 (d) 17,504
- Q.4** D, R, A, W and S have different marks. Only one person has scored between A and R. Only one person has scored between R and W. S has scored more than R and W. How many people have scored less than D?
(a) One (b) Two
(c) Four (d) Three
- Q.5** Express $5.9\overline{73}$ as a vulgar fraction.
(a) $5\frac{219}{225}$ (b) $5\frac{319}{225}$
(c) $5\frac{229}{255}$ (d) $5\frac{319}{215}$
- Q.6** Select the pair which follows the same pattern as that followed by the two set of pairs given below. Both pairs follow the same pattern.
JKK : KFH
HVO : IQL
(a) CPR : DKN (b) OOP : PJM
(c) FJL : GDI (d) CUK : DPG
- Q.7** If $\frac{4(x^2 + 1) - 8x}{3x} = 6$, $x > 0$, then find the positive value of $\sqrt{x} + \frac{1}{\sqrt{x}}$.
(a) $\sqrt{\frac{2}{5}}$ (b) $\sqrt{\frac{2}{3}}$
(c) $\sqrt{\frac{5}{3}}$ (d) $\sqrt{\frac{17}{3}}$
- Q.8** If $14.8 : x :: x : 3.7$ and $x > 0$, then find the value of x .
(a) 7.4 (b) 4.1
(c) 12.9 (d) 11.4
- Q.9** Seven boxes, D, E, F, G, H, W and X, are kept one over the other, but not necessarily in the same order.
Only H is kept above E. Only D is kept between E and G. Only F is kept below X. How many boxes are kept between W and E?
(a) One (b) Three
(c) Two (d) Four
- Q.10** 19 is related to 287 following a certain logic. Following the same logic, 23 is related to 347. To which of the following is 28 related, following the same logic?
(NOTE: Operations should be performed on the whole numbers, without breaking down the numbers into their constituent digits. E.g. 13 – Operations on 13 such as adding /subtracting / multiplying etc. to 13 can be performed. Breaking down 13 into 1 and 3 and then performing

mathematical operations on 1 and 3 is not allowed.)

- (a) 422 (b) 426
(c) 424 (d) 420

Q.11 In a certain code language,

A + B means 'A is the daughter of B'

A – B means 'A is the brother of B'

A × B means 'A is the wife of B'

A ÷ B means 'A is the father of B'

Based on the above, how is E related to K if

'E – F + G × H ÷ K'?

- (a) Husband (b) Brother
(c) Son (d) Father

Q.12 If + means –, – means ×, × means ÷, ÷ means +, then what will come in place of the question mark (?) in the following equation?

$$4 - 18 \times 3 \div 50 + 33 = ?$$

- (a) 31 (b) 40
(c) 41 (d) 30

Q.13 The average of the first 18 positive multiples of 11 is:

- (a) 104.5 (b) 18
(c) 11 (d) 99

Q.14 How many metres of cloth 2 metres wide will be required to make a conical tent with the diameter of the base being 14 metres and its slant height being 9.5 metres?

$$\left(\text{Use } \pi = \frac{22}{7} \right)$$

- (a) 114.5 (b) 104.5
(c) 124.5 (d) 109.5

Q.15 Girish scored 695 marks in an examination and was 17 marks short of 89% of the maximum marks. In the same examination, his friend scored 688 marks. What is the percentage of marks scored by his friend?

- (a) 84% (b) 83%
(c) 86% (d) 87%

Q.16 P is the brother of W. W is the father of R. T is the father of J. J is the son of R. How is T related to P?

- (a) Daughter's son
(b) Brother's daughter's son
(c) Daughter's husband
(d) Brother's daughter's husband

Q.17 A shopkeeper sells his goods at cost price. If by

using false weights he gains $3\frac{19}{27}\%$, then what

weight does he use for 1 kg (in g, rounded off to 2 decimal places)?

- (a) 987.35 (b) 964.29
(c) 938.99 (d) 954.79

Q.18 What should come in place of '?' in the given series?

7 10 16 25 ?

