SSC CGL Tier 1 Maths Short Tricks and Formulas

1. Number System Quick Maths Formulas

- ✓ 1 + 2 + 3 + 4 + 5 + … + n = n(n + 1)/2
- ✓ (12 + 22 + 32 + ... + n2) = n (n + 1) (2n + 1) / 6
- ✓ (13 + 23 + 33 + ... + n3) = (n(n + 1)/ 2)2
- ✓ Sum of first n odd numbers = n2
- ✓ Sum of first n even numbers = n (n + 1)
- ✓ (a + b)*(a - b) = (a2 - b2)
- ✓ (a + b)*2 = (a2 + b2 + 2ab)
- ✓ (a - b)*2 = (a2 + b2 - 2ab)
- ✓ (a + b + c)*2 = a2 + b2 + c2 + 2(ab + bc + ca)
- ✓ (a3 + b3) = (a + b)*(a2 - ab + b2)
- ✓ (a3 - b3) = (a - b)*(a2 + ab + b2)
- ✓ (a3 + b3 + c3 - 3abc) = (a + b + c)*(a2 + b2 + c2 - ab - bc - ac)
- ✓ When a + b + c = 0, then a3 + b3 + c3 = 3abc
- ✓ (a + b)*n = an + (nC1)*an-1b + (nC2)*an-2b2 + … + (nCn-1)*abn-1 + bn.

For more Number System Short Tricks Methods, please visit - How to Solve Number System Questions in Exams [Short trick PDF].

2. HCF and LCM Quick Maths Formulas

- ✓ Product of two numbers a and b (a*b) = Their HCF * Their LCM.
  But a*b*c ≠ HCF*LCM

  #Note:
  HCF of two or more numbers is the greatest number which divide all of them without any remainder.
  LCM of two or more numbers is the smallest number which is divisible by all the given numbers.

- ✓ HCF of given fractions = (HCF of Numerator)/(LCM of Denominator)

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- ✓ If d = HCF of a and b, then there exist unique integer m and n, such that -> d = am + bn.

Some important HCF and LCM Rules-

- ✓ **Factors and Multiples**

  If number a, divided another number b exactly, we say that a is a factor of b. In this case, b is called a multiple of a.

- ✓ **Co-primes**

  Two numbers are said to be co-primes if their H.C.F. is 1.

✓ HCF of a given number always divides its LCM.

Methods of finding HCF of two or more numbers

Method 1: Prime Factors Method

Break the given numbers into prime factors and then find the product of all the prime factors common to all the numbers.

The product will be the required HCF.

Example
If you have to find the HCF of 42 and 70.
Then 42 = 2*3*7
And 72 = 2*5*7

Common factors are – 2 and 7 so, HCF = 2*7 =14.

Method 2: Division Method

Divide the greater number by the smaller number, divide the divisor by the remainder, divide the remainder by the next remainder and so on until no remainder is left. The last divisor is required HCF.

To check the complete procedure in example format, then please visit here – [Number System Division and Remainder Rules](#).

Method 3: HCF of Large Numbers

Find the obvious common factor from both the numbers and remove it.
Also remove the prime number (if any found).
Now perform division method to remaining numbers and find the HCF.

Check out the example for better understanding.

Example

If you have to find out the HCF of 42237 and 75582.

Then first check out for the common factor –

42237 = 4693*9

75582 = 2*9*4199

Here we can remove 9 and 2 is a prime number so we can also extract this.

Now calculate with remaining numbers.

After performing Division method - 4693/4199, we get the remainder 494.

Now the remainder 494 is divided by 2 but divisor 4199 is not.

So it should be proceeded further after dividing 494 by 2 i.e. 247.

Now performing division method as – 4199/247, we get the remainder as 0.

Now by multiplying 247 with 9 we can have our required HCF i.e. 247*9=2223.

Methods of finding LCM of two or more numbers

Method 1: Prime Factors Method

Resolve the given numbers into their Prime Factors and then find the product of the highest power of all the factors that occur in the given numbers. The product will be the LCM.

Example

LCM of 8,12,15 and 21.

Now $8 = 2*2*2 = 2^3$

$12 = 2*2*3 = 2^2*3$

$15 = 3*5$

$21 = 3*7$

So highest power factors occurred are – 2^3, 3, 5 and 7

LCM = $2^3*3*5*7 = 840$.

