

# **CAREERS** 360

## **PREPARATION** **Series**

### **CAT 2024**

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# **100 Must Know Quant Facts**

## The QA Quest

Quantitative Ability is one of the major sections of CAT exam, which will make or break your future. Compared to other sections QA is a **rapier** (A two-edged sword... so what, if this E-book is for quant, we can share some knowledge on Verbal Ability as well).

Why we call it a rapier, because on one hand it gives you the chance to score high in less time, but at the same time chances of silly mistakes, calculation errors are more, and hence the same QA section contributes towards most of the negative marks. So, it is necessary to focus more on accuracy, than attempting more number of questions.

But again, from our past experience we can tell that you need to attempt at least 22-23 questions in this section (QA and DI form the first section with 30 questions) with 85% accuracy, only then you can expect a score of 98+ %ile in this section.

So what do we do now?? We can't compromise on accuracy, but we need speed also. So you need to remember these 100 facts about Quantitative Aptitude, which will enhance your speed and improve your accuracy as well.

*“The more you sweat in peace*

*The less you bleed in war”*

*Good Luck !!!*

## 100 Facts for a Score of 100 %ile

1.	A number in base N when written in base 10 is divisible by N-1 when the sum of the digits of the number in base N is divisible by N-1
2.	When digits of an P digit number written in base N are rearranged in any order to form a new P digit number, the difference of the two numbers when written in base 10 is divisible by N-1
3.	A difference between a 3 digit number and its reverse is always divisible by 99
4.	Fibonacci numbers: a) The square of any Fibonacci number differs by 1 from the product of the two Fibonacci numbers on each side b) $a_n^2 + a_{n+1}^2 = a_{2n+1}$ c) For any 4 consecutive Fibonacci numbers A,B,C,D, $C^2 - B^2 = A.D$
5.	For any number, $X = p_1^{m_1} p_2^{m_2} p_3^{m_3} \dots p_n^{m_n}$ , where $p_1, p_2 \dots p_n$ are prime numbers, if 'f' is a factor of 'N', then total number of pairs satisfying $a_1.a_2.a_3 \dots a_r = f$ is given by: ${}^{(m_1+r)}C_r \cdot {}^{(m_2+r)}C_r \cdot {}^{(m_3+r)}C_r \dots {}^{(m_n+r)}C_r$
6.	If a number is expressed in base 'p' where p is a prime number, then number of 0s at the end of the number = highest power of p in the given number
7.	If a number has n digits, then its square will have 2n or 2n -1 digits
8.	Number of digits in square root of 'n' digit number: a) $(n+1)/2$ if n is odd b) $n/2$ if n is even
9.	$a^k$ and $a^{(k+4)}$ will have same units digit
10.	Number of possible pairs of $a_1, a_2, \dots, a_n$ possible such that $a_i \geq 0$ and $a_1+a_2+\dots+a_n = m$ is ${}^{(m+n-1)}C_{n-1}$
11.	$2n!$ is divisible by $n! \times n+1!$
12.	Any natural number can be expressed as the sum of the power of 2
13.	Any number from 1 to 40 can be formed by using sum/difference of $3^0, 3^1, 3^2, 3^3$

14.	Sum of power of 2 from 0 to any number 'k' = $2^{k+1} - 1$
15.	${}^{2n}C_n = {}^nC_0 + {}^nC_1 + {}^nC_2 + \dots + {}^nC_n$
16.	If a & b are prime numbers and $ab = (k-1).(k+1)$ then a, b are called twin primes. There 8 pairs of twin primes from 1 to 100
17.	HCF of two consecutive even numbers = 2
18.	$HCF(A,B) = HCF[LCM(A,B), A+B]$
19.	HCF of fractions = HCF (Numerator)/ LCM (Denominators)
20.	LCM of fractions = LCM (Numerator)/ HCF (Denominators)
21.	For any given numbers, HCF is a factor of their LCM, HCF is the product of least powers of common factors and LCM is the product of highest powers of all factors
22.	Product of two numbers = HCF x LCM Or LCM = Product of numbers/HCF
23.	If $P \% N = Q \% N = R \% N$ , largest value of N = HCF (P-Q, Q-R)
24.	If $p^{th}, q^{th}, r^{th}$ terms of an A.P. are a, b and c then $(q-r)a + (r-p)b + (p-q)c = 0$
25.	If the sum of the $1^{st}$ p, q and r terms of an A.P. are a,b and c respectively, then $a(q-r)/p + b(r-p)/q + c(p-q)/r = 0$
26.	If n arithmetic means $m_1, m_2, m_3, \dots, m_n$ are inserted between a & b, $b = a+(n+1)d$ and $d = (b-a)/(n+1)$
27.	If $y+(z-x)/x, x+(z-y)/y, x+(y-z)/z$ are in A.P. then $1/x, 1/y, 1/z$ are in A.P
28.	If A1 is an A.P. with $1^{st}$ term $a_1$ and C.D. = $d_1$ and A2 is an A.P. with $1^{st}$ term $a_2$ and C.D. = $d_2$ , then C.D. of A.P. formed by terms that are common to both A1 & a2 is LCM ( $d_1, d_2$ )
29.	In an A.P. of n terms, $m^{th}$ term from the beginning = $n-m+1^{th}$ term from the end, $m^{th}$ term from the end = $n-m+1^{th}$ term from the beginning
30.	If $p^{th}, q^{th}$ and $r^{th}$ terms of a GP are a, b, c, then $a^{q-r} \cdot b^{r-p} \cdot c^{p-q} = 1$
31.	Product of $1^{st}$ n terms of GP = $a^n r^{n(n-1)/2}$
32.	If n geometric means are inserted between two numbers a & b, a $m_1 m_2 m_3 \dots m_n$ b is in GP, $b=ar^{n+1}, r=(b/a)^{1/(n+1)}, m_1 = ar, m_2 = ar^2, m_3 = ar^3$ and so on

