

QUANTITATIVE APTITUDE · CHAPTER 1

Number System

Types of numbers, place value, divisibility, factors, primes, remainders, unit digits, factorials and series — the base for HCF & LCM, Simplification and Algebra.

SSC CGL Tier 1 & 2

SSC CHSL Tier 1

RRB NTPC CBT 1 & 2

SECTION SIZE

CGL 25 Qs · NTPC
30–35 Qs

PYQ FREQUENCY

High

PREREQUISITE

None

STUDY TIME

2 hr theory + 90 min
practice

Why this chapter matters: every shift we checked across CGL, CHSL and NTPC had Number System questions — mostly divisibility, remainders and "which number divides X". They are quick marks once the rules are automatic.

IN THIS CHAPTER

02 Concepts

03 Formula box

04 Shortcuts

05 Traps

06 19 PYQs

07 Practice MCQs

07 Answer key

08 Quick revision

2 PART 2 Concepts & theory

2.1 Classification of numbers

- 1 **Natural numbers (N):** counting numbers 1, 2, 3, ... The smallest is 1; there is no largest.
- 2 **Whole numbers (W):** natural numbers with 0 → 0, 1, 2, ... The smallest is 0.
- 3 **Integers (Z):** whole numbers with negatives → ..., -2, -1, 0, 1, 2, ... 0 is neither positive nor negative.
- 4 **Rational (Q):** p/q with $q \neq 0$. Decimals end (0.25) or repeat (0.333...). Every integer is rational ($5 = 5/1$).

- 5 Irrational:** cannot be written as p/q — $\sqrt{2}$, $\sqrt{3}$, π . The square root of any non-perfect square is irrational.
- 6 Even / odd:** even numbers are divisible by 2; odd numbers are not. 0 is even.
- Even $\pm$ even = even · odd $\pm$ odd = even · even $\pm$ odd = odd.
 - Odd $\times$ odd = odd · even $\times$ anything = even.
- 7 Prime:** exactly two factors, 1 and itself.
- 2 is the only even prime. 1 is neither prime nor composite.
 - 25 primes from 1 to 100: 15 up to 50, and 10 from 51 to 100.
- 8 Composite:** more than two factors. The smallest composite is 4; the smallest odd composite is 9.
- 9 Co-prime:** two numbers with HCF = 1, e.g. (8, 15). Any two consecutive numbers are co-prime.
- 10 Twin primes:** primes that differ by 2 $\rightarrow$ (3, 5), (5, 7), (11, 13), (17, 19), (29, 31), (41, 43).
- 11 Perfect numbers:** sum of factors (excluding the number) equals the number $\rightarrow$ 6, 28, 496.

Real numbers (R)

Rational (Q) · p/q , $q \neq 0$

$3/4$, -0.5 , $0.333\ldots$ — decimals end or repeat

Integers (Z)

$\ldots, -2, -1, 0, 1, 2, \ldots$

Whole numbers (W)

0, 1, 2, 3, ...

Natural numbers (N)

1, 2, 3, ... the counting numbers

Irrational

$\sqrt{2}$ $\sqrt{3}$ π

Decimals never end and never repeat.

Rational + irrational = all real numbers.

$N \subset W \subset Z \subset Q \subset R$. Every natural number is also whole, an integer, rational and real.

25 primes to 100 $\rightarrow$ 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

Recurring decimals to fractions: $0.\overline{ab} = ab/99 \rightarrow 0.\overline{27} = 27/99 = 3/11$. One repeating digit goes over 9; two over 99; three over 999.

Solved example 1**EASY**

Which is irrational: 0.75, 0.333..., $\sqrt{16}$, $\sqrt{7}$?

0.75 = $\frac{3}{4}$ and 0.333... = $\frac{1}{3}$ are rational. $\sqrt{16} = 4$ is rational. 7 is not a perfect square, so $\sqrt{7}$ never ends or repeats. **$\sqrt{7}$**

Solved example 2**EXAM LEVEL**

If a and b are odd numbers, which is always even: $a \times b$, $a + b$, $a \times b + 2$, or $a + b + 1$?

$a \times b = \text{odd} \times \text{odd} = \text{odd}$; adding 2 keeps it odd. $a + b = \text{odd} + \text{odd} = \text{even}$; adding 1 makes it odd.

