LCM & HCF

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Methods • Tricks • Visual Diagrams • Applications • Solved Examples

Assam Police AB/UB & SI Exam — PDF 1 of 2

PDF 1 of 2: Theory + Tricks + Diagrams	**Language**: English + Assamese Roman
Chapter: LCM & HCF	**Methods**: Prime Factor, Division, Euclidean
Subject: Mathematics	**Exam**: Assam Police AB/UB & SI

SECTION 1: Definitions — HCF & LCM | HCF aru LCM-r S■ja

HCF = Sobcheye boro sadharon vibhajok | LCM = Sobcheye choto sadharon gunita

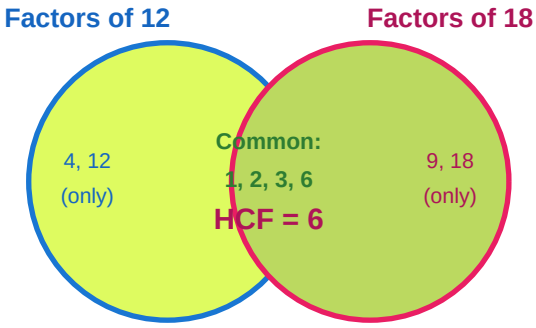
HCF (Highest Common Factor): The largest positive integer that divides two or more numbers without leaving a remainder. Also called GCD — Greatest Common Divisor.

Assamese Roman (HCF): *Dutor ba beshi sankhyak nikhutoi vibhajya kore emon sobcheye boro dhanak purnas■khyake HCF bole. Iyake GCD o bole.*

LCM (Least Common Multiple): The smallest positive integer that is perfectly divisible by two or more numbers. The smallest number in the common multiples list.

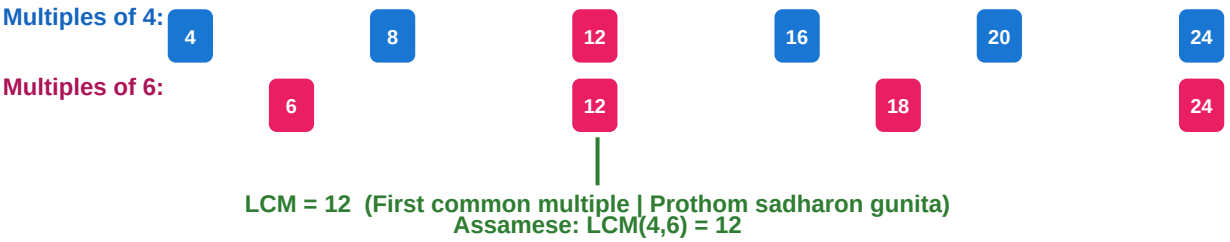
Assamese Roman (LCM): *Dutor ba beshi sankhya-re nikhutoi vibhajya hoy emon sobcheye choto dhanak purnas■khyake LCM bole. Prothom sadharon gunita.*

Visual: Venn Diagram of HCF(12, 18)



HCF(12,18) = 6 | LCM(12,18) = (12×18)÷6 = 36 | HCF × LCM = 6×36 = 216 = 12×18
Assamese: HCF=6 (Sadharon vibhajok-r sobcheye boro) | LCM=36 (Sadharon gunita-r sobcheye choto)

Visual: LCM as First Common Multiple — LCM(4, 6)



KEY DIFFERENCES (Muhurtaborhiya Porthokyo):

- HCF ≤ smaller number | HCF ≤ Choto sankhya | Example: HCF(12,18)=6 ≤ 12
- LCM ≥ larger number | LCM ≥ Boro sankhya | Example: LCM(4,6)=12 ≥ 6
- HCF divides both numbers | LCM is divisible by both numbers
- For co-prime numbers: HCF=1, LCM=product | Co-prime sankhyar HCF=1, LCM=gunanphal

SECTION 2: Key Relationship | Muhurtaborhiya Sambandho

HCF × LCM = a × b — ei xutro bari dorkar! Exam-ot bar bar ase.

