# Cheat Sheet for Fractions

**Converting Fractions:**

1. Mixed to Improper:
    a. Multiply the whole number by the denominator (bottom number)
    b. Add the numerator (top number)
    c. This number becomes the new numerator
    d. The denominator stays the same

    Example:

$$3\frac{2}{5} \longrightarrow \begin{matrix} 3 \times 5 = 15 \\ 15 + 2 = 17 \end{matrix} \longrightarrow \frac{17}{5}$$

2. Improper to Mixed:
    a. Divide the numerator by the denominator
    b. The number of full times the denominator fits into the numerator is your whole number
    c. The remainder goes into a fraction over the original denominator

    Example:

$$\frac{17}{5} \longrightarrow \begin{array}{r} 3 \\ 5\overline{)\,17} \\ \underline{-15} \\ 2 \end{array} \longrightarrow 3\frac{2}{5}$$

**Prime Numbers:**

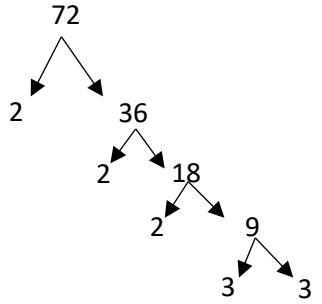
- Prime numbers are only dividable by itself and 1

    Example: 2, 3, 5, 7, 11, 13, 17, 19, 23, 29

**Prime Factorization:**

- Tree!
- Start by dividing the number by the first prime number (2)
- When you can't divide by a prime number, you move on to the next prime number possible

    Example:



- Write as each prime number multiplies by the next
- Simplify with exponents

Example: $2 \times 2 \times 2 \times 3 \times 3$

$2^3 \times 3^2$

## Writing Fractions in Lowest Terms

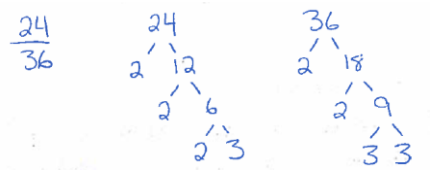
1. Divide the numerator (top number) and denominator (bottom number) by common factors

   Example:

$$\frac{24}{36} \overset{\div 3}{=} \frac{12}{18} \overset{\div 2}{=} \frac{4}{6} = \frac{2}{3}$$

2. Find lowest terms using prime factorization
   a. Do a prime factorization tree for both numbers in the fraction
   b. Write the product of each tree into a fraction
   c. Divide the terms

   Example:




$$\frac{24}{36} = \frac{2 \times 2 \times 2 \times 3}{2 \times 2 \times 3 \times 3} = \frac{2}{3}$$

## Multiplying Fractions

1. Proper Fractions:
   a. Multiply the numerators
   b. Multiply the denominators
   c. Write in lowest terms

   Example: $\frac{2}{3} \times \frac{3}{5} = \frac{2 \times 3}{3 \times 5} = \frac{6}{15} \overset{\div 3}{=} \frac{2}{5}$ ← lowest terms

2. Improper Fractions:
   a. Multiply the numerators
   b. Multiply the denominators
   c. Use long division to write as a mized number
   d. Write fraction in lowest terms

Example: $\frac{6}{4}\times\frac{5}{2}=\frac{30}{8}\longrightarrow 8\overline{)\begin{array}{r}3\\30\\-24\\\hline 6\end{array}}\longrightarrow 3\frac{6}{8}=3\frac{3}{4}$ ($\div 2$)

3. Mixed Fractions:
    a. Write each mixed number as an improper fraction
    b. Multiply the numerators
    c. Multiply the denominators
    d. Use long division to write as a mixed number
    e. Write fraction in lowest terms

Example: $2\frac{1}{5}\times 2\frac{2}{3}=\frac{11}{5}\times\frac{8}{3}=\frac{88}{15}\longrightarrow 15\overline{)\begin{array}{r}5\\88\\-75\\\hline 5\end{array}}\longrightarrow 5\frac{5}{15}=5\frac{1}{3}$ ($\div 5$)