 $a + b$

2.2 Place value, face value and number of digits

TC

Ten crore

C

Crore

TL

Ten lakh

L

Lakh

TThTen
thousand**Th**

Thousand

H

Hundred

T

Ten

O

One

- 1 Face value** = the digit itself, wherever it sits.
- 2 Place value** = digit $\times$ value of its position. In 57,436 the 7 has place value 7,000.
- 3** For 0, face value and place value are both always 0.
- 4 Indian vs international:** 1 lakh = 100 thousand; 10 lakh = 1 million; 1 crore = 10 million.
- 5 Count of n -digit numbers** = $9 \times 10^{n-1}$. There are 90 two-digit and 900 three-digit numbers.
- 6 Largest / smallest n -digit numbers:** 99...9 and 100...0. Using given digits: arrange descending for the largest, ascending for the smallest (0 cannot lead).

Solved example 3**EASY**

Difference between the place value and face value of 6 in 46,215?

Place value = 6,000; face value = 6 $\rightarrow$ **5,994**

Solved example 4**EXAM LEVEL**

Using the digits 0, 3, 5, 8 once each, find the difference between the largest and smallest four-digit numbers.

Largest = 8530. Smallest = 3058 (0 cannot lead). $8530 - 3058 =$ **5,472**

2.3 Divisibility rules

Divisor	Rule	Example
2	Last digit even (0, 2, 4, 6, 8)	3,578 ✓
3	Digit sum divisible by 3	4,317 → 15 ✓
4	Last two digits divisible by 4	7,316 → 16 ✓
5	Last digit 0 or 5	8,435 ✓
6	Divisible by both 2 and 3	4,326 ✓
7	Double the last digit, subtract from the rest; repeat	343 → 34 – 6 = 28 ✓
8	Last three digits divisible by 8	51,128 → 128 ✓
9	Digit sum divisible by 9	7,281 → 18 ✓
10	Last digit 0	4,560 ✓
11	(Odd-place sum) – (even-place sum) = 0 or a multiple of 11	9,163 → 15 – 4 = 11 ✓
12	Divisible by both 3 and 4	1,644 ✓
13	Add 4 × last digit to the rest; repeat	1,729 → 172 + 36 = 208 → 20 + 32 = 52 ✓
16	Last four digits divisible by 16	3,10,256 → 0256 ✓
25	Last two digits 00, 25, 50 or 75	4,375 ✓

Composite divisors: split into **co-prime** factors and test each. $72 = 8 \times 9$, $88 = 8 \times 11$, $99 = 9 \times 11$, $22 = 2 \times 11$. Never 6×12 for 72 — they share a factor.

The 1001 trick: $1001 = 7 \times 11 \times 13$. Any six-digit number of the form $abcabc$ (567567) is divisible by 7, 11 and 13 together.

Solved example 5

EXAM LEVEL

If $57x632$ is divisible by 9, find the smallest x .

Digit sum = $23 + x$. The next multiple of 9 above 23 is 27 → **$x = 4$**

Solved example 6**EXAM LEVEL**

If 3 8 x 4 9 6 is divisible by 11, find x.

From the right — odd places: $6 + 4 + 8 = 18$; even places: $9 + x + 3 = 12 + x$. Difference $6 - x = 0$
 $\rightarrow$ **x = 6** Check: $386,496 \div 11 = 35,136 \checkmark$

2.4 Testing large primes — the osculator method

- 1 NTPC regularly asks "which of these numbers divides X?" with options like 23, 29, 97, 103. Use the **osculator** to test quickly.
- 2 **Positive osculator k**: repeatedly do (number without last digit) + $k \times$ (last digit). If the end result is a multiple of the divisor, so was the original.
- 3 **Negative osculator k**: same, but subtract: (rest) - $k \times$ (last digit).
- 4 Option shortcut: strike out options using 2, 3, 5, 9 and 11 first. Often only one prime option is left to test.