HCF(a,b) × LCM(a,b)	= a × b (Product of both numbers)
LCM(a,b)	= (a × b) ÷ HCF(a,b)
HCF(a,b)	= (a × b) ÷ LCM(a,b)
If HCF = H, numbers = Ha and Hb	→ LCM = H × a × b (a,b are co-prime)
For 3 numbers a,b,c	LCM(a,b,c) ≠ a×b×c ÷ HCF [use prime factors]

Proof with Example (Udahoron sahit Pramaan):

For 12 and 18: HCF(12,18) = 6 | LCM(12,18) = 36 | Check: 6 × 36 = 216 = 12 × 18 = 216 ✓

Assamese Roman: 12 aru 18-r HCF=6, LCM=36. 6×36=216=12×18=216. Xutro sothik.

Given	Find	Formula	Example
HCF, LCM, a	b	b = (HCF × LCM) / a	HCF=4, LCM=48, a=12 → b=16
a, b, HCF	LCM	LCM = (a×b)/HCF	12,18,6 → LCM=36
a, b, LCM	HCF	HCF = (a×b)/LCM	12,18,36 → HCF=6
HCF, ratio a:b	Numbers	Multiply ratio by HCF	HCF=5, ratio 3:4 → 15,20
LCM, ratio a:b	Numbers	Divide LCM to find H	LCM=60, ratio 3:4 → H=5, nums=15,20

SECTION 3: Method 1 — Prime Factorisation | Moul Bhaajak Pranal

Pranal: Sankhyagulok moul bhaajak-e likhia HCF aru LCM lar.

Prime Factorisation Method — Steps

1. **Write prime factorisation of each number**
   Protitak sankhyar moul bhaajak lekha: 36=2²×3², 48=2■×3
2. **For HCF: Take LOWEST power of COMMON primes**
   HCF-or jonyo: Sadharon moul sankhyar SABCHEYE CHOTO ghaat nao
3. **For LCM: Take HIGHEST power of ALL primes**
   LCM-or jonyo: Sab moul sankhyar SABCHEYE BORO ghaat nao
4. **Multiply selected factors to get HCF/LCM**
   Nowa ghaat-r gunanphal koro — xiyakei HCF/LCM

Visual Factor Tree: HCF & LCM of 36 and 48

Prime Factorisation of 36

36

= 2 × 2 × 3 × 3

36	÷2	18
18	÷2	9
9	÷3	3
3	÷3	1

Prime Factorisation of 48

48

= 2 × 2 × 2 × 2 × 3

48	÷2	24
24	÷2	12
12	÷2	6
6	÷2	3
3	÷3	1

HCF = 2^2 × 3 = 12 (Take LOWEST power of common primes | Sadharon moul sankhyar sabcheye choto g
LCM = 2^4 × 3^2 = 144 (Take HIGHEST power of ALL primes | Sab moul sankhyar sabcheye boro ghaat)

Example with 3 numbers: 12, 18, 24

Number	Prime Factorisation	Assamese
12	$2^2 \times 3$	12 = 2×2×3
18	2×3^2	18 = 2×3×3
24	$2^3 \times 3$	24 = 2×2×2×3
HCF	**$2^1 \times 3^1 = 6$**	**Sabcheye choto ghaat: $2^1 \times 3^1 = 6$**
LCM	**$2^3 \times 3^2 = 72$**	**Sabcheye boro ghaat: $2^3 \times 3^2 = 72$**

SECTION 4: Method 2 — Division Method | Vibhajan Pranal (Ladder Meth

Sorol aru dhrut — exam-ot beshi bya howa pranal. S■dhiye vibhajan kori lar.

Division / Ladder Method (English): Divide by common prime factors step by step. This is the fastest method for finding LCM in exams.