## Dividing Fractions

1. Dividing Proper or Improper Fractions:
    a. Change the division sign to multiplication
    b. Leave the first term the same
    c. Find the reciprocalo of the second term (flip)

Example: $\frac{3}{5}\div\frac{1}{3}=\frac{3}{5}\times\frac{3}{1}=\frac{9}{5}$

    d. Simplify by writing the fraction in lowest terms or by writing aas a mixed number

Example: $\frac{9}{5}\longrightarrow 5\overline{)\begin{array}{r}1\\9\\-5\\\hline 4\end{array}}\longrightarrow 1\frac{4}{5}$

2. Dividing Mixed Numbers:
    a. Change the mixed number to an improper fraction
    b. Change the division sin to multiplication
    c. Leave the first term the same
    d. Find the reciprocal of the second term (flip)
    e. Simplify by writing the fracvtion in lowest terms or by writing as a mixed number

Example: $3\frac{5}{9}\div 2\frac{2}{5}=\frac{32}{9}\div\frac{12}{5}=\frac{32}{9}\times\frac{5}{12}=\frac{160}{108}=\frac{80}{54}=\frac{40}{27}\longrightarrow 27\overline{)\begin{array}{r}1\\140\\-27\\\hline 13\end{array}}\longrightarrow 1\frac{13}{27}$ ($\div 2$ twice)

## Adding/Subracting Fractions:

1. Adding/Subtracting Like Fractions:
    a. Add or subtract the numerators
    b. Leave the bottom numbers the same

c. Simplify by writing in lowest terms or as a mixed number

Example: $\frac{2}{8}+\frac{4}{8}=\frac{6}{8}=\frac{3}{4}$ ($\div 2$)

$\frac{4}{5}-\frac{1}{5}=\frac{3}{5}$

2. Finding the Lowest Common Multiple:
   a. List Method
      i. List the first fe multiples of each denominator
      ii. Find the lowest number they have in common

      Example: $\frac{1}{4},\frac{2}{6}$

      4, 8, (12), 16, 20, 24, 28, 32
      6, (12), 18, 24, 30

   b. Dividing Prime Numbers Method
      i. Start by trying to divide by the first prime number
      ii. Continue dividing by prime numbers untill all quotients are 1
      iii. Multiply all prime numbers used to get lowest common multiple

      Example: 9, 15

| | | |
|---|---|---|
| 3 | 9 | 15 |
| 3 | 3 | 5 |
| 5 | 1 | 5 |
| | 1 | 1 |

$3 \times 3 \times 5 = 45$ is the lowest common multiple

3. Adding/Subtraciting Unlike Fractions:
   a. Find the lowest common multiple
   b. Reqrite the fractions with the lowest common multiple as the denominator
   c. Add/subtract the numerators (top numbers)
   d. Simplify by writing in lowest terms or by writing as a mized number

   Example:

$\frac{1}{3}+\frac{1}{4}+\frac{1}{10}$

| | | | |
|---|---|---|---|
| 2 | 3 | 4 | 10 |
| 2 | 3 | 2 | 5 |
| 3 | 3 | 1 | 5 |
| 5 | 1 | 1 | 5 |
| | 1 | 1 | 1 |

$2 \times 2 \times 3 \times 5 = 60$ is the lowest common multiple

$\frac{1}{3}(\times 20)+\frac{1}{4}(\times 15)+\frac{1}{10}(\times 6) \rightarrow \frac{20}{60}+\frac{15}{60}+\frac{6}{60} \rightarrow =\frac{41}{60}$ ← lowest terms

4. Adding/Subtracting Mixed Numbers:
    a. Change the Mixed Number to an improper fraction
    b. Find the lowest common multiple of the denominators (bottom number)
    c. Reqrite the fractions with the lowest common multiple as the denominators
    d. Add or subtract the numerators (top number)
    e. Simplify by writing in lowest terms or by writing as a mixed number

