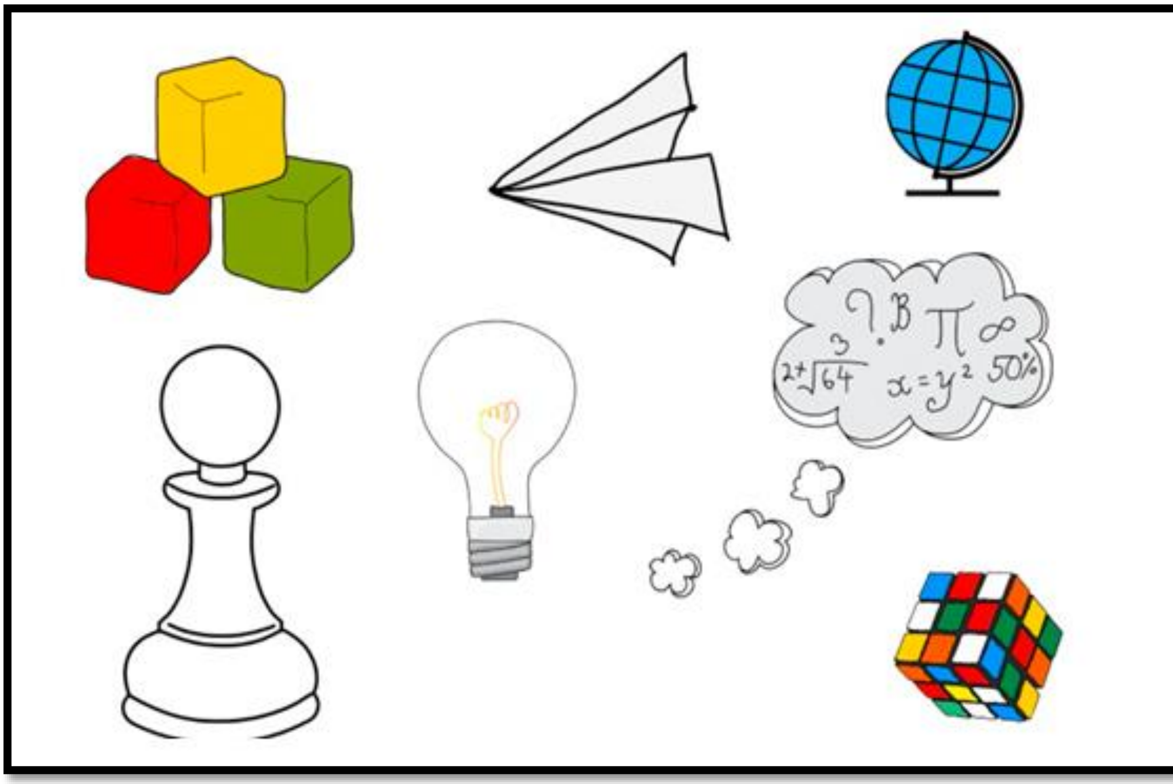

Aptitude Skills

(Participant Guide)

Welcome Note

Dear Participant,

Welcome to the training program titled as “Aptitude Skills”. With this training, participants can use these skills to become more productive at work.

Aptitude and ability tests are designed to assess your logical reasoning or thinking performance. They consist of multiple-choice questions and are administered under exam conditions. You may be asked to answer the questions either on paper or online. The advantages of online testing include immediate availability of results and the fact that the test can be taken at employment agency premises or even at home. This makes online testing particularly suitable for initial screening as it is obviously very cost-effective.

Your role in the activities of this course is of great importance. When engaged in active, deep learning, you are not passively taking in information from instructors but are reading, writing, discussing and problem-solving.

You as participants are expected to follow the training course as directed by our efficient trainers and ensure to complete the assignments religiously.

Please remember, you are adults now and trying to step into the corporate sector; hence it is crucial for you to interact with your trainer and acquire the knowledge of accounting.