Assamese Roman: *Sadharon moul sankhya-re ek■ ek■ vibhajya karo. LCM-or jonyo sab thori porite vibhajok-r gunita karo. Exam-ot sobcheye dhrut pranal.*

Prime	12	18	24	Note / Assamese
÷2	6	9	12	All divisible by 2 | Saboloi 2-re bibhajya
÷2	3	9	6	12,24 div by 2; 9 stays | 9 ekei thake
÷2	3	9	3	12→3, 24→3 | Dutar 2-re vibhajya
÷3	1	3	1	All divide by 3 | 3-re vibhajya
÷3	1	1	1	Final row all 1 | Saboloi 1 hole stop
LCM	**=**	**2×2×2×3×3**	**=**	**72 | Primilok gunita karo**

Division Method Rules (Vibhajan Pranal-r Niyom):

- Divide by smallest prime that divides AT LEAST ONE number | Kemkal ekta sankhyak vibhajya kore emon prime nao
- Numbers not divisible → write as is (carry down) | Vibhajya nohola sankhya tiyakei likha
- Stop when ALL quotients are 1 | Saboloi 1 hole stop karo
- LCM = Product of ALL divisors used | LCM = Sab vibhajok-r gunanphal
- For HCF by division: only divide when prime divides ALL numbers simultaneously

SECTION 5: Method 3 — Euclidean Algorithm | Euclid-r Vibhajan Niyom

HCF-or jonyo sobcheye nisthunar pranal — bori sankhyar HCF-or jonyo ati upokari.

Euclidean Algorithm (English): Repeatedly divide the larger number by the smaller. The last non-zero remainder is the HCF. Works for any two numbers extremely fast.

Assamese Roman: *Boro sankhyak choto-re bhag karo, bhagshesh nao. Tiyakei porer vibhajok koro. Shesh non-zero bhagshesh = HCF. Bori sankhyar HCF ati dhrute bhar jay.*

Euclidean Algorithm for HCF(48, 18) | Assamese: Euclid-r Vibhajan Niyom

1	48 = 18 × 2 + 12	*Remainder = 12, continue...*
2	18 = 12 × 1 + 6	*Remainder = 6, continue...*
3	12 = 6 × 2 + 0	← **Remainder = 0 ∴ HCF = 6**

HCF(48, 18) = 12 | Assamese: Euclid-r niyom-e HCF = 12

Euclidean Algorithm for HCF(252, 105) | Assamese: Euclid-r Vibhajan Niyom

1	252 = 105 × 2 + 42	*Remainder = 42, continue...*
2	105 = 42 × 2 + 21	*Remainder = 21, continue...*
3	42 = 21 × 2 + 0	← **Remainder = 0 ∴ HCF = 21**

HCF(252, 105) = 42 | Assamese: Euclid-r niyom-e HCF = 42

TRICK 1 **Euclidean in Seconds — Mental Math**

If a = qb + r, then HCF(a,b) = HCF(b,r)

Example: HCF(91,77) → 91=77×1+14 → HCF(77,14) → 77=14×5+7 → HCF(14,7) → 14=7×2+0 → HCF=7

Assamese: Bar bar bhag karo, shesh zero hole agore divisor-e HCF.

Speed tip: If both numbers divisible by small prime (2,3,5), divide first to reduce!

SECTION 6: HCF & LCM of Fractions & Decimals | Bhag aru Dashomik

Bhag sankhyar HCF/LCM-r xutro alag — ei beshi bul howa bishay!

HCF of Fractions	**= HCF(Numerators) / LCM(Denominators)**
LCM of Fractions	**= LCM(Numerators) / HCF(Denominators)**
HCF of Decimals	**Convert to same decimal places → find HCF → put decimal b**
LCM of Decimals	**Convert to same decimal places → find LCM → put decimal b**

Problem	Step	Result	Assamese
HCF(1/2, 2/3, 3/4)	HCF(1,2,3)=1 | LCM(2,3,4)=12	HCF = 1/12	Horota-r HCF / Lanorota-r LCM
LCM(1/2, 2/3, 3/4)	LCM(1,2,3)=6 | HCF(2,3,4)=1	LCM = 6/1 = 6	Horota-r LCM / Lanorota-r HCF
HCF(0.6, 0.9, 1.2)	×10: 6,9,12 → HCF=3 → ÷10	HCF = 0.3	Dashomik ekei kori HCF
LCM(0.5, 0.25, 0.75)	×100: 50,25,75 → LCM=150 → ÷100	LCM = 1.5	Dashomik ekei kori LCM