3. Simplification Quick Maths Formulas

'BODMAS' Rule

Through this rule, you can understand the correct sequence in which the operations are to be executed and

This rule depicts the correct sequence in which the operations are to be executed and the sequence can be evaluated.

Here are some rules of simplification given below-

- ✓ B – Bracket

(First of all remove all the brackets strictly in the order (), {} and || and after removing the brackets, you can follow the below sequence)

- ✓ O – Of
- ✓ D - Division,
- ✓ M - Multiplication,
- ✓ A - Addition and
- ✓ S - Subtraction

Modulus of a Real Number

Modulus of a real number a is defined as

$$|a| = \begin{cases} a, \text{ if } a > 0 \\ -a, \text{ if } a < 0 \end{cases}$$

Thus, $|5| = 5$ and $|-5| = -(-5) = 5$.

Vinculum (or Bar):

When an expression contains Vinculum, before applying the 'BODMAS' rule, we simplify the expression under the Vinculum.

4. Square roots & Cube Roots Quick Maths Formulas

Duplex Combination Method for Squaring

In this method either we simply calculate the square by multiplying the same digit twice or we have to perform cross multiplication.

Here are the following Duplex rules and formulas, please check below.

- ✓ a = D = (a*a)
- ✓ ab = D = 2*(a*b)
- ✓ abc = D = 2*(a*c)+$(b)^2$
- ✓ abcd = D = 2*(a*d) + 2*(b*c)
- ✓ abcde = D = 2*(a*e) + 2*(b*d) + $(c)^2$
- ✓ abcdef = D = 2*$(a*f)^2$ + 2*$(b*e)^2$ + 2*$(c*d)^2$

Now I'll make you understand the complete squaring procedure in a better way with the help of examples.

Check out the example here –

We have to find out the solution of $(207)^2$ instantly.

Then,

$(207)^2$ = D for 2 / D for 20 / D for 207 / D for 07 / D for 7

$(207)^2$ = 2*2 / 2*(2*0) / 2*(2*7) + 0^2 / 2*(0*7) / 7*7

$(207)^2$ = 4/0/28/0/49

$(207)^2 = 4/0/{}_{2}8/0/{}_{4}9$

$(207)^2 = 4 / (0+2) / 8 / (0+4) / 9$

$(207)^2 = 4 / 2 / 8 / 4 / 9$

$(207)^2$ = 42849.

Easy Method to calculate Cube

I would like to explain the cube method through example only.

Find out the result of $(16)^3$

Here we'll write like this –

1 6 (6*6) (6*6*6) = 1 6 36 216

To find out the cube, it will be solved like this –

1 6 36 216

12 72

$4 \quad {}_{3}0 \quad {}_{12}9 \quad {}_{21}6$ = 4096

5. Problems on Ages Quick Maths Formulas

Formulas -

- ✓ If the current age is x, then n times the age is nx.
- ✓ If the current age is x, then age n years later/hence = x + n.
- ✓ If the current age is x, then age n years ago = x - n.
- ✓ The ages in a ratio a : b will be ax and bx.
- ✓ If the current age is x, then 1/n times the age is x/n.

Quicker Methods –

To find out son's age, use this formula –

- ✓ If t_1 years earlier the father's age was x times that of his son. At present the father's age is y times that of his son. Then the present age of son will be?

Son's Age = t_1 (x-1) / (x-y)

- ✓ If present age of the father is y times the age of his son. After t_2 years the father's age become z times the age of his son. Then the present age of son will be?

Son's Age = (z-1)t_1 / (y-z)

- t_1 years earlier, the age of the father was x times the age of his son. After t_2 years, the father's age becomes x times the age of his son. Then the present age of son will be?