We hope that you will gain from this program and will be able to inspire for you future self.

All the best!

Table of Content

As a participant/ trainee, keep in mind the following guidelines

1. Greet your instructor and the other participants when you enter class
2. Always be punctual for every class
3. Be regular. Candidates who fall short of the required attendance will not be certified
4. Inform your instructor if, for any reason, you need to miss class
5. Pay careful attention to what your instructor is saying or showing
6. In case you do not understand something do not hesitate to put up your hand and seek clarification
7. Make sure you do all the exercises in your workbook. It will help you understand the concept better
8. Practice any new skills you have learnt as many times as possible. Seek the help of your Trainer or co-participant for practice
9. Take all necessary precautions, as instructed by your Trainer, when using machinery and tools
10. Make sure you are neatly attired and presentable at all times
11. Participate actively in all the activities, discussions and games during training. It will make you more confident and help in the learning process.

Aptitude Skills
At the end of this module, you will be able to: ❖ Understand importance of aptitude skills ❖ Understand importance of aptitude tests in Corporate Sector ❖ Solve logical and verbal reasoning questions

MODULE - Number System

Aptitude tests are short tests which employers use to assess whether a candidate has the level of competency necessary for success in the role: do they have the skills necessary to do the job. Tests generally have challenging time limits and often increase in difficulty throughout the test. This is to put the candidate under pressure and try to understand what their maximum level of performance is.

Typically tests present the candidate with some information and ask them to use this information to answer a question, usually providing few possible answers.

In the end of this module, students should be able to familiarize with aptitude and quantitative techniques.

Quantitative Aptitude simply means the ability of an individual to solve numerical and mathematical calculations. It assesses the capability of playing with numbers in a logical manner. This is very often required in most of the competitive exams.

Module Objective

At the end of this module, students should be able to demonstrate appropriate knowledge, and show an understanding of the following:

- Identify different quantitative concepts
- Examine the calculations

Number System

Number system means basic calculations that includes basic formulae, addition, subtraction, multiplication and division.

Number system is one the fundamental topics in the quantitative aptitude. Number system is a system to represent numbers using symbols and digits.

Basic Calculations

In Aptitude, basic calculation includes simple formulae that we've been using since our school times.

Some of them are:

1. $(a + b)^2 = a^2 + b^2 + 2ab$
2. $(a - b)^2 = a^2 + b^2 - 2ab$
3. $(a + b)^2 - (a - b)^2 = 4ab$
4. $(a + b)^2 + (a - b)^2 = 2 (a^2 + b^2)$
5. $(a^2 - b^2) = (a + b) (a - b)$
6. $(a + b + c)^2 = a^2 + b^2 + c^2 + 2 (ab + bc + ca)$
7. $(a^3 + b^3) = (a +b) (a^2 - ab + b^2)$
8. $(a^3 - b^3) = (a - b) (a^2 + ab + b^2)$
9. $(a^3 + b^3 + c^3 -3abc) = (a + b + c) (a^2 + b^2 + c^2 - ab - bc - ca)$
10. If $a + b + c = 0$, then $a^3 + b^3 + c^3 = 3abc$.

Types of Numbers:

- ✓ **Natural Numbers**: The numbers 1,2,3,4.... are called natural numbers or positive integers.
- ✓ **Whole Numbers**: The numbers 0,1,2,3.... are called whole numbers. Whole numbers include "0".
- ✓ **Integers**: The numbers .... -3, -2, -1, 0, 1, 2, 3, ... are called integers. You will see questions on integers in almost all the exams where you see number system aptitude questions.
- ✓ **Negative Integers**: The numbers -1, -2, -3, ... are called negative integers.
- ✓ **Positive Fractions**: The numbers(2/3) ,(4/5) ,(7/8) ... are called positive fractions.
- ✓ **Negative Fractions**: The numbers -(6/8) ,-(7/19) , -(12/17) ... are called negative fractions.
- ✓ **Rational Numbers**: Any number which is a positive or negative integer or fraction, or zero is called a rational number. A rational number is one which can be expressed in the following format ⇒(a/b) , where b ≠ 0 and a & b are positive or negative integers.
- ✓ **Irrational Numbers**: An infinite non-recurring decimal number is known as an irrational number. These numbers cannot be expressed in the form of a proper fraction a/b where b ≠ 0. e.g.√2 , √5 , Π, etc.
- ✓ **Surds**: Any root of a number, which cannot be exactly found is called a surd. Essentially, all surds are irrational numbers. e.g. √2 , √5 etc.
- ✓ **Even Numbers**: The integers which are divisible by 2 are called even numbers e.g. -4, 0, 2, 16 etc.