- (a) 34 (b) 43
(c) 40 (d) 37

Q.19 A question is followed by two statements numbered (I) and (II). You have to decide whether the data provided in the statements are sufficient to answer the question. Read both the statements carefully and decide the appropriate answer.

Question: 5 people, P, Q, X, Y and Z, have an exam on different days of the same week between Monday and Friday. Who has an exam on Thursday?

Statements:

I. P has an exam on Wednesday. Only one person has an exam between P and Q. Z has an exam immediately before X.

II. No one has an exam between P and Y. Only two people have an exam between Y and X. Z does not have an exam on Monday.

- (a) Data in statement II alone is sufficient to answer the question while data in statement I is not
(b) Data in statement I alone is sufficient to answer the question while data in statement II is not
(c) Data in statements I and II together is not sufficient to answer the question
(d) Data in statements I and II together (and not statement I alone or statement II alone) is sufficient to answer the question

Q.20 When x is added to each of 13, 19, 16 and 23, then the numbers so obtained, in this order, are in proportion. Then, if $5x : y :: y : (8x - 4)$, and $y > 0$, what is the value of y?

- (a) 42 (b) 37
(c) 41 (d) 30

Q.21 Refer to the following letter, number and symbol series and answer the question that follows.

(Left) H @ \$ V 1 B 2 C N E T U 8 6 % # L C N Q A
(Right)

If all the letters are dropped from the series, which of the following will be fifth from the left?

- (a) 6 (b) 8
(c) % (d) 2

Q.22 The monthly income of Chetan is ₹60,000 and his expenditure is ₹35,000. If his income increases by 25%, and his expenditure increases by 15%, then what will be the percentage increase in his savings?

- (a) 35% (b) 36%
(c) 39% (d) 38%

Q.23 In a certain code,

'parents teach good values' is coded as 'sc fs ye un',

'strong values shape character' is coded as 'lx zv fs lb' and

'good habits discipline strong' is coded as 'ye hk gb zv'.

(All the codes are two-letter codes only.)

What is the possible code for 'character'?

- (a) Either 'ye' or 'lb' (b) Either 'fs' or 'zv'
(c) Either 'lb' or 'fs' (d) Either 'lb' or 'lx'

Q.24 Select the set in which the numbers are related in the same way as are the numbers of the following sets.

(NOTE: Operations should be performed on the whole numbers, without breaking down the numbers into its constituent digits. E.g. 13 – Operations on 13 such as adding/subtracting/multiplying etc. to 13 can be performed. Breaking down 13 into 1 and 3 and then performing mathematical operations on 1 and 3 is not allowed)

(13, 91, 27)

(19, 133, 39)

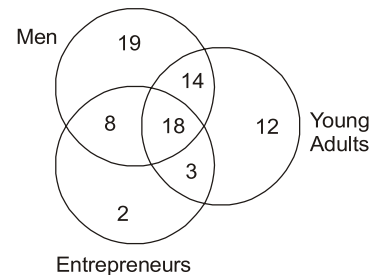
- (a) (25, 175, 50) (b) (26, 130, 53)
(c) (20, 140, 41) (d) (29, 210, 57)

Q.25 The roots of the equation $ax^3 - 24x^2 + 188x - 480 = 0$ are three consecutive even natural numbers. The value of a is:

- (a) 2 (b) 1
(c) 3 (d) 4

Q.26 Study the given diagram carefully and answer the question that follows. The numbers in different sections indicate the number of persons.

(NOTE: You have to take the given data to be true even if they seem to be at variance from commonly known facts.)



How many young adults are entrepreneurs?

- (a) 21 (b) 3
(c) 22 (d) 18

Q.27 In the Assumed Mean Method, if the assumed mean (A) = 55 and an observed value $x = 40$, what is the deviation d ?