Divisor	Osculator	Divisor	Osculator
7	-2 (subtract 2x)	19	+2 (add 2x)
13	+4 (add 4x)	23	+7 (add 7x)
17	-5 (subtract 5x)	29	+3 (add 3x)
31	-3 (subtract 3x)	41	-4 (subtract 4x)

Solved example 7**NTPC LEVEL**

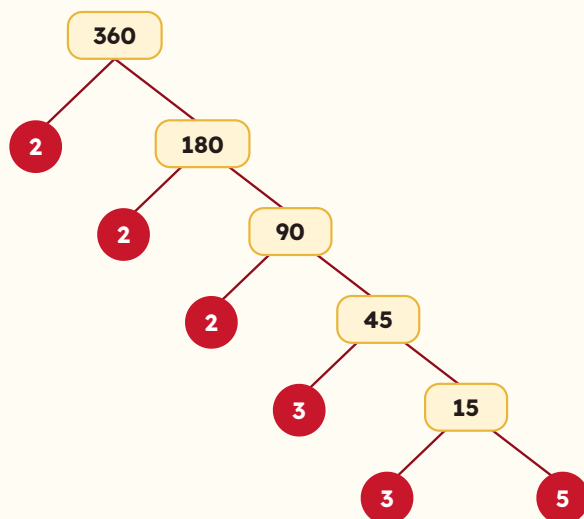
Is 726179 divisible by 23?

Osculator +7: $72617 + 63 = 72680 \rightarrow 7268 + 0 = 7268 \rightarrow 726 + 56 = 782 \rightarrow 78 + 14 = 92 = 23 \times 4$. **Yes**

2.5 Factors

- 1 Write N in **prime-factor form**: $N = a^p \times b^q \times c^r$.
- 2 **Number of factors** = $(p + 1)(q + 1)(r + 1)$.
- 3 **Odd factors**: drop the power of 2, apply the same formula. **Even factors** = total - odd.
- 4 **Factors divisible by k**: take k out first, then count factors of $N \div k$.

- 5 **Sum of factors** = $[(a^{p+1} - 1)/(a - 1)] \times [(b^{q+1} - 1)/(b - 1)] \times \dots$
- 6 **Product of factors** = $N^{(\text{number of factors} \div 2)}$
- 7 A **perfect square** always has an **odd** number of factors; every other number has an even number.
- 8 Ways to write N as a product of two factors = $\text{factors} \div 2$ (perfect square: $(\text{factors} + 1) \div 2$).



PRIME FACTOR FORM

$$2^3 \times 3^2 \times 5^1$$

$$\text{Factors} = (3+1)(2+1)(1+1) = 24$$

$$\text{Odd factors} = (2+1)(1+1) = 6$$

$$\text{Even factors} = 24 - 6 = 18$$

$$\text{Sum} = 15 \times 13 \times 6 = 1170$$

- prime — branch stops
- composite — keep splitting

Factor tree of 360: split off the smallest prime each time until only primes are left.

Solved example 8

EXAM LEVEL

$N = 2^3 \times 3^2 \times 5 \times 7$. How many factors of N are divisible by 5?

Take one 5 out: $N \div 5 = 2^3 \times 3^2 \times 7$. Factors = $4 \times 3 \times 2 =$ **24**

2.6 Primes and prime factorisation

- 1 **Testing N :** find $\sqrt{N}$ and divide by every prime up to it. If none divides, N is prime.
- 2 Every prime above 3 is of the form $6k \pm 1$ — but not every $6k \pm 1$ is prime (25, 35).
- 3 Every whole number above 1 has exactly one prime factorisation.
- 4 **Counting primes in a range:** check only odd numbers not ending in 5, then test each by primes up to its square root.

Solved examples 9 & 10

EASY

Is 221 prime? $\sqrt{221} \approx 14.9$. Test 2, 3, 5, 7, 11, 13 $\rightarrow 221 = 13 \times 17$. **Not prime**

Is 179 prime? $\sqrt{179} \approx 13.4$. None of 2, 3, 5, 7, 11, 13 divides it. **Prime**

2.7 Remainders

- 1 **Dividend = Divisor $\times$ Quotient + Remainder**, with $0 \leq \text{remainder} < \text{divisor}$.
- 2 Remainder of a sum or product = sum or product of the remainders, divided again.
- 3 **Negative remainder:** under $\div 8$, a remainder of 7 can be used as -1 .
- 4 **Powers:**
 - $a^n \div (a - 1) \rightarrow$ remainder 1.
 - $a^n \div (a + 1) \rightarrow 1$ if n is even; a if n is odd.
- 5 **$a^n - b^n$** is divisible by $(a - b)$ always, and by $(a + b)$ when n is even. **$a^n + b^n$** is divisible by $(a + b)$ when n is odd.
- 6 **Fermat:** if p is prime and a is not a multiple of p , $a^{p-1} \div p$ leaves 1.
- 7 **Same number, smaller divisor:** if $N \div 512$ leaves 67 and 32 divides 512, then $N \div 32$ leaves $67 \div 32 \rightarrow 3$.
- 8 **Smallest number to add / subtract:** find remainder r . To subtract $\rightarrow r$. To add $\rightarrow \text{divisor} - r$.
- 9 **Nearest multiple:** compare r with divisor $- r$; pick the smaller move.
- 10 **Same remainder r from several divisors:** $N = k \times \text{LCM}(\text{divisors}) + r$.