- **Odd Numbers**: The integers which are not divisible by 2 are odd numbers e.g. -7, -15, 5, 9 etc.

- **Prime Numbers**: Those numbers, which are divisible only by themselves and 1, are called prime numbers. In other words, a number, which has only two factors, 1 and itself, is called a prime number. e.g. 2, 3, 5, 7, etc.

  Note: 2 is the only even prime number.
  There are 25 prime numbers upto 100. These are 2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47, 53, 59, 61, 67, 71, 73, 79, 83, 89 & 97. These should be learnt by heart.

- **Co-Prime Numbers**: Two numbers are considered to be prime to each other if their HCF is 1. e.g. 5 and 24 are prime to each other. In other words, 5 and 24 are co-prime.

- **Composite Number**: A number, which has factors other than itself and 1, is called a composite number. e.g. 9, 16, 25....

- **Consecutive Numbers**: Numbers arranged in increasing order and differing by 1 are called consecutive numbers. e.g. 4, 5, 6, 7 etc.

- **Real Numbers**: The natural numbers, integers, whole numbers, rational numbers and irrational numbers constitute the set of real numbers. Every real number can be represented by a point on a number line.

- **Perfect Numbers**: If the sum of all the factors of a number excluding the number itself happens to be equal to the number, then the number is called as perfect number. 6 is the first perfect number. The factors of 6 are 1, 2, 3 & 6. Leaving 6 the sum of other factors of 6 are equal to 6. The next three perfect numbers after 6 are: 28,496 and 8128.

- **Complex Numbers**: Complex numbers have a real and an imaginary component; e.g. ($\sqrt{-2}$ - 4), (2 +$\sqrt{-3}$), etc. Square root of any negative number is an imaginary number - e.g.$\sqrt{-2}$,$\sqrt{-3}$. The square root of a negative number does not exist in the real sense. Such numbers are called imaginary numbers.

- **Fibonacci Numbers**: The numbers, which follow the following series are known as Fibonacci numbers. E.g. 1,1,2,3,5,8,13,21..... The series is obtained by adding the sum of the preceding two numbers. In general, for a Fibonacci number X, $X_{i+2} = X_{i+1} + X_i$.