- (a) 1.5 (b) -1.5
(c) 15 (d) -15

Q.28 The value of

$$4^3 - 7^2 + \left(\frac{16}{4}\right)^2 - 4 + 9 \times 1 = \underline{\hspace{2cm}}$$

- (a) 33 (b) 44
(c) 42 (d) 36

Q.29 A farmer wants to plant 95 mango trees, 171 banyan trees, and 152 banana trees in equal rows (in terms of the number of trees). Also, he wants to create distinct rows of trees, with only one type of tree in each row. Find the minimum number of rows required.

- (a) 23 (b) 18
(c) 19 (d) 22

Q.30 Find the roots of the quadratic equation $15x^2 - x - 2 = 0$.

- (a) $x = \frac{-1}{3}$ or $x = \frac{-2}{5}$
(b) $x = \frac{1}{3}$ or $x = \frac{2}{5}$
(c) $x = \frac{-1}{3}$ or $x = \frac{2}{5}$
(d) $x = \frac{1}{3}$ or $x = \frac{-2}{5}$

Q.31 If $14\sin Y + \cos Y = \sqrt{14}\sin Y$, then find the value of $\tan Y$.

- (a) $\frac{-14 - \sqrt{14}}{182}$ (b) $\frac{-14 - \sqrt{14}}{187}$
 (c) $\frac{-14 - \sqrt{14}}{192}$ (d) $\frac{-15 - \sqrt{14}}{182}$

Q.32 This question is based on the following words/letter clusters.

(left) ADS DUG AGS BEG (right)

How many letters are there between the second letter of the second word/letter cluster from the right and the second letter of the second word/letter cluster from the left, counted in the English alphabetical order?

- (a) 11 (b) 12
 (c) 13 (d) 14

Q.33 Simplify: $110 - 42 \times (5 + 6) - 6$

- (a) -348 (b) -363
 (c) -350 (d) -358

Q.34 A regular hexagon is inscribed in a circle. If the length of the shortest diagonal of the hexagon is 12 cm, find one-sixth of the area (in cm^2) of the region lying between the circle and the hexagon.

- (a) $6(3\pi - 2\sqrt{3})$ (b) $4(2\pi - 3\sqrt{3})$
 (c) $4(3\pi - 2\sqrt{3})$ (d) $6(2\pi - 3\sqrt{3})$

Q.35 What should come in place of the question mark (?) in the given series?

2 16 44 100 212 ?

- (a) 436 (b) 433
 (c) 430 (d) 435

Q.36 Select the set in which the numbers are related in the same way as are the numbers of the following sets.

(NOTE: Operations should be performed on the whole numbers, without breaking down the numbers into their constituent digits. E.g. 13 – Operations on 13 such as adding / subtracting / multiplying, etc. to 13 can be performed. Breaking down 13 into 1 and 3 and then performing mathematical operations on 1 and 3 is not allowed.)

(133, 5, 23)

(107, 1, 18)

- (a) (76, 20, 16) (b) (10, 22, 2)
 (c) (75, 9, 4) (d) (18, 24, 1)

Q.37 Amit had invested same amount of sums at simple as well as compound interest, compounded annually. The time period of both the sums was 2 years and rate of interest too was same 10% per annum. At the end, he found a difference of ₹97 in both the interests received. What were the sums (in ₹) invested?

- (a) 8,950 (b) 8,800
 (c) 9,700 (d) 10,050

Q.38 Mr. W travelled 425 km, 946 km and 340 km at a speed of 5 km/hr, 43 km/hr and 34 km/hr, respectively. Find his average speed in km/hr.

- (a) $14 \frac{71}{117}$ (b) $14 \frac{75}{117}$
 (c) $14 \frac{73}{117}$ (d) $14 \frac{70}{117}$

Q.39 In what ratio should sugar costing ₹34/kg be mixed with sugar costing ₹58/kg so that by selling the mixture at ₹52.80/kg, there is a profit of 32%?

- (a) 5 : 3 (b) 7 : 3
 (c) 3 : 1 (d) 5 : 2

Q.40 Read the given statements and conclusions carefully. Assuming that the information given in the statements is true, even if it appears to be at variance with commonly known facts, decide which of the given conclusions logically follow(s) from the statements.

Statements:

All apples are mangos.

