DECIMALS, FRACTIONS & NUMBER RELATIONSHIPS

Complete SSC CGL Examination Notes

Comprehensive Guide with Formulas & Examples • Created by GovtExamPrep

1. FRACTIONS - BASIC CONCEPTS & TYPES

Understanding Fractions

Fraction: A fraction represents a part of a whole. It is written as a/b where:
• **a** is the numerator (number of parts considered)
• **b** is the denominator (total number of equal parts)
• The line between them is called the fraction bar

Fraction Type	Definition	Example
Proper Fraction	Numerator < Denominator	3/5, 7/9
Improper Fraction	Numerator ≥ Denominator	7/5, 11/9
Mixed Fraction	Whole number + Proper fraction	2¾, 5½
Like Fractions	Same denominator	2/7, 3/7, 5/7
Unlike Fractions	Different denominators	2/3, 3/4, 5/7

Fraction Operations

Addition/Subtraction:
- `Same denominator: a/c ± b/c = (a ± b)/c`
- `Different denominators: Find LCM first`

Multiplication:
`a/b × c/d = (a × c)/(b × d)`

Division:
`a/b ÷ c/d = a/b × d/c = (a × d)/(b × c)`

Example: Add 2/3 + 3/4 and multiply 2/5 × 3/7

Solution:

Addition: LCM of 3 and 4 = 12

2/3 = 8/12, 3/4 = 9/12

> $2/3 + 3/4 = 8/12 + 9/12 = 17/12 = 1\frac{5}{12}$
>
> **Multiplication:** $2/5 \times 3/7 = (2\times3)/(5\times7) = 6/35$

2. DECIMALS - COMPLETE GUIDE

Decimal Number System

Place Value Chart:
Thousands | Hundreds | Tens | Units | Decimal | Tenths | Hundredths | Thousandths
1000 | 100 | 10 | 1 | . | 1/10 | 1/100 | 1/1000

Example: Break down the number 345.678

Solution:

- 3 is in hundreds place = 300
- 4 is in tens place = 40
- 5 is in units place = 5
- 6 is in tenths place = 6/10 = 0.6
- 7 is in hundredths place = 7/100 = 0.07
- 8 is in thousandths place = 8/1000 = 0.008
- Total = 300 + 40 + 5 + 0.6 + 0.07 + 0.008 = 345.678

Decimal Operations

Addition/Subtraction: `Align decimal points`
Multiplication: `Multiply normally, then count total decimal places`
Division: `Move decimal points to make divisor whole number`

Example: Multiply 2.5 × 3.4 and divide 6.25 ÷ 2.5

Solution:

Multiplication: 25 × 34 = 850

Total decimal places = 1 + 1 = 2

2.5 × 3.4 = 8.50

Division: 6.25 ÷ 2.5 = 62.5 ÷ 25 = 2.5

3. FRACTION-DECIMAL CONVERSIONS

Conversion Methods

Fraction to Decimal:
1. Divide numerator by denominator
2. Continue division until it terminates or repeats

Decimal to Fraction:
1. Write decimal as numerator
2. Denominator = 1 followed by zeros equal to decimal places
3. Simplify the fraction

Fraction	Decimal	Percentage
1/2	0.5	50%
1/4	0.25	25%
3/4	0.75	75%
1/3	0.333...	33.33%
2/3	0.666...	66.67%
1/5	0.2	20%
1/8	0.125	12.5%

Recurring Decimals

Types of Recurring Decimals:
• Pure Recurring: All digits repeat (0.333..., 0.454545...)
• Mixed Recurring: Some digits don't repeat (0.1666..., 0.2333...)

Example: Convert 0.333... and 0.2333... to fractions

Solution:

Pure Recurring (0.333...):

Let x = 0.333... → 10x = 3.333...

10x - x = 3.333... - 0.333... → 9x = 3 → x = 3/9 = 1/3

Mixed Recurring (0.2333...):

Let x = 0.2333... → 10x = 2.333... and 100x = 23.333...

100x - 10x = 23.333... - 2.333... → 90x = 21 → x = 21/90 = 7/30

4. NUMBER RELATIONSHIPS & PROPERTIES

Types of Numbers

Number Type	Definition	Examples
Natural Numbers	Counting numbers	1, 2, 3, 4, ...
Whole Numbers	Natural numbers + 0	0, 1, 2, 3, ...
Integers	Whole numbers + negatives	..., -2, -1, 0, 1, 2, ...
Rational Numbers	Can be expressed as p/q	2/3, -4/5, 0.75, 2
Irrational Numbers	Cannot be expressed as p/q	√2, π, e
Prime Numbers	Divisible only by 1 and itself	2, 3, 5, 7, 11, ...
Composite Numbers	Have more than 2 factors	4, 6, 8, 9, 10, ...

Divisibility Rules

Important Divisibility Rules:
- **2:** Last digit even (0,2,4,6,8)
- **3:** Sum of digits divisible by 3
- **4:** Last two digits divisible by 4
- **5:** Last digit 0 or 5
- **6:** Divisible by both 2 and 3
- **8:** Last three digits divisible by 8
- **9:** Sum of digits divisible by 9
- **10:** Last digit 0
- **11:** Difference between sum of odd and even place digits is 0 or multiple of 11

Example: Check divisibility of 123456 by 2, 3, 4, 6, 9, 11

Solution:

- **2:** Last digit 6 (even) → Divisible
- **3:** Sum = 1+2+3+4+5+6 = 21 (divisible by 3) → Divisible
- **4:** Last two digits 56 ÷ 4 = 14 → Divisible
- **6:** Divisible by both 2 and 3 → Divisible
- **9:** Sum 21 not divisible by 9 → Not divisible

- **11:** (1+3+5) - (2+4+6) = 9-12 = -3 → Not divisible

5. HCF & LCM - CONCEPTS & APPLICATIONS

Basic Definitions

HCF (Highest Common Factor): Largest number that divides all given numbers exactly.
Also called GCD (Greatest Common Divisor)

LCM (Lowest Common Multiple): Smallest number that is exactly divisible by all given numbers.