Divisibility Rules

- ✓ **Divisibility rule of 2** - A number is divisible by 2 when its units place is 0 or divisible by 2. e.g. 120, 138.
- ✓ **Divisible by 3** - 19272 is divisible by 3 when the sum of the digits of 19272 i.e. 21 is divisible by 3. Note that if n is odd, then 2n + 1 is divisible by 3 and if n is even, then 2n - 1 is divisible by 3.
- ✓ **Divisibility rule of 4** - A number is divisible by 4 when the last two digits of the number are 0s or are divisible by 4. As 100 is divisible by 4, it is sufficient if the divisibility test is restricted to the last two digits. e.g. 145896, 128, 18400
- ✓ **Divisibility by 5** - A number is divisible by 5, if its unit's digit is 5 or 0. e.g. 895, 100
- ✓ **Divisibility rule of 7**: How to check whether a number is divisible by 7 or not. Let us check divisibility of 343. Double the last digit of the given number: 3 x 2 = 6, subtract it from the rest of the number: 34 - 6 = 28. Check if the difference is divisible by 7 i.e. 28 is divisible by 7, therefore 343 is divisible by 7.
- ✓ **Divisibility rule of 8** - A number is divisible by 8, if the last three digits of the number are 0s or are divisible by 8. As 1000 is divisible by 8, it is sufficient if the divisibility test is restricted to the last three digits e.g. 135128, 45000.
- ✓ **Divisibility rule of 9** - A number is divisible by 9, if the sum of its digits is divisible by 9. e.g. 810, 92754
- ✓ **Divisibility rule of 11**- A number is divisible by 11, if the difference between the sum of the digits at odd places and the digits at even places of the number is either 0 or a multiple of 11. e.g. 121, 65967. In the first case 1 + 1 - 2 = 0. In the second case 6 + 9 + 7 = 22 and 5 + 6 = 11 and the difference is 11. Therefore, both these numbers are divisible by 11.
- ✓ **Divisibility rule of 25**- Any number is divisible by 25, if the last 2 digits of the number are 00 or they are multiples of 25.e.g. 2358975 is divisible by 25 as its last two digits are 75.

Power Cycle

In the quantitative aptitude section, questions based on power cycle concept or cyclicity of numbers are common. Every year few questions are based on this topic and thus, it is crucial to be thorough with this topic. These questions are easily solvable and can improve the overall aptitude scores.

The last digit of a number of the form *ab* falls in a particular sequence or order depending on the unit digit of the number *"a"* and the power the number is raised to *"b"*. Thus, the power cycle of a number depends on its' unit digit.

Consider the power cycle of 2:

2^1=2 2^5=32

2^2=4 2^6=64

2^3=8 2^7 =128

2^4=16 2^8 =256

It can be observed that the unit digit gets repeated after every 4th power of 2. Hence, we can say that 2 has a power cycle of 2, 4, 8, 6 with frequency 4.

This means that, a number of the form:

- 2^{4k+1} will have the last digit as 2
- 2^{4k+2} will have the last digit as 4
- 2^{4k+3} will have the last digit as 8
- 2^{4k+4} will have the last digit as 6 (where k=0, 1, 2, 3…)

This is applicable not only for 2 but for all numbers ending in 2. (e.g. 12^{32} ,3452^{123})

Example:

Find the remainder when 3^{75} is divided by 5.

Solution:

Step 1: Express the power in the form, 4k+x where x=1, 2, 3, 4. In this case 75 = 4k+3.

Step 2: Take the power cycle of 3 which is 3,9,7,1. Since the form is 4k+3, take the third digit in the cycle, which is 7.

Any number divided by 5, the remainder will be that of the unit digit divided by 5. Hence the remainder is 2.

Remainder Cycle

Some patterns of remainders cycle are:

- 4^1 divided by 9, leaves a remainder of 4.
- 4^2 divided by 9, leaves a remainder of 7. {Rem(16/9) = 7}
- 4^3 divided by 9, leaves a remainder of 1. {Rem (64/9) = 1}
- 4^4 divided by 9, leaves a remainder of 4. {Rem (256/9) = 4}
- 4^5 divided by 9, leaves a remainder of 4. {Rem (1024/9) = 7}
- 4^6 divided by 9, leaves a remainder of 4. {Rem (4096/9) = 1}

- $4^{(3k+1)}$ leaves a remainder of 4

- $4^{(3k+2)}$ leaves a remainder of 7
- 4^{3k} leaves a remainder of 1

As you can see above, the remainder when 4n is divided by 9 is cyclical in nature. The remainders obtained are 4,7,1, 4,7,1, 4,7,1 and so on. They will always follow the same pattern.

Example:

What will be the remainder when 4143 is divided by 9?

Solution:

Based on the calculations that is done in the beginning of the post, I know that,

Remainders of 4^n when divided by 9, move in a cycle of 3.

So, I need to express 143 $=3^{k+x}$ and that would lead to the answer.