Solved example 11

EXAM LEVEL

Remainder when $17 \times 23 \times 29$ is divided by 8?

$17 \rightarrow 1, 23 \rightarrow -1, 29 \rightarrow 5$. Product $-5 \rightarrow -5 + 8 =$ **3**

Solved example 12

TOUGH

Remainder when 3^{100} is divided by 7?

Fermat: 3^6 leaves 1. $100 = 6 \times 16 + 4 \rightarrow$ same as $3^4 = 81 \rightarrow 81 \div 7$ leaves **4**

Solved example 13

EXAM LEVEL

Smallest number that leaves remainder 3 when divided by 4, 5 and 6 (other than 3)?

$\text{LCM}(4, 5, 6) = 60 \rightarrow N = 60k + 3$. Smallest after 3 is **63**

2.8 Unit digit and cyclicity

- 1 The unit digit of a product or sum depends only on the unit digits of the numbers.

- 2 **For x^n :** divide n by 4, take remainder r , pick the r -th term of the cycle. $r = 0 \rightarrow$ 4th term.
- 3 0, 1, 5, 6 never change. 4 and 9 alternate (odd power $\rightarrow$ first term, even power $\rightarrow$ second term).
- 4 $n!$ for $n \geq 5$ ends in 0, so in sums like $1! + 2! + \dots + 100!$ only $1!$ to $4!$ matter $\rightarrow 33 \rightarrow$ unit digit 3.

Digit	$r = 1$	$r = 2$	$r = 3$	$r = 0$
2	2	4	8	6
3	3	9	7	1
7	7	9	3	1
8	8	4	2	6
4	4	6	4	6
9	9	1	9	1

r = remainder when the power is divided by 4. The red column ($r = 0$) is where most students slip.

Solved example 14

EASY

Unit digit of 7^{95} ?

$95 \div 4$ leaves 3 $\rightarrow$ third term of (7, 9, 3, 1) = **3**

Solved example 15

EXAM LEVEL

Unit digit of $7^{23} + 3^{17}$?

$7^{23} \rightarrow 23 \div 4$ leaves 3 $\rightarrow$ 3. $3^{17} \rightarrow 17 \div 4$ leaves 1 $\rightarrow$ 3. $3 + 3 =$ **6**

2.9 Trailing zeros and highest power in $n!$

- 1 $n! = 1 \times 2 \times 3 \times \dots \times n$, and $0! = 1$.
- 2 Each trailing zero needs one 2×5 . In $n!$ there are more 2s than 5s, so **count the 5s**.
- 3 **Trailing zeros** = $\lfloor n/5 \rfloor + \lfloor n/25 \rfloor + \lfloor n/125 \rfloor + \dots$
- 4 **Highest power of prime p in $n!$** = $\lfloor n/p \rfloor + \lfloor n/p^2 \rfloor + \lfloor n/p^3 \rfloor + \dots$
- 5 For a product that is not a factorial, count 2s and 5s separately; take the smaller.

Solved examples 16–18**EXAM LEVEL****Zeros in 100!** $\rightarrow 20 + 4 =$ **24****Zeros in 250!** $\rightarrow 50 + 10 + 2 =$ **62****Highest power of 3 in 50!** $\rightarrow 16 + 5 + 1 =$ **22****2.10 Sums, averages and counting multiples**

Series	Sum	Average
First n natural numbers	$n(n + 1)/2$	$(n + 1)/2$
First n whole numbers (0 to $n-1$)	$n(n - 1)/2$	$(n - 1)/2$
First n even numbers	$n(n + 1)$	$n + 1$
First n odd numbers	n^2	n
Squares of first n	$n(n + 1)(2n + 1)/6$	—
Cubes of first n	$[n(n + 1)/2]^2$	—
First 10 primes	129	12.9
Any AP	$(\text{terms}/2)(\text{first} + \text{last})$	$(\text{first} + \text{last})/2$