33.	In a G.P if $T_1 = p$ , $T_n = q$ , then product of all terms from 1 to $n = (pq)^{n/2}$
34.	If $a, b, c$ are in G.P. $\log_a x, \log_b x, \log_c x$ are in HP
35.	Expressing the square of a number as sum of squares of two numbers $c^2 = a^2 + b^2$ $\Rightarrow (ck)^2 = (ak)^2 + (bk)^2$ And $d = m^2 + n^2$ $\Rightarrow d^2 = (m^2 - n^2)^2 + (2mn)^2$
36.	Remainder when $6^N$ or $4^{2N}$ is divided by 10 = 6
37.	Square of a number can leave only 0,1,4 as remainders when divided by 5
38.	If a polynomial in one variable 'x' is divided by $x-a$ where $a$ is any real number, then the remainder is the value of the polynomial at $x=a$ . e.g. remainder when $x^4 - 3x^2 + 2$ is divided by $x-2 = 2^4 - 3 \times 2^2 + 2 = 6$ , $x^4 - 3x^2 + 2 = (x-2) \cdot (x^3 - 2x^2 + x - 2) + 6$
39.	Chinese Remainder Theorem: If $N = a \cdot b$ where $a$ & $b$ are prime to each other and $M \% a = r_1$ and $M \% b = r_2$ , then $M \% N = ar_2x + br_1y$ , where $ax + by = 1$ e.g. $3101 \% 77 = ?$ $3101 \% 7 = 5$ , $3101 \% 11 = 3$ , $7x + 11y = 1 \Rightarrow x = -3$ $y = 2$ , remainder = 47
40.	$x^y + y^x = (xy)^{xy}$ where $x$ & $y$ are natural numbers has no solution
41.	$k^3 + 1/k^3 = (k+1/k)^3 - 3(k+1/k)$
42.	The 5th power of any single digit number has the same units digit as the number itself
43.	All odd numbers can be expressed as difference of two perfect squares
44.	All multiples of 4 (except 4) can be expressed as difference of 2 perfect squares
45.	The number of possibilities of $x_1 + x_2 + x_3 + \dots + x_n = m$ , with no $x_i$ as zero is ${}^{m-1}C_{n-1}$ (It is equal to number of ways of arranging $m-n$ black balls and $n-1$ white balls in a row)
46.	If the roots of an equation are real and positive and if sum of the roots = $n$ (degree of equation) and product of the roots = 1, then equation is $k(x-1)^n = 0$
47.	Least number of identical cubes that can be cut from a cuboid of dimension $a, b, c = a \cdot b \cdot c / \text{HCF}(a, b, c)^3$ . Side of such a cube = $\text{HCF}(a, b, c)$

48.	Least number of cuboids of dimensions a , b, c required to form a cube = $\text{LCM of } (a,b,c)^3 / a.b.c$
49.	If a number is expressed in base 'pq' where p & q are prime numbers and $p > q$ , then number of 0s at the end of the number = highest power of p in the given number e.g. no of zeros at the end of $1000! = [1000/5] + [1000/5^2] + [1000/5^3] + [1000/5^4] = 200 + 40 + 8 + 1 = 249$
50.	If 'a' is a factor of N, then sum of all factors of N which are multiples of 'a' is a.[Sum of all factors of $N/a$ ]
51.	If 'a' is prime to N, then N-a is also prime to N From this, sum of all coprimes of N, that are less than N = $N/2$ .(Number of coprimes of N less than N)
52.	If a number has 'p' distinct prime factors, then number of ways of expressing N as product of two co-primes is $2^{p-1}$
53.	If p, q are consecutive positive integers and $s = p^2 + q^2 + (pq)^2$ , then s is always an odd integer
54.	The number of divisors of a number $N = a^m b^n c^p$ where a,b,c are prime numbers are $(1+m).(1+n).(1+p)$ and the sum of the divisors is $(a^{m+1} - 1 / a - 1).(b^{n+1} - 1 / b - 1).(c^{p+1} - 1 / c - 1)$
55.	A square cannot end with odd number of zeros
56.	A square cannot end with 2,3,7 or 8
57.	All square numbers can be expressed as $3n$ or $3n + 1$
58.	All square numbers can be expressed as $4n$ or $4n + 1$
59.	If a square number ends in 9, preceding digit is even
60.	Product of 4 consecutive positive integers plus 1 is always a perfect square and odd number i.e. $n.(n+1).(n+2).(n+3) + 1$ is always a perfect square
61.	The cube of any natural number is of the form $4k, 4k+1$ or $4k+3$ , k is an integer
62.	Cube of even number is of the form $4k$
63.	Cube of a number in the form $4k+1$ will be in the form $4x+1$
64.	Cube of a number in the form $4k+3$ will be in the form $4x+3$
65.	If a number has no factors equal to or less than its square root, then that number must be a