I know that 143 = 141 + 2

(since 141 is divisible by 3)

So, my answer would be the 2nd value in the list, which is 7.

In the questions where you have to find out the remainder of an by d, as a rule you can follow this process,

Step 1: Find out the cycle of remainders when an is divided by d and make a list of those values.

Step 2: Find out the cyclicity, say r

Step 3: Find out the remainder when the power is divided by the cyclicity, that is Rem = p

Step 4: The answer would be the p^{th} value in the list. {If p = 0, it would be the last value in the list}

LCM & HCF

HCF and LCM are one of the common terms in mathematics. Maths is never an easy subject to understand, it takes patience and a keen sense of curiosity and appreciation to comprehend it. But at this age, it is easy enough to grasp these concepts. Hence, it's of great importance that one spends enough time on revising and clearing their doubts.

HCF (Highest Common Factor):

As has been taught in Factors and multiples, the factors of a number are all the numbers that divide into it. Let's proceed to the highest common factor (HCF) and the least common multiple (LCM). As the rules of mathematics dictate, the greatest common divisor or the GCD of two or more integers, when at least one of them is not zero, happens to be the largest positive that divides the numbers without a remainder. For instance, take 8 and 12, the gcd of these two numbers or the HCF of two numbers will be 4. Since this greatest common divisor or GCD is also known as the highest common factor or HCF.

LCM- Least Common Multiple:

In arithmetic, the least common multiple or LCM of two numbers, let's assume a and b, is denoted as LCM (a,b) is the smallest or least, as the name suggests, a positive integer that is divisible by both a and b. Take the LCM of 4 and 6. Multiples of four are: 4,8,12,16,20,24 and so on while that of 6 is 6, 12, 18, 24…. The common multiples for four and six are 12, 24, 36, 48…and so on. The least common multiple in that lot would be 12. Let us now try to find out the LCM of 24 and 15.

Division method to find the HCF:

Steps to find the HCF of any given numbers;

1) Larger number/ Smaller Number

2) The divisor of the above step / Remainder

3) The divisor of step 2 / Remainder. Keep doing this step till R = 0(Zero).

4) The last step's divisor will be HCF.

The above steps can also be used to find the HCF of more than 3 numbers.

Finding LCM

Suppose there are two numbers, 8 and 12, whose LCM we need to find. Let us write the multiples of these two numbers.

8 = 16, **24**, 32, 40, 48, 56, …

12 = **24**, 36, 48, 60, 72, 84,…

You can see, the least common multiple or the smallest common multiple between the two number, 8 and 12 is 24.

SURDS & INDICES

Indices: The base x raised to the power of p is equal to the multiplication of x, p times x = x × x × ... × x p times.

x is the base and p is the indices.

Surds and indices math problems have a frequent appearance in some of the entrance exams.

Examples:
$3^1 = 3$
$3^2 = 3 \times 3 = 9$
$3^3 = 3 \times 3 \times 3 = 27$
$3^4 = 3 \times 3 \times 3 \times 3 = 81$

Surds: Numbers which can be expressed in the form √p + √q , where p and q are natural numbers and not perfect squares.

Irrational numbers which contain the radical sign (n√) are called as surds.

Hence, the numbers in the form of √3, 3√2, ……. n√x

Indices power rules:

Power rule 1
$(a^n)^m = a^{nm}$
Example:
$(2^3)^2 = 2^{3*2} = 2^6 = 2·2·2·2·2·2 = 64$
Power rule 2
${}_p n^m = {}_p(n^m)$
Example:
${}_2 3^2 = {}_2(3^2) = 2^{(3.3)} = 2^9 = 2·2·2·2·2·2·2·2·2 = 512$
Power rule 3
n√p =p1/n
Example:
$27^{1/3} = {}^3\sqrt{27} = 3$