Counting: terms in an AP = $(\text{last} - \text{first})/d + 1$. Multiples of k from 1 to $N = \lfloor N/k \rfloor$.**Solved examples 19–21****EXAM LEVEL****51 + 52 + ... + 100** $\rightarrow 5050 - 1275 =$ **3775****Average of first 100 even numbers** $\rightarrow n + 1 =$ **101****Numbers between 100 and 300 divisible by 7** $\rightarrow$ first 105, last 294 $\rightarrow (294 - 105)/7 + 1 =$ **28**

Formula box

Memorise these 14

MUST KNOW

- | | | |
|----|--|-------------------------------|
| 1 | Dividend = Divisor $\times$ Quotient + Remainder | $D = dQ + R$ |
| 2 | $N = a^p b^q c^r \rightarrow \text{factors} = (p+1)(q+1)(r+1)$ | Add 1 to each power, multiply |
| 3 | Sum of factors = $\prod (a^{p+1} - 1)/(a - 1)$ | GP sum for each prime |
| 4 | Product of factors = $N^{\text{factors}/2}$ | |
| 5 | Zeros in $n! = \lfloor n/5 \rfloor + \lfloor n/25 \rfloor + \lfloor n/125 \rfloor + \dots$ | Count the 5s |
| 6 | Unit digit of $x^n \rightarrow n \div 4$; remainder 0 = 4th term | Cycle of 4 |
| 7 | $a^n \div (a - 1) \rightarrow 1 \cdot a^n \div (a + 1) \rightarrow 1$ (n even), a (n odd) | |
| 8 | $a^{p-1} \div p \rightarrow \text{remainder } 1$ (p prime) | Fermat |
| 9 | Smallest to add = divisor - remainder; to subtract = remainder | |
| 10 | Osculators: 7 (-2), 13 (+4), 17 (-5), 19 (+2), 23 (+7), 29 (+3), 31 (-3), 41 (-4) | For "which number divides X" |
| 11 | $\sum n = n(n+1)/2 \cdot \sum n^2 = n(n+1)(2n+1)/6 \cdot \sum n^3 = [n(n+1)/2]^2$ | |
| 12 | Average: first n even = $n + 1$ · first n odd = n · first n natural = $(n+1)/2$ | |
| 13 | $1001 = 7 \times 11 \times 13 \rightarrow \text{abcabc divisible by all three}$ | |
| 14 | 25 primes to 100 · 2 is the only even prime · 1 is neither | |

Shortcuts & exam tricks

Negative remainder

Swap a big remainder for (remainder – divisor).
 $23 \div 8 \rightarrow$ use -1 , not 7 . Powers of -1 are instant.

Unit digit only

Cut every number to its last digit first. $1,237^{43}$ is just 7^{43} .

Co-prime split

Check $22, 72, 88, 99$ by co-prime parts: $2 \times 11, 8 \times 9, 8 \times 11, 9 \times 11$.

Cheapest rule first

In "which number divides X ", strike out options with $2, 3, 5, 9, 11$ first, then use an osculator on what is left.

Shuffled digits

Rearranging digits keeps the digit sum, so divisibility by 3 and 9 survives. Divisibility by 11 does not.

Last digit of a square

Squares end only in $0, 1, 4, 5, 6$ or 9 . Ending in $2, 3, 7$ or $8 \rightarrow$ never a perfect square.

Common mistakes & traps

WATCH OUT

- | | |
|---|---|
| ✗ Calling 1 a prime. | ✓ 1 is neither prime nor composite. |
| ✗ Remainder 0 in cyclicity $\rightarrow$ 1st term. | ✓ Remainder 0 means the 4th term. |
| ✗ Testing 72 as 6×12 . | ✓ Use co-prime factors 8×9 . |
| ✗ Zeros in $125! = 25$. | ✓ $25 + 5 + 1 = 31$. Don't stop at $\lfloor n/5 \rfloor$. |
| ✗ "Between 100 and 300 " counted from 100 . | ✓ Find the first and last multiple inside the range; check if endpoints are included. |
| ✗ Answering the remainder in "smallest number to add". | ✓ Answer = divisor – remainder. |
| ✗ Using 0 as a digit when the question says "natural number". | ✓ Natural numbers start at 1 (CHSL 5 Jul 2024 used exactly this). |
| ✗ Treating co-prime as prime. | ✓ $(8, 9)$ are co-prime; neither is prime. |

Previous year questions

19 questions taken word for word from real CGL, CHSL and NTPC papers. Answers are worked out independently and checked; the published papers do not mark the official key.