	prime number.
66.	All prime numbers $> 3$ can be expressed as $6n \pm 1$ where $n = 1, 2, 3, \dots$
67.	If two positive integers have highest common factor of 1, then they are relatively prime
68.	If sum of the divisors of $N$ , excluding $N$ is equal to $N$ , then $N$ is a perfect number e.g. divisors of 6 : 1, 2, 3 $1+2+3 = 6$
69.	Sum of the reciprocals of the divisors of a perfect number including the number is always 2 e.g. $1/1 + 1/2 + 1/3 + 1/6 = 2$
70.	For any integer $n$ divisible by 4, $2^n - 1$ is divisible by 15
71.	$n!$ is always divisible by 9 when $n > 5$
72.	Product of 3 consecutive integers is divisible by 6 i.e. $n.(n^2 - 1)$ is divisible by 6
73.	If $n$ is prime number greater than 3, then $n^2 - 1$ is divisible by 24
74.	If $n$ is odd number greater than 1, then $n.(n^2 - 1)$ is divisible by 24
75.	The product of any 'n' consecutive positive integers is divisible by $n$ and $n!$
76.	A number is divisible by 8, when the number formed by last 3 right hand digits is divisible by 8 or last 3 digits are 0s
77.	Product of 4 consecutive natural numbers is divisible by 24
78.	If $n = 6p \pm 1$ then $n^2 - 1$ is divisible by 24
79.	If sum of digits of a number is subtracted from the number then the difference is always divisible by 9
80.	Highest power of 2 that divides $2^n!$ is $2^n - 1$
81.	If 'a' is prime, highest power of 'a' that divides $a^n!$ is $(a^n - 1)/(a - 1)$
82.	$49^n + 16n - 1$ is always divisible by 64
83.	$7^{2n} + 2^{3n-3} \cdot 3^{n-1}$ is always divisible by 25
84.	Sum of cubes of 3 consecutive natural numbers is divisible by 9
85.	$3 \cdot 5^{2n+1} + 2^{3n+1}$ is always divisible by 17 where $n$ is a natural number

86.	$10^{2n-1} + 1$ is always divisible by 11
87.	Any single digit number 'N' written p-1 times (p is prime number $\neq 2,3,5$ ) is divisible by p
88.	If a number abcd is divisible by 7, then $a+5b+25c+125d$ is also divisible by 7
89.	Any power of 9 divided by 18 will give a remainder of 9
90.	An even number when divided by an even number will never give an odd remainder but, an odd number when divided by an even number will always give an odd remainder
91.	Cubes of natural numbers will give only 3 remainders -1, 0, 1 when divided by 9
92.	Remainder Theorem: $f(x) \% (x-a) = f(a)$ e.g. $269/9 = (23)23/(23-(-1))$ remainder = $(-1)23 = -1 \rightarrow$ remainder = 8
93.	If A is prime to N, the remainder when $A^p$ is divided by N, where p is the number of numbers less than N and prime to N is 1. If $N = a^x b^y c^z$ , where a,b,c are prime, $p = N(1-(1/a))(1-(1/b))(1-(1/c))$
94.	If 'p' is a prime number and $a \neq p$ then $a^{p-1} \% p = 1$ Note: this is derived from above formula as p-1 and p are co-prime to each other
95.	For any integer n, $n^3 - n$ is divisible by 3, $n^5 - n$ is divisible by 5, $n^7 - n$ is divisible by 7. In general, for any prime number 'p', $n^p - n$ is divisible by p
96.	$a^n + b^n$ is divisible by a+b when n is odd $a^n - b^n$ is always divisible by a-b $a^n - b^n$ is divisible by a+b when n is even
97.	If N is prime $(N-1)! + 1 \% N = 0$ or If N is prime $(N-1)! \% N = N-1$
98.	If an odd number is raised to power of an even number, it will give a remainder 1 when divided by 8
99.	Squares of natural numbers will leave all possible remainders when divided by 9
100.	If given two numbers and asked to select a number that divides the given two numbers leaving the same remainder, then subtract the given two numbers and choose a number from the options, such that remainder when above difference is divided by it is 0