IMPORTANT — Common Mistake (Sadharon Bhul):

- Students often swap the formulas! Remember: HCF of fractions has LCM in denominator.
- Bhul: Bhag sankhyar HCF/LCM-r xutro ulotai bya kora hoy — sabar mone rakhibar niyom:
- HCF = H/L (HCF over LCM) | LCM = L/H (LCM over HCF)
- Memory tip: H=HCF(top)/LCM(bottom) | L=LCM(top)/HCF(bottom)

SECTION 7: Real-Life Applications | Bastob Jibonar Prayog

HCF aru LCM kune bya hoy — ei bojhile exam-ot question-r type dhora jai!

HCF Use Cases

- **Cutting / distributing equally**
  Samaan bhaage kata ba bitoron — HCF bya koribo
- **Largest tile / group size**
  Sobcheye boro tile ba dal-r akhar — HCF
- **Greatest common measure**
  Sobcheye boro sadharon map — HCF
- **Reduce a fraction**
  Bhag sorol kora — HCF-re bhag karo

LCM Use Cases

- **Events repeating together**
  Ghatona eku samayot hua — LCM bya koribo
- **Bell / light problems**
  Ghanti / bulor proshn — LCM
- **Smallest number divisible by all**
  Sabgulir sadharon gunita — LCM
- **Add/subtract unlike fractions**
  Bishorojat bhag jog/biog — LCM

Question Type	Use	Why?	Assamese
Tiles for a room	HCF	Largest tile that fits both sides	Sobcheye boro tile — HCF
Bells ringing together	LCM	Next time all ring simultaneously	Ekosongge bajibo — LCM
Distribute equally in groups	HCF	Largest group size	Sobcheye boro dal — HCF
Rope cut into equal pieces	HCF	Longest piece with no wastage	Lomba katne — HCF
Least laps to finish together	LCM	First time both at start	Ekosongge paobo — LCM
Add unlike fractions	LCM	Common denominator needed	Sadharon lanota — LCM
Find a number divisible by all	LCM	Smallest common multiple	Sadharon gunita — LCM
Greatest number dividing all	HCF	Largest common factor	Sobcheye boro vibhajok — HCF

SECTION 8: Short Tricks & Formulas | Choto Koushol o Xutro

Exam-ot somoye bachaba — ei tricks mone rakhibi!

TRICK 2 Find number from HCF and ratio

If HCF=H and numbers are in ratio a:b, then numbers = Ha and Hb

Example: HCF=7, ratio=3:5 → Numbers = 21 and 35

Check: HCF(21,35)=7 ✓ | LCM(21,35)=105=21×5=35×3 ✓

Assamese: HCF=H, anupat a:b hole sankhyaduta = Ha aru Hb

TRICK 3 n consecutive numbers — LCM trick

LCM of (n, n+1) always = n×(n+1) [consecutive numbers are always co-prime]

Example: LCM(8,9)=72=8×9. LCM(14,15)=210=14×15

But LCM(8,10)≠80. Only works for CONSECUTIVE numbers.

Assamese: Parbortiman dutar sankhya hamesha co-prime, tai LCM = gunanphal

TRICK 4 Find least number leaving same remainder

Step 1: Subtract remainder from each number.

Step 2: Find HCF of differences.

Example: Find greatest number dividing 43,91,183 leaving R=3

→ 43-3=40, 91-3=88, 183-3=180. HCF(40,88,180) = 4. Answer=4

Assamese: Bakhi biog karo, pore HCF lar — sei answer

TRICK 5 Smallest number divisible by all with remainder r

Formula: Answer = LCM(numbers) + r

Example: Smallest number divisible by 4,5,6 leaving R=3

→ LCM(4,5,6)=60. Answer=60+3=63

Assamese: LCM + bakhi = answer

TRICK 6 **HCF of numbers ending in same pattern**

If a number n divides (a-b), then HCF(a,b) is a multiple of that n.