Indices Multiplication rules

Multiplication rule with same base
$p^n \cdot p^m = p^{m+n}$
Example:
$2^3 \cdot 2^4 = 2^{3+5} = 2^8 = 2·2·2·2·2·2·2.2 = 256$
Multiplication rule with same indices
$p^n \cdot y^n = (p \cdot y)^n$
Example: $3^2 \cdot 2^2 = (3·2)^2 = 36$

Indices division rules

Division rule with same base
$p^m / p^n = p^{m-n}$

Example: $3^5 / 3^3 = 3^{5-3} = 9$
Division rule with same indices
$x^n / y^m = (x / y)^n$
Example: $9^3 / 3^3 = (9/3)^3 = 27$

Rule name	**Rule**
Multiplication Rule	$p^n \cdot p^m = p^{m+n}$
	$p^n \cdot q^n = (p \cdot q)^n$
Division Rule	$p^m / p^n = x^{m-n}$
	$p^n / q^n = (p / q)^n$
Power Rule	$(p^n)^m = p^{n.m}$
	${}_{p}n^m = {}_{p}(n^m)$
	${}^m\sqrt{}(p^n) = p^{n/m}$
	${}^n\sqrt{}p = p^{1/n}$
	$p^{-n} = 1 / p^n$

Sample Paper – Number System

Q1. Which one of the following is not a prime number?

a. 31 b. 61 c. 71 d. 91

Q2. (112 x 54) = ?

a. 67000 b. 70000 c. 76500 d. 77200

Q3. It is being given that (232 + 1) is completely divisible by a whole number. Which of the following numbers is completely divisible by this number?

a. $(2^{16} + 1)$ b. $(2^{16} - 1)$ c. (7×2^{23}) d. $(2^{96} + 1)$

Q4. What least number must be added to 1056, so that the sum is completely divisible by 23 ?

a. 2 b. 3 c. 18 d. 21

Q5. 1397 x 1397 = ?

a. 1951609 b. 1981709 c. 18362619 d. 2031719

Q6. How many of the following numbers are divisible by 132 ?

264, 396, 462, 792, 968, 2178, 5184, 6336

a. 4 b. 5 c. 6 d. 7

Q7. (935421 x 625) = ?

a. 575648125 b. 584638125 c. 584649125 d. 585628125

Q8. The largest 4-digit number exactly divisible by 88 is:

a. 9944 b. 9768 c. 9988 d. 8888

Q9. Which of the following is a prime number ?

a. 33 b. 81 c. 93 d. 97

Q10. What is the unit digit in $\{(6374)^{1793} \times (625)^{317} \times (341^{491})\}$?

a. 0 b. 2 c. 3 d. 5

Q11. 5358 x 51 = ?

a. 273258 b. 273268 c. 273348 d. 273358

Q12. The sum of first five prime numbers is:

a. 11 b. 18 c. 26 d. 28

Q13. The difference of two numbers is 1365. On dividing the larger number by the smaller, we get 6 as quotient and the 15 as remainder. What is the smaller number ?

a. 240 b. 270 c. 295 d. 360

Q14. (12)3 x 64 ÷ 432 = ?

a. 5184 b. 5060 c. 5148 d. 5084

Q15. 72519 x 9999 = ?

a. 725117481 b. 674217481 c. 685126481 d. 696217481

Q16. If the number 517*324 is completely divisible by 3, then the smallest whole number in the place of * will be:

a. 0 b. 1 c. 2 d. none of these

Q17. The smallest 3-digit prime number is:

a. 101 b. 103 c. 109 d. 113

Q18. Which one of the following numbers is exactly divisible by 11?

a. 235641 b. 245642 c. 315624 d. 415624

Q19. The H.C.F. of two numbers is 23 and the other two factors of their L.C.M. are 13 and 14. The larger of the two numbers is:

a. 276 b. 299 c. 322 d. 345

Q20. Six bells commence tolling together and toll at intervals of 2, 4, 6, 8 10 and 12 seconds respectively. In 30 minutes, how many times do they toll together ?

a. 4 b. 10 c. 15 d. 16