Son's Age = $[(z-1)t_2 + (x-1)t_1] / (x-z)$

- **Son's or Daughter's Age = [Total ages + No. of years ago (Times - 1)] / (Times+1)**

- **Son's or Daughter's Age = [Total ages - No. of years ago (Times - 1)] / (Times+1)**

- Father : Son

  Present Age = x : y
  T years before = a : b

  Then, **Son's age = y * [T(a-b) / Difference of cross product]**
  And **Father's age = x * [T(a-b) / Difference of cross product]**

6. Average Quick Maths Formulas

- ✓ Average = (Total of data) / (No. of data)
- ✓ Age of New Entrant = New Average + No. of Old Members * Increase
- ✓ Weight of New Person = Weight of Removed Person + No. Of Persons * Increase In Average
- ✓ Number of Passed Candidates = Total Candidates * (Total Average – Failed Average) / (Passed Average – Failed Average)
- ✓ Number of Failed Candidates = Total Candidates * (Passed Average – Total Average) / (Passed Average – Failed Average)
- ✓ Age of New Person = Age of Removed Person – No. of Persons * Decrease in Average Age
- ✓ Average after x innings = Total Score – Increment in Average * y innings
- ✓ If a person travels a distance at a speed of x km/hr and the same distance at a speed of y km/hr, then the average speed during the whole journey is given by – **2xy / (x+y)** km/hr.
- ✓ If half of the journey is travelled at a speed of x km/hr and the next half at a speed of y km/hr, then average speed during the whole journey is **2xy / (x+y)** km/hr.

- If a man goes to a certain place at a speed of x km/hr and returns to the original place at a speed of y km/hr, then the average speed during up and down journey is **2xy / (x+y)** km/hr.

- If a person travels 3 equal distances at a speed of x km/hr, y km/hr and z km/hr respectively, then the average speed during the whole journey is **3xyz / (xy+yz+zx)** km/hr.

- If decrease in average = x
  Increase in expenditure = y
  Increase in no. of students = z
  And number of students (originally) = N, then
  The original expenditure = N * [x*(N+z) + y] / z]

7. Percentage Quick Maths Formulas

- **Percentage = [Value / Total Value * 100]**

- If two values are respectively x% and y% more than a third value, then the first is the **(100+x) / (100+y) *100%** of the second.

- If A is x% of C and B is y% of C, then A is **x/y*100% of B**.

- x% of quantity is taken by the first, y% of the remaining is taken by the second and z% of the remaining is taken by third person. Now is A is left in the fund then there was (**A*100*100*100) / (100-x) (100-y) (100-z)** in the beginning.

- x% of quantity is added. Again y% of increased quantity is added. Again z% of the increased quantity is added. Now, it becomes A, then the initial amount is given by **(A*100*100*100) / (100+x) (100+y) (100+z)**

- If the original population of a town is P and the annual increase is r%, then the population in n years will be –

  P + P*r/100 = P*(1+r/100)

- The population of a town is P. It increases by x% during the 1^{st} year, increases by y% during the 2^{nd} year and again increases by z% during the third year. Then, the population after 3 years will be -

  P*(100+x)(100+y)(100+z) / 100*100*100

- When the population decreases by y% during the 2nd year, while for the 1st and 3rd years, it follows the same, the population after 3 years will be –

  P*100+x)(100-y)(100+z) / 100*100*100

- If the price of a commodity increases by r%, then the reduction in consumption so as not to increase the expenditure, is **(r/100+r) * 100%**

- If the price of a commodity decreases by r%, then the increase in consumption so as not to decrease the expenditure, is **(r/100-r) * 100%**

- If the first value is r% more than the second value, then the second is **(r/100+r) * 100%** less than the first value.

- If the first value is r% less than the second value, then the second is **(r/100-r) * 100%** more than the first value.

- If the value of a number is first increased by x% and later decreased by x%, the **net change is always a decrease which is equal to x% of x or x^2/100**.

- If the value of a number is first increased by x% and later decreased by y%, then there is **[x-y-(x*y/100)] %** increase or decrease, according to the =ve or –ve sign respectively.

- If the order of increase and decrease is changes, the result remain unaffected.

- If the value is increased by x% and y% then the final increase is **[x+y+(x*y/100)] %**.

- If the price of a commodity is diminished by x% and its consumption is increased by y%

  Or

  If the price of a commodity is increased by x% and its consumption is decreased by y%

  Then the effect on revenue is = **[Inc. % Value – Dec. % Value – (Inc. % Value * Dec. % Value/100)]**.

- The passing marks in an examination is x%. If a candidates who scores y marks, fails by z marks, then the max marks –

  M = 100*(y+z)/x.