Important Formulas:

- `Product of two numbers = HCF × LCM`
- `HCF of fractions = HCF of Numerators / LCM of Denominators`
- `LCM of fractions = LCM of Numerators / HCF of Denominators`

Calculation Methods

Prime Factorization Method:
- HCF: Take common primes with lowest power
- LCM: Take all primes with highest power

Example: Find HCF and LCM of 24, 36, 48

Solution using Prime Factorization:

- $24 = 2^3 \times 3^1$
- $36 = 2^2 \times 3^2$
- $48 = 2^4 \times 3^1$
- HCF = $2^2 \times 3^1 = 4 \times 3 =$ **12**
- LCM = $2^4 \times 3^2 = 16 \times 9 =$ **144**

Example: Find HCF and LCM of 2/3, 3/4, 4/5

Solution:

- HCF of fractions = HCF(2,3,4) / LCM(3,4,5)
- HCF(2,3,4) = 1, LCM(3,4,5) = 60

- HCF = 1/60
- LCM of fractions = LCM(2,3,4) / HCF(3,4,5)
- LCM(2,3,4) = 12, HCF(3,4,5) = 1
- LCM = 12/1 = **12**

6. SIMPLIFICATION & APPROXIMATION

BODMAS/PEMDAS Rule

Order of Operations:

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B - Brackets (Parentheses)
O - Orders (Exponents/Roots)
D - Division
M - Multiplication
A - Addition
S - Subtraction
```

Example: Simplify 12 + 6 ÷ 2 × 3 - 4

Solution using BODMAS:

- Division: 6 ÷ 2 = 3
- Multiplication: 3 × 3 = 9
- Addition: 12 + 9 = 21
- Subtraction: 21 - 4 = **17**

Approximation Techniques

Rounding Rules:
• If digit after rounding position is 0-4 → Round down
• If digit after rounding position is 5-9 → Round up

Decimal Approximation:
• To nearest whole number: Look at tenths digit
• To one decimal: Look at hundredths digit
• To two decimals: Look at thousandths digit

Example: Approximate 123.4567 to nearest whole number, one decimal, two decimals

Solution:

- Nearest whole number: 123.4567 → 123 (since 4 < 5)
- One decimal: 123.4567 → 123.5 (since 5 ≥ 5)

- Two decimals: 123.4567 → 123.46 (since 6 ≥ 5)

7. SSC CGL PRACTICE PROBLEMS

Previous Year Question Types

Problem 1: Simplify (2/3 + 3/4) ÷ (5/6 - 1/2)

Detailed Solution:

- Numerator: 2/3 + 3/4 = (8+9)/12 = 17/12
- Denominator: 5/6 - 1/2 = (5-3)/6 = 2/6 = 1/3
- Division: (17/12) ÷ (1/3) = 17/12 × 3/1 = 17/4 = **4.25**

Problem 2: Convert 0.125 to fraction and find its square root

Detailed Solution:

- 0.125 = 125/1000 = 1/8
- √(1/8) = 1/√8 = 1/(2√2) = √2/4
- Decimal value ≈ 1.414/4 = **0.3535**

Problem 3: Find HCF and LCM of 0.75, 0.5, and 0.625

Detailed Solution:

- Convert to fractions: 0.75 = 3/4, 0.5 = 1/2, 0.625 = 5/8
- HCF of fractions = HCF(3,1,5)/LCM(4,2,8) = 1/8 = **0.125**
- LCM of fractions = LCM(3,1,5)/HCF(4,2,8) = 15/2 = **7.5**

Quick Calculation Shortcuts

Shortcut 1: Multiplication by 5 = Multiply by 10 and divide by 2
Shortcut 2: Division by 5 = Multiply by 2 and divide by 10
Shortcut 3: Square of number ending with 5: $n5^2$ = n×(n+1) followed by 25
Shortcut 4: Percentage to fraction: x% = x/100

Example using shortcuts:

- 48 × 5 = 48 × 10 ÷ 2 = 480 ÷ 2 = 240

- 65^2 = 6×7 followed by 25 = 4225
- 37.5% = 37.5/100 = 3/8

8. SSC CGL PREPARATION STRATEGY

Expected Marks Distribution

Topic	Frequency	Difficulty	Marks Weightage
Fraction Operations	High	Easy-Medium	2-3 marks
Decimal Operations	High	Easy	2-3 marks
Fraction-Decimal Conversion	Medium	Medium	1-2 marks
HCF & LCM	High	Medium	2-3 marks
Simplification	Very High	Easy-Medium	3-4 marks
Number Properties	Medium	Medium	1-2 marks

30-Day Study Plan

Week 1-2: Foundation Building
• Days 1-5: Fractions (types, operations, conversions)
• Days 6-10: Decimals (operations, place value, conversions)
• Days 11-14: Number relationships & properties

Week 3-4: Advanced Concepts & Practice
• Days 15-18: HCF & LCM (concepts, applications)
• Days 19-22: Simplification & approximation
• Days 23-28: Mixed practice & previous year questions
• Days 29-30: Revision & mock tests

Daily Practice: 10 fraction problems, 10 decimal problems, 5 simplification problems, learn 5 important conversions.