SSC CGL Tier 1 · 2024

SSC CGL Tier 1 11 Sep 2024 · Shift 1

In a division problem, the divisor is 4 times the quotient and 2 times the remainder. If the remainder is 32, then find the dividend.

(a) 1065

(b) 3240

(c) 1650

(d) 1056

Solution: Divisor = $2 \times 32 = 64$. Quotient = $64 \div 4 = 16$. Dividend = $64 \times 16 + 32 = 1056$.

SSC CGL Tier 1 11 Sep 2024 · Shift 1

Find the smallest number to be added to 999, so that 99 divides the sum exactly.

(a) 90

(b) 0

(c) 9

(d) 99

Solution: $999 = 99 \times 10 + 9$. Add $99 - 9 = 90$. **Trap:** option (c) is the remainder.

SSC CGL Tier 1 9 Sep 2024 · Shift 1

Which of the following can be the value of 'k' so that the number 217924k is divisible by 6?

(a) 2

(b) 6

(c) 0

(d) 4

Solution: Digit sum $25 + k$ must be a multiple of 3 $\rightarrow k = 2, 5$ or 8 . It must also be even $\rightarrow 2$ or 8 . Only 2 is offered.

SSC CHSL Tier 1

1 Jul 2024 · Shift 1

What will be the least value of x so that the 5-digit number $627x5$ becomes divisible by 9?

(a) 3

(b) 9

(c) 4

(d) 7

Solution: $6 + 2 + 7 + 5 = 20 + x$. Next multiple of 9 is 27 $\rightarrow x = 7$.

SSC CHSL Tier 1

3 Jul 2024 · Shift 1

An 8 digit number is divisible by 99. If the digits are shuffled, then the number is always divisible by _____.

(a) 9

(b) 11

(c) 6

(d) 5

Solution: $99 = 9 \times 11$. Shuffling keeps the digit sum, so divisibility by 9 survives; the 11-test depends on positions, so it may fail.

SSC CHSL Tier 1

3 Jul 2024 · Shift 1

When a number is divided by 512 it leaves a remainder 67. If the same number is divided by 32, then what will be the remainder?

(a) 5

(b) 0

(c) 4

(d) 3

Solution: 32 divides 512, so the remainder is $67 \div 32 \rightarrow 3$.

SSC CHSL Tier 1

4 Jul 2024 · Shift 1

Which of the following numbers is divisible by 22?

(a) 654320

(b) 893002

(c) 602351

(d) 645372

Solution: $22 = 2 \times 11$. (c) is odd — out. For 893002 from the right: $(2 + 0 + 9) - (0 + 3 + 8) = 0 \checkmark$. (a) gives $8 - 12$ and (d) gives $9 - 18$ — not multiples of 11.

SSC CHSL Tier 1

4 Jul 2024 · Shift 1

The number nearest to 7658 and exactly divisible by 45 is:

(a) 7645

(b) 7660

(c) 7640

(d) 7650

Solution: $7658 \div 45$ leaves 8. Subtracting 8 ($\rightarrow 7650$) is a smaller move than adding 37 ($\rightarrow 7695$).

SSC CHSL Tier 1

5 Jul 2024 · Shift 1

If $3c2933k$ is divisible by both 5 and 11, where c and k are single digit natural numbers, then $c + k = \underline{\hspace{2cm}}$.

(a) 6

(b) 8

(c) 5

(d) 7

Solution: Divisible by 5 and natural $\rightarrow k = 5$ (not 0). In $3c29335$ from the right: $(5 + 3 + 2 + 3) - (3 + 9 + c) = 1 - c = 0 \rightarrow c = 1$. $c + k = 6$.

SSC CHSL Tier 1

11 Jul 2024 · Shift 1

If the number $6p5157q$ is divisible by 88, then $p \times q = \underline{\hspace{2cm}}$, where p and q are single digit numbers.

(a) 12

(b) 18

(c) 20

(d) 15

Solution: $88 = 8 \times 11$. For 8: $57q$ divisible by 8 $\rightarrow q = 6$ (576). For 11, in $6p51576$ from the right: $(6 + 5 + 5 + 6) - (7 + 1 + p) = 14 - p = 11 \rightarrow p = 3$. $p \times q = 18$.

RRB NTPC

CBT 1 · 2025

RRB NTPC Graduate CBT 1

5 Jun 2025 · Shift 3

Which of the following numbers is divisible by 7?