- A candidate scoring x% in an exam fails by 'a' marks, while another candidate who scores y% marks gets 'b' marks more than the min required pass marks. Then the max marks for the exam are -

  M = 100*(a+b) / (y-x).

- In measuring the sides of rectangle, one side is taken x% in excess and the other y% in deficit. The error % in area calculated from the measurement is [**x – y - (x*y/100)]**.

- If the sides of triangle, rectangle, square, circle, rhombus are increased by x%, then **its area is increased by [x * (x+200) / 100] % or [2*x + (x^2/100)] %**.

- In an exam x% students failed in English and y% students failed in Maths. If z% of students failed in both, Then the % of passed students in both subjects is = **100 – (x + y - z) or (100-x) + (100-y) + z**.

8. Profit and Loss Quick Maths Formulas

- ✓ **Profit = Selling Price (SP) – Cost Price (CP)**
- ✓ Loss = Cost Price (CP) – Selling Price (SP)
- ✓ Gain or Loss % = (Loss or Gain / CP) * 100 %
- ✓ Gain % = [Error / (True Value – Error)] * 100 %
- ✓ Gain % = [(True Weight – False Weight) / False Weight] * 100 %
- ✓ Total % Profit = [(% Profit + % Less in wt) / (100 - % Less in wt)] * 100 %
- ✓ Cost Price = (More Gain * 100) / Diff in % Profit
- ✓ Selling Price = [More Rupees * (100 + % Final Gain)] / (%gain + %loss)
- ✓ Cost Price = [(Initial Profit%) + (Inc. in Profit%)] * A / (Inc. in Profit%)
- ✓ If CP of x articles is = SP of y articles, then **Profit % = [(x –y) / y] * 100**
- ✓ Cost Price = (100 * More Charge) / (% Diff in Profit)
- ✓ Selling Price = More Charge * (100+ First Profit%) / (% Diff in Profit).

9. Time and Work Quick Maths Formulas

- ✓ If M1 persons can do W1 work in D1 days and M2 persons can do W2 work in D2 days then the formula will be -

  M1 * D1 * W1 = M2 * D2 * W2

  If we add Time for both the groups T1 and T2 respectively, then the formula will become –

  M1 * D1 * T1 * W1 = M2 * D2 * T2 * W2

  And if we add efficiency for both the groups E1 and E2 respectively, then the formula becomes –

  M1 * D1 * T1 * E1 * W1 = M2 * D2 * T2 * E2 * W2

- ✓ If A can do a piece of work in x days and B can do it in y days, then A and B working together will do the same work in **[(x*y)/(x+y)]** days.

- ✓ If A, B and C can do a work in x, y and z days respectively, then all of them working together can finish the work in **[(x*y*z) / (xy + yz + zx)]**

- ✓ If A and B together can do a piece of work in x days and A can do it in y days, then B alone can do the work in **(x*y) / (x-y)** days.

- ✓ Original Number of Workers = (No. of more workers * No. of days taken by the second group) / No. of less days

10. Pipe & Cisterns Quick Maths Formulas

- ✓ If a pipe can fill a tank in x hours, then the part filled in 1 hour = 1/x.

- ✓ If a pipe can empty a tank in y hours, then the part of the full tank emptied in 1 hour = 1/y.

- ✓ If a pipe can fill a tank in x hours and another pipe can empty the full tank in y hours, then the net part filled in 1 hour, when both the pipes are opened = (1/x) – (1/y).

  Time taken to fill the tank, when both the pipes are opened = xy / (y-x).

- ✓ If a pipe can fill a tank in x hours and another can fill the same tank in y hours, then the net part filled in 1 hour, when both the pipes are opened = (1/x) + (1/y).

  Time taken to fill the tank = xy / (x+y).

- ✓ If a pipe can fill a tank in x hours and another can fill the same tank in y hours, but a third one empties the full tank in z hours and all of thm are opened together, then the net part filled in 1 hour = (1/x) + (1/y) + (1/z).

  Time taken to fill the tank = xyz / (yz + xz - xy) hours.

- ✓ A pipe can fill a tank in x hours. Due to a leak in the bottom, it is filled in y hours. If the tank is full, then the time taken by the leak to empty the tank = xy / (y-x) hours.