All mangos are balls.

No ball is a cat.

Conclusions:

(I): No apple is a cat.

(II): Some balls are apples.

- (a) Both conclusions (I) and (II) follow
 (b) Neither conclusion (I) nor (II) follows
 (c) Only conclusion (II) follows
 (d) Only conclusion (I) follows

Q.41 Find the ratio between the fourth proportional of 8, 12 and 4, and the third proportional of 6 and 9.

- (a) 4 : 9 (b) 5 : 11
 (c) 7 : 11 (d) 9 : 13

Q.42 The ratio of the cost prices of articles X and Y is 1 : 2. A man earns a profit of 12% by selling X and incurs a loss of 36% by selling Y. What is his overall gain or loss percentage in the entire transaction?

- (a) Loss, 20% (b) Gain, 20%
 (c) Gain, 26.5% (d) Loss, 24.5%

Q.43 Each of C, D, E, F, X, Y and Z has an exam on a different day of a week starting from Monday and ending on Sunday of the same week.

X has exam on Friday. Only two people have exams between Y and X. Only four people have exams between C and Y. D has exam immediately after F. Z doesn't have exam on Monday.

How many people have exam(s) between Z and E?

- (a) Four (b) Two
(c) Three (d) One

Q.44 A can do a work in 9 days and B in 12 days. They work on alternate days, beginning with B. In how many days will the work be completed?

- (a) $8\frac{1}{3}$ (b) $9\frac{1}{3}$
(c) $10\frac{1}{3}$ (d) $12\frac{1}{3}$

Q.45 Select the triad which follows the same pattern as that followed by the two triads given below. Both triads follow the same pattern.

JM-HK-FI

MP-KN-IL2594

- (a) QS-NP-KO (b) PS-NQ-LO
(c) PS-NQ-KO (d) QS-MP-KO

Q.46 In a certain code,

'green apple sweet' is coded as 'ta lo mi'

'red apple fresh' is coded as 'ku lo pe'

'green mango fresh' is coded as 'ta si pe'

(all the codes are two letter coded only)

What is the code for "green apple"?

- (a) ku lo (b) mi si
(c) ta lo (d) ta pe

Q.47 A boat travels 36 km downstream in 3 hours and returns upstream covering the same distance in 5 hours. What is the speed of boat in still water?

- (a) 10.2 km/hour (b) 9.6 km/hour
(c) 11.7 km/hour (d) 8.5 km/hour

Q.48 What should come in place of ? in the given series based on the English alphabetical order?

JMQ ILP HKO GJN ?

- (a) FJM (b) FIN
(c) FIM (d) FJN

Q.49 Based on the English alphabetical order, three of the following four letter cluster pairs are alike in a certain way and thus form a group. Which is the one that does not belong to that group?

(Note: The odd man out is not based on the number of consonants/vowels or their position in the letter cluster.)

- (a) KI-EF (b) SQ-NL
(c) AY-VT (d) LJ-GE

Q.50 Calculate the population standard deviation of the data 13, 17, 23, 26, 31, 28, 15, 34, 17, and 26. (Round off your answer to two decimal places.)

- (a) 7.18 (b) 7.26
(c) 6.81 (d) 6.19

Q.51 Refer to the following letter, number, symbol series and answer the question that follows. (NOTE: All numbers are single digit numbers only) Counting to be done from left to right only.

(Left) H 9 & 3 L ! 6 M \$ 7 R @ 4 C % 2 F # 5 K * 8 P (Right)

How many such symbols are there, each of which is immediately preceded by a number and also immediately followed by another symbol?

- (a) Two (b) None
(c) One (d) Three

Q.52 Five years ago, the ratio of the ages of Amit and Bhanu was 2 : 3. Fifteen years from now, their ages will be in the ratio of 5 : 6. Find the sum of their present ages. (Give your answer in years and months, if relevant.)

- (a) 43 years, 4 months
(b) 80 years
(c) 43 years
(d) 43 years, 3 months

Q.53 Akshay has borrowed an amount of ₹440000 from a bank to start a business. How much simple interest (in ₹) will he pay at a rate of 5% per annum after 4 years?