(a) 894

(b) 87

(c) 875

(d) 687

Solution: 875: $87 - 2 \times 5 = 77 = 7 \times 11 \checkmark$. ($875 = 7 \times 125$.)

RRB NTPC Graduate CBT 1

6 Jun 2025 · Shift 1

What is the average of the first 10 prime numbers?

(a) 15.8

(b) 14

(c) 16

(d) 12.9

Solution: $2 + 3 + 5 + 7 + 11 + 13 + 17 + 19 + 23 + 29 = 129 \rightarrow 129 \div 10 = 12.9$.

RRB NTPC Graduate CBT 1

6 Jun 2025 · Shift 2

Which of the following numbers is divisible by 41?

(a) 7995

(b) 7431

(c) 8537

(d) 7889

Solution: Osculator -4 : $799 - 20 = 779 \rightarrow 77 - 36 = 41 \checkmark$. ($7995 = 41 \times 195$.)

Which of the following numbers is divisible by both 6 and 31?

(a) 3720

(b) 2132

(c) 4916

(d) 2858

Solution: Divisible by 6 needs digit sum a multiple of 3: only 3720 (sum 12) qualifies. $3720 = 186 \times 20$ ✓.

What smallest number should be added to 81661 so that the sum is completely divisible by 73?

(a) 25

(b) 24

(c) 26

(d) 30

Solution: $81661 = 73 \times 1118 + 47$. Add $73 - 47 = 26$.

Which of the following numbers divide 726179?

(a) 29

(b) 28

(c) 23

(d) 20

Solution: Odd and not ending in 0 $\rightarrow$ 28 and 20 are out. Osculator for 23 (+7) gives $92 = 23 \times 4$ ✓ (see Solved example 7).

The number of prime numbers lying between 393 and 401, both included, is:

(a) 7

(b) 2

(c) 3

(d) 1

Solution: Odd candidates not ending in 5: 393, 397, 399, 401. $393 = 3 \times 131$; $399 = 3 \times 133$. 397 and 401 are prime $\rightarrow$ 2.

If the 6-digit number N37M01 is divisible by 11, then which of the options below can give possible correct relation between M and N?

(a) $M = N$

(b) $M - N = 1$

(c) $M - N = 3$

(d) $M + N = -3$

Solution: From the right: $(1 + M + 3) - (0 + 7 + N) = M - N - 3 = 0 \rightarrow M - N = 3$.

Which of the following numbers divides 54,10,96,943?

(a) 103

(b) 97

(c) 87

(d) 107

Solution: Digit sum 43 $\rightarrow$ not divisible by 3, so 87 ($= 3 \times 29$) is out. Direct division: $541096943 = 97 \times 5578319 \checkmark$.

Trend: CHSL leans on divisibility by composite numbers (22, 88, 99) and remainder transfer. NTPC repeatedly asks "which number divides X" with large prime options — learn the osculator table and option elimination.



PART 7

Practice MCQs

Level 1 · Basic

Q1–Q8 · 30 sec each

Level 2 · Exam level

Q9–Q16 · 45 sec each

Level 3 · CGL Tier 2

Q17–Q20 · 60–90 sec each

Level 1 — Basic

Q1 Which is NOT a prime number?
(a) 89 (b) 91 (c) 97 (d) 83

Q2 The smallest composite number is:
(a) 1 (b) 2 (c) 4 (d) 9

Q3 Place value of 5 in 3,58,642:
(a) 5 (b) 500 (c) 5,000 (d) 50,000

Q4 Which number is divisible by 9?
(a) 4,563 (b) 7,421 (c) 8,134 (d) 2,345

Q5 The unit digit of 3^{42} is:
(a) 1 (b) 3 (c) 7 (d) 9

Q6 The number of factors of 72 is:
(a) 10 (b) 12 (c) 8 (d) 6

Q7 Sum of the first 20 natural numbers:
(a) 200 (b) 210 (c) 220 (d) 190

Q8 Remainder when 2^{50} is divided by 3:
(a) 0 (b) 1 (c) 2 (d) Cannot be found

Level 2 — Exam level

Q9 If 53×82 is divisible by 11, x is:
(a) 2 (b) 4 (c) 6 (d) 8

Q10 Trailing zeros in $200!$:
(a) 40 (b) 48 (c) 49 (d) 50

Q11 Remainder when $17 \times 19 \times 23$ is divided by 9:
(a) 2 (b) 4 (c) 5 (d) 7