11. Time and Distance Quick Maths Formulas

- ✓ Speed = Distance / Time
- ✓ If the speed of a body is changed in the ratio a:b, then the ratio of the time taken changes in the ration b:a.
- ✓ If a certain distance is covered at x km/hr and the same distance is covered at y km/hr, then the average speed during the whole journey is 2xy / (x+y) km/hr.
- ✓ Required Distance = [(Product of two speeds) / (Difference of two speeds)] * Diff between arrival times.
- ✓ Required Distance = Total Time Taken * [(Product of two speeds) / (Addition of two speeds)]
- ✓ Distance = (2*Time*S1*S2) / (S1 + S2)

  Where S1 = Speed during first half and S2 = Speed during second half of journey
- ✓ Meeting point's distance from starting point = (S1 * S2 * Difference in time) / (Difference in speed)
- ✓ Distance travelled by A = 2 * Distance of two points (a / a+b)
- ✓ Distance = [(Multiplication of speeds) / (Difference of Speeds)] * (Difference in time to cover the distance)

- ✓ Meeting Time = (First's starting time) + [(Time taken by first) * (2nd's arrival time – 1st's starting time)] / (Sum of time taken by both)

- ✓ Time of rest per hour = (Difference of Speed) / (Speed without Stoppage)

- ✓ Distance = (Total Time) * (Multiplication of two speeds) / (Sum of Speeds)

- ✓ Speed = [2 * (Increase in speed) * (Decrease in speed)] / Difference in Increase and Decrease in Speeds

12. Problem on Train Quick Maths Formulas

- ✓ When x and y trains are moving in opposite direction, then their **relative speed = Speed of x + Speed of y**
- ✓ When x and y trains are moving in same direction, then their **relative speed = Speed of x - Speed of y**
- ✓ When a train passes a platform, it should travel the length equal to **the sum of the lengths of train & platform both**.
- ✓ Distance = (Difference in Distance) * [(Sum of Speed) / (Diff in Speed)]
- ✓ Length of Train = [(Length of Platform) / (Difference in Time)] * (Time taken to cross a stationary pole or man)
- ✓ Speed of faster train = (Average length of two trains) * [(1/Opposite Direction's Time) + (1/Same Direction's Time)]
- ✓ Speed of slower train = (Average length of two trains) * [(1/Opposite Direction's Time) - (1/Same Direction's Time)]
- ✓ Length of the train = [(Difference in Speed of two men) * T1 * T2)] / (T2-T1)
- ✓ Length of the train = [(Difference in Speed) * T1 * T2)] / (T1-T2)
- ✓ Length of the train = [(Time to pass a pole) * (Length of the platform)] / (Diff in time to cross a pole and platform)
- ✓ First train's starting point = S1 * [{(Total Distance) – S2 * (T1-T2)} / (S1+S2)]

- S2 = S1 * Square root of [(Time taken by first train after meeting) / (time taken by second train after meeting)]

13. Boats and Streams Quick Maths Formulas

- ✓ If the speed of the boat is x and if the speed of the stream is y while upstream then the effective speed of the boat is = x - y
- ✓ And if downstream then the speed of the boat = x + y
- ✓ If x km/hr be the man's rate in still water and y km/hr is the rate of the current. Then

  Man's rate with current = x + y
  Man's rate against current = x – y
- ✓ A man can row x km/hr in still water. If in a stream which is flowing at y km/hr, it takes him z hrs to row to a place and back, the distance between the two places is = z * $(x^2 – y^2)$ / 2x
- ✓ A man rows a certain distance downstream in x hours and returns the same distance in y hours. If the stream flows at the rate of z km/hr, then the speed of the man in still water is given by – z* (x + y) / (y - x) km/hr.
- ✓ Man's rate against current = Man's rate with current – 2 * rate of current
- ✓ Distance = Total Time * [(Speed in still water)^2 – (Speed of current)^2] / 2 * (Speed in still water)
- ✓ Speed in Still Water = [(Rate of Stream) * (Sum of upstream and downstream time)] / (Diff of upstream and downstream time)