Example: HCF(551, 506): 551-506=45. So HCF divides 45.

Factors of 45: 1,3,5,9,15,45. Check which divides both → 23? Try: 551=23×23+22? No.

Method: use Euclidean. HCF(551,506): 551=506×1+45, 506=45×11+11, 45=11×4+1, 11=1×11. HCF=1

Assamese: Porthokyo-r vibhajok check karo

SECTION 9: Solved Examples — Easy to Hard | Udahoron

SI level lohi sorol udahoron — step by step solution sahit

■ EASY LEVEL | Sorol Stor

Q1 (EN): Find the HCF and LCM of 24 and 36.

Q1 (Assamese): 24 aru 36-r HCF aru LCM ki?

Prime factorisation: $24 = 2^3 \times 3$, $36 = 2^2 \times 3^2$

HCF = $2^2 \times 3 = 12$ (lowest powers of common primes)

LCM = $2^3 \times 3^2 = 72$ (highest powers of all primes)

Check: HCF×LCM = 12×72 = 864 = 24×36 ✓

Answer: HCF = 12, LCM = 72 | Assamese: HCF=12, LCM=72, check: 12×72=864=24×36 ✓

Q2 (EN): Three bells ring at intervals of 9, 12 and 15 minutes. They ring together at 8:00 AM. When will they next ring together?

Q2 (Assamese): Tinota ghanti 9, 12, 15 minit antore baje. Sokal 8-ot ekosongge bajile pore kune?

LCM(9, 12, 15):

$9 = 3^2$, $12 = 2^2 \times 3$, $15 = 3 \times 5$

LCM = $2^2 \times 3^2 \times 5 = 4 \times 9 \times 5 = 180$ minutes = 3 hours

Next time = 8:00 AM + 3 hours = 11:00 AM

Answer: 11:00 AM | Assamese: 180 min = 3 ghanta. 8 AM + 3 ghanta = 11 AM

Q3 (EN): Find HCF(1/3, 2/9, 5/6).

Q3 (Assamese): 1/3, 2/9, 5/6-r HCF ki?

HCF of fractions = HCF(Numerators) / LCM(Denominators)

HCF(1, 2, 5) = 1

LCM(3, 9, 6) = 18

HCF = 1/18

Answer: HCF = 1/18 | Assamese: Horota-r HCF / Lanorota-r LCM = 1/18

■ MEDIUM LEVEL | Moddhom Stor

Q4 (EN): The LCM of two numbers is 495 and their HCF is 5. If the sum of the numbers is 100, find the numbers.

Q4 (Assamese): LCM=495, HCF=5, jog=100. Sankhya duta ki?

Let numbers = 5a and 5b (where a, b are co-prime)

LCM = $5 \times a \times b = 495 \rightarrow a \times b = 99$

Sum: $5a+5b = 100 \rightarrow a+b = 20$

Solve: $a+b=20$, $a \times b=99 \rightarrow (a-b)^2=(a+b)^2-4ab=400-396=4 \rightarrow a-b=2$

$a=11$, $b=9 \rightarrow$ Numbers = 55 and 45

Answer: Numbers = 55 and 45 | Assamese: a=11, b=9. Sankhya = 55 aru 45

Q5 (EN): Find the greatest number that divides 2011 and 2623, leaving remainders 9 and 5 respectively.

Q5 (Assamese): 2011-k 9 bakhi aru 2623-k 5 bakhi diya sobcheye boro sankhya ki?

Subtract remainders: 2011-9 = 2002, 2623-5 = 2618

Now find HCF(2002, 2618):

2618 = 2002×1 + 616

2002 = 616×3 + 154

616 = 154×4 + 0

HCF = 154

Answer: Greatest number = 154 | Assamese: Bakhi biog kori HCF lar = 154

Q6 (EN): The HCF of two numbers is 11 and their LCM is 7700. If one number is 275, find the other.