- (a) 87000 (b) 89000
(c) 78000 (d) 88000

Q.54 Seven people, F, J, M, L, R, V and X, are sitting in a row, facing north.

Only three people sit to the left of X. Only M sits to the right of R. Only three people sit between R and V. J sits at some place to the left of L but at some place to the right of F.

How many people sit to the left of V?

- (a) 4 (b) 2
(c) 3 (d) 1

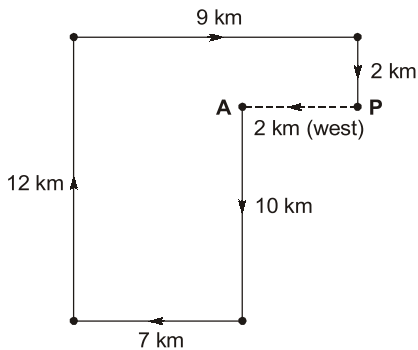
- Q.55** The radius and slant height of a cone are 59.5 cm and 85 cm, respectively. Find its total surface area.

$$\left(\text{Take } \pi = \frac{22}{7} \right)$$

- (a) 30,021.5 cm² (b) 28,021.5 cm²
(c) 27,021.5 cm² (d) 27,000.5 cm²

Solutions: RRB-JE Solved Paper (25-02-2026 : Shift-3)

1. (a)



2. (d)

$$\text{Filling rate} = \frac{1}{32}$$

$$\text{Emptying rate} = \frac{1}{64}$$

$$\text{Net rate} = \frac{1}{32} - \frac{1}{64} = \frac{1}{64}$$

$$\text{Time to fill } \frac{1}{4} \text{ cistern} = \frac{\frac{1}{4}}{\frac{1}{64}} = 16 \text{ hours}$$

3. (a)

$$\text{Cost to retailer} = 15000 \times \frac{68}{100} \times \frac{60}{100} = 6120$$

$$\text{Retailer wants 45\% profit} = 6120 \times 1.45 = 8874$$

$$\text{After giving 49\% discount,} \\ \text{selling price} = 51\% \text{ of marked price}$$

$$0.51 M = 8874$$

$$M = \frac{8874}{0.51} = 17,400$$

4. (d)

Possible order

$$S > A > D > R > W$$

5. (a)

$$x = 5.97333 \dots \\ 10x = 59.7333 \dots$$

$$100x = 597.333 \dots$$

$$90x = 537.6$$

$$x = \frac{537.6}{90} = \frac{5376}{900} = \frac{896}{150} \\ = \frac{448}{75} = 5 + \frac{219}{225}$$

6. (b)

J	K	K	→	K	F	H
10	11	11		11	6	8
H	V	O	→	I	Q	L
8	22	15		9	17	12
O	O	P	→	P	J	M
15	15	16		16	10	13

Pattern (+1, -5, -3)

7. (d)

$$4x^2 + 4 - 8x = 18x$$

$$4x^2 + 4 - 26x = 0$$

$$2x^2 + 2 - 13x = 0$$

Divide by x

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

$$x + \frac{1}{x} = \frac{13}{2}$$

$$\left(\sqrt{x} + \frac{1}{\sqrt{x}} \right)^2 = x + \frac{1}{x} + 2 = \frac{13}{2} + 2 = \frac{17}{2}$$

$$\sqrt{x} + \frac{1}{\sqrt{x}} = \sqrt{\frac{17}{2}}$$

8. (a)

$$\text{Given: } 14.8 : x :: x : 3.7$$

$$x^2 = 14.8 \times 3.7$$

$$x = \sqrt{14.8 \times 3.7} = 7.4$$

9. (b)

Possible arrangement:

H E D G W X F

There is only two box between W and E.

10. (a)

Pattern:

$$19 \times 15 + 2 = 287$$

$$23 \times 15 + 2 = 347$$

Similarly,

$$28 \times 15 + 2 = 422$$

11. (b)