14. Alligation Quick Maths Formulas

- ✓ If the gradients are mixed in a ratio, then
  [(Quantity of cheaper) / (Quantity of dearer)] = [(CP of dearer) – (Mean Price)] / (Mean price) – (CP of cheaper)]

- ✓ Quantity of Sugar Added = [Solution * (Required% value – Present% value)] / (100 – required% value)

- ✓ Required quantity of water to be added = [Solution * (Required Fractional Value – Present Fractional Value)] / 1 – (Required Fractional Value)

15. Simple Interest Quick Maths Formulas

- ✓ SI = p*t*r/100
- ✓ The annual payment that will discharge a debt of INR A due in t years at the rate of interest r% per annum is = **(100 * A) / [(100 * t) + r*t* (t-1)]/2**
- ✓ P = (Interest * 100) / [(t1*r1) + (t2*r2) + (t3*r3) + …..]
- ✓ Rate = [100 * (Multiple number of principal - 1)] / Time
- ✓ Sum = (More Interest * 100) / (Time * More Rate)

16. Compound Interest Quick Maths Formulas

- ✓ When Interest is compounded annually –

  Amount = P [1 + (r/100)]^{t}
- ✓ When Interest is compounded half-yearly –

  Amount = P [1 + (r/200)]^{2t}
- ✓ When Interest is compounded quarterly –

  Amount = P [1 + (r/400)]^{4t}
- ✓ When rate of Interest is r1%, r2% and r3% then –

Amount = P [1 + (r1/100)] * [1 + (r2/100)] * [1 + (r3/100)]

- ✓ Simple Interest for 2 years = 2*r = 2r% of capital
- ✓ Compound Interest for 2 years = [2r +(r^2/100)]% of capital
- ✓ Simple Interest for 3 years = 3*r = 3r% of capital
- ✓ Compound Interest for 3 years = [3r +(3r^2/100) + (r^3/100^2)]% of capital

17. Mensuration Quick Maths Formulas

- ✓ Area of Rectangle = Length * Breadth
- ✓ $(\text{Diagonal of Rectangle})^2 = (\text{Length})^2 * (\text{Breadth})^2$
- ✓ Perimeter of Rectangle = 2 * (Length + Breadth)
- ✓ Area of a Square = $(\text{Side})^2 = 1/2 * (\text{Diagonal})^2$
- ✓ Perimeter of Square = 4 * Side
- ✓ Area of 4 walls of a room = 2 * (Length + Breadth) * Height
- ✓ Area of a parallelogram = (Base * Height)
- ✓ Area of a rhombus = 1/2 * (Product of Diagonals)
- ✓ Area of a Equilateral Triangle = Root of (3) / 4 * $(\text{Side})^2$
- ✓ Perimeter of an Equilateral Triangle = 3 * Side
- ✓ Area of an Isosceles Triangle = b/4 * root of $4a^2 – b^2$
- ✓ Area of Triangle = 1/2 * Base * Height
- ✓ Area of Triangle = root of [s(s - a) * (s - b) * (s-c)]
- ✓ Area of Trapezium = 1/2 * (Sum of parallel sides * perpendicular distance between them)

- Circumference of a circle = 2*(22/7)*r
- Area of a circle = (22/7) * r^2
- Area of a parallelogram = 2 * root of [s(s - a) * (s - b) * (s-d)]
- Volume of cuboid = (l*b*h)
- Whole Surface of cuboid = 2 * (lb + bh + lh) sq. units
- Diagonal of Cuboid = Root of (l^2 + b^2 + h^2)
- Volume of a cube = a^3
- Whole Surface Area of cube = (6*a^2)
- Diagonal of Cube = Root of (3) * a
- Volume of Cylinder = (22/7) * r^2 * h
- Curved Surface area of Cylinder = 2*(22/7)*r*h
- Total Surface Area of Cylinder = [2*(22/7)*r*h] + {2*(22/7)*r^2)
- Volume of Sphere = (4/3) * (22/7) * r^3
- Surface Area of Sphere = 4 * (22/7) * r^2
- Volume of hemisphere = (2/3) * (22/7) * r^3

- ✓ Curved Surface area of hemisphere = 2 * (22/7) * r^2
- ✓ Whole Surface Area of hemisphere = 3 * (22/7) * r^2.