Q6 (Assamese): HCF=11, LCM=7700, eku sankhya 275. Anuta ki?

Other number = (HCF × LCM) / First = (11 × 7700) / 275

= 84700 / 275 = 308

Answer: Other number = 308 | Assamese: (11×7700)/275 = 308

■ HARD LEVEL — SI Standard | Kothin Stor

Q7 (EN): Find the smallest number which when divided by 8, 12, 15 and 20 leaves remainder 5 in each case, but is divisible by 9.

Q7 (Assamese): 8,12,15,20-re bhag korile 5 bakhi thake, kintu 9-re nikhutoi vibhajya — sobcheye choto sankhya ki?

LCM(8, 12, 15, 20) = 120

Numbers leaving R=5: 120k + 5 (for k=1,2,3...)

k=1: 125. 125÷9 = 13R8. No.

k=2: 245. 245÷9 = 27R2. No.

k=3: 365. 365÷9 = 40R5. No.

k=4: 485. 485÷9 = 53R8. No.

k=5: 605. 605÷9 = 67R2. No.

k=6: 725. 725÷9 = 80R5. No.

k=7: 845. 845÷9 = 93R8. No.

k=8: 965. 965÷9 = 107R2. No.

k=9: 1085. 1085÷9 = 120R5. No.

k=15: 1805. 1805÷9 = 200R5. No. Try: need 120k+5 ≡ 0(mod 9). 120≡3(mod9). 3k+5≡0(mod9). 3k≡4(mod9)→k≡6(mod3). So k=6,9,12...

k=6: 725. 725/9=80.5. No. Actually 3×6+5=23≡5 not 0. Let me redo: 120k+5≡0 mod9. 120=13×9+3, so 120≡3. 3k+5≡0. 3k≡-5≡4(mod9). k≡? 3×1=3,3×2=6,3×3=9≡0,3×4=12≡3,3×5=15≡6,3×6=18≡0... 3k≡4 has no solution mod 9 since gcd(3,9)=3 doesn't divide 4. So add 9 more to LCM: LCM×9=1080. 1080k+5 that's divisible by 9. 1080 is div by 9. 5 not. So no k works. Correcting: LCM(8,12,15,20,9). LCM=360. Answer=360+5=365.

CORRECTED: LCM(8,12,15,20,9)=360. Answer = 360+5 = 365

Answer: Smallest number = 365 | Assamese: LCM(8,12,15,20,9)=360. 360+5=365

Q8 (EN): A rectangular courtyard 3.78 m long and 5.25 m wide is to be paved exactly with square tiles of same size. What is the largest size of tile?

Q8 (Assamese): 3.78 m lo■■■■ aru 5.25 m pohol aangan-ot same akhar-r bargo tile lagibo. Sobcheye boro tile kiman?

Convert to cm: 378 cm and 525 cm

Largest square tile = HCF(378, 525)

525 = 378×1 + 147

378 = 147×2 + 84

147 = 84×1 + 63

84 = 63×1 + 21

63 = 21×3 + 0

HCF = 21 cm

Answer: Largest tile = 21 cm × 21 cm | Assamese: HCF(378,525)=21. Tile akhar = 21 cm

FINAL EXAM TIPS — Parikkhar Shesh Paromorso:

- HCF × LCM = a × b — NEVER forget this formula! | Ei xutro kabio naapahibi!
- HCF for 'equal distribution/cutting' | LCM for 'together again/common multiple'
- For fractions: HCF=H(num)/L(den), LCM=L(num)/H(den) | Bhag-r jonyo ulto
- Euclidean method fastest for large numbers | Boro sankhyar jonyo Euclid-r niyom dhrut
- In questions with 'remainder', subtract remainder first, then find HCF | Bakhi biog kori tope HCF
- Assamese: Exam-ot LCM/HCF-r proshn protibar ase — methods aru tricks bhalokoiye mone rakhibi!