Example:

$$8\frac{5}{8} - 3\frac{11}{12} = \frac{69}{8} - \frac{47}{12}$$

LCM = 8, 16, (24), 32, 40
12, (24), 36, 48

$$\frac{69}{8} - \frac{47}{12} = \frac{207}{24} - \frac{94}{24} = \frac{113}{24}$$

$\times 3$ over $\frac{69}{8}$; $\times 2$ over $\frac{47}{12}$; $\frac{113}{24}$ improper

$$24\overline{)113} \quad 4 \quad -96 \quad 17 \qquad 4\frac{17}{24}$$

**Estimating Fraction Equations:**

1. Round the mixed numbers/fractions to a whole number
2. Estimate the answer
3. Use estimate to check if your exact answer is reasonable
    - If the numerator of the fraction is at least half of the denominator, you round the whole number up
    - If the numerator of the fraction is less than half of the denominator, you round down (leave the whole number as is)

Example:

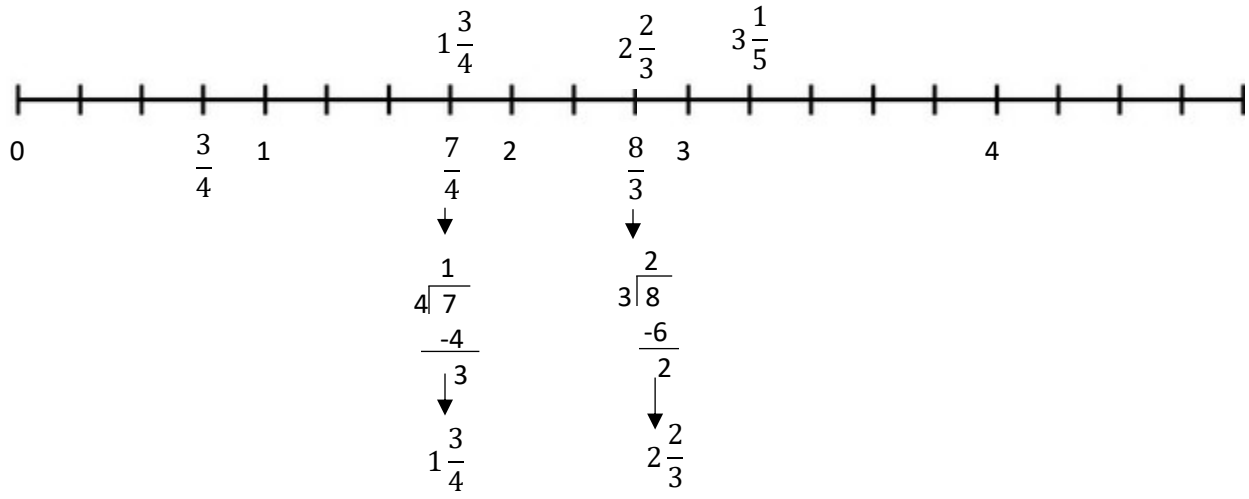
less, more

$$8\frac{1}{3} - 2\frac{5}{6} = 8 - 3 = 5$$

less, more

$$5\frac{5}{12} + 2\frac{5}{8} = 5 + 3 = 8$$

**Locating Fractions on a Number Line:**



**Greater than, Less than or Equal:**

Greater than $>$ Less than $<$ Equal to $=$

*Alligator wants to eat the bigger one*

1. Find lowest common multiple
2. Rewrite fractions with lowest common multiple as the denominator
3. Compare fractions

Example: $\frac{2}{3} < \frac{3}{4}$

LCM: 3, 6, 9, (12), 15, 21, 24
4, 8, (12), 16, 20, 24

$\times 4$

$\frac{2}{3} < \frac{3}{4} = \frac{8}{12} < \frac{9}{12}$

$\times 3$

Greater than