Q12 Unit digit of $7^{105} \times 4^{62}$:
(a) 2 (b) 4 (c) 6 (d) 8

Q13 Numbers between 200 and 500 divisible by 13:
(a) 22 (b) 23 (c) 24 (d) 25

Q14 Number of even factors of 240:
(a) 16 (b) 20 (c) 4 (d) 12

Q15 A number leaves 40 when divided by 63. Remainder when divided by 9?
(a) 1 (b) 4 (c) 5 (d) 7

Q16 $1^2 + 2^2 + \dots + 15^2 = ?$
(a) 1240 (b) 1225 (c) 1360 (d) 1140

Level 3 — Tough

Q17 Remainder when 5^{100} is divided by 7:
(a) 1 (b) 2 (c) 4 (d) 6

Q18 Sum of all factors of 72:
(a) 180 (b) 195 (c) 210 (d) 168

Q19 Highest power of 7 dividing 500!:
(a) 71 (b) 81 (c) 82 (d) 83

Q20 $47^{43} + 43^{43}$ is always divisible by:
(a) 4 (b) 47 (c) 90 (d) 43

Score yourself: ____ / 20 · Time taken: ____ min

7.1 Answer key

1 B	2 C	3 D	4 A	5 D	6 B	7 B	8 B	9 B	10 C
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11 B	12 A	13 B	14 A	15 B	16 A	17 B	18 B	19 C	20 C
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Q9 Odd places $7 + x$, even places $11 \rightarrow x - 4 = 0 \rightarrow x = 4$. Check $53,482 \div 11 = 4,862$.

Q10 $40 + 8 + 1 = 49$.

Q11 $17 \rightarrow -1$, $19 \rightarrow 1$, $23 \rightarrow 5$. Product $-5 \rightarrow -5 + 9 = 4$.

Q12 $7^{105} \rightarrow 7$; 4 to an even power $\rightarrow 6$; $7 \times 6 = 42 \rightarrow 2$.

Q13 208 (13×16) to 494 (13×38) $\rightarrow 38 - 16 + 1 = 23$.

Q14 $240 = 2^4 \times 3 \times 5 \rightarrow$ total 20, odd 4, even 16.

Q15 9 divides 63, so $40 \div 9$ leaves 4.

Q16 $15 \times 16 \times 31 / 6 = 1240.$

Q17 5^6 leaves 1; $100 = 96 + 4 \rightarrow 5^4 = 625 \rightarrow 625 - 623 = 2.$

Q18 $(2^4 - 1) \times (3^3 - 1)/2 = 15 \times 13 = 195.$

Q19 $71 + 10 + 1 = 82.$

Q20 Odd power $\rightarrow a^n + b^n$ divisible by $a + b = 90.$

One-page quick revision

Night-before sheet · Number System

QA-01

TOP 12 POINTS

1. $N \subset W \subset Z \subset Q \subset R$. 1 is neither prime nor composite; 2 is the only even prime.
2. 25 primes to 100. Test primes only up to $\sqrt{N}$.
3. Dividend = Divisor $\times$ Quotient + Remainder.
4. Composite divisors $\rightarrow$ co-prime factors ($22 = 2 \times 11$, $88 = 8 \times 11$).
5. 11-rule: odd-place sum – even-place sum = 0 or 11k.
6. Large primes $\rightarrow$ osculators: 13 (+4), 23 (+7), 41 (–4).
7. Factors of $a^p b^q = (p+1)(q+1)$. Odd factors $\rightarrow$ drop the 2s.
8. Unit digit: power $\div 4$; remainder 0 $\rightarrow$ 4th term.
9. Zeros in $n!$ $\rightarrow$ divide by 5, 25, 125 ... and add.
10. Smaller divisor of the original divisor $\rightarrow$ remainder $\div$ new divisor.
11. Smallest number to add = divisor – remainder.
12. Average of first n even = $n + 1$; first n odd = n .

$$N \subset W \subset Z \subset Q \subset R$$

TOP 3 TRAPS

- Remainder 0 in a cycle means the 4th term.
- "Smallest number to add" is not the remainder.
- "Natural number" digits cannot be 0.

SELF-CHECK

- ☐ Level 2 question in under 45 seconds
- ☐ Osculator table recalled without looking
- ☐ All 19 PYQs solved once