Fraction Operations, Mr. Martin

Addition:

- Convert fractions to common denominators (bottom of fraction)
- Add numerators (top of fraction)
- The common denominator stays the same

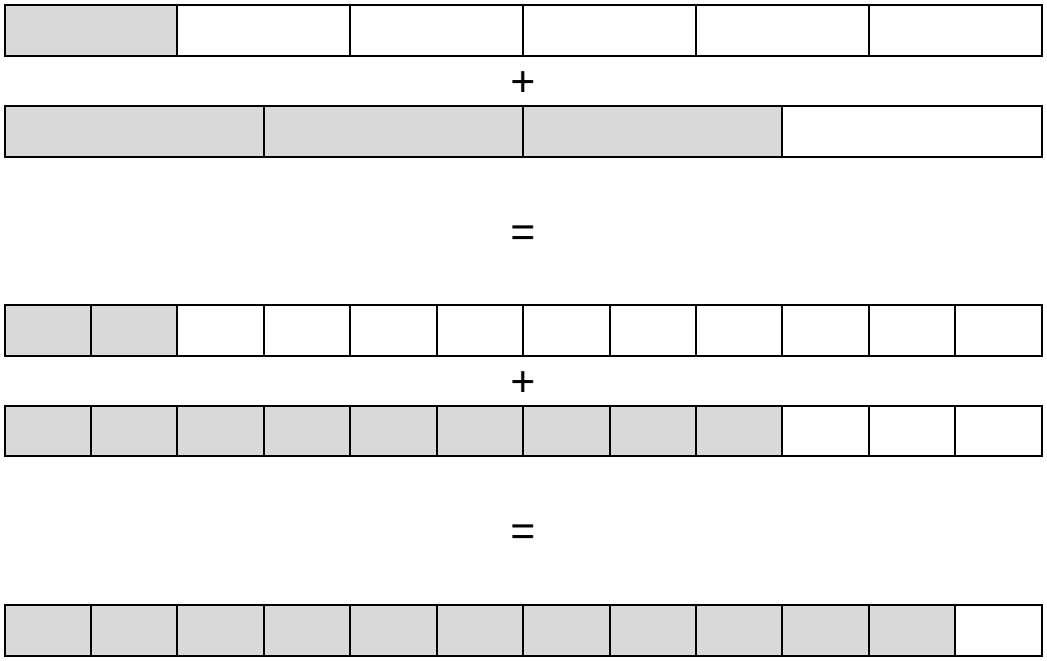
    - *Example 1*:
    - $\frac{5}{8}+\frac{1}{8}=\frac{6}{8}=\frac{3}{4}$
    - The denominators were the same
    - Therefore, add numerators. Keep denominator the same.
    - The answer, $\frac{6}{8}$, is reduced to $\frac{3}{4}$ by dividing top and bottom by 2

    - *Example 2:*
    - $\frac{1}{6}+\frac{3}{4}=\frac{2}{12}+\frac{9}{12}=\frac{11}{12}$
    - The denominators were different
    - The least common denominator is 12
    - To change $\frac{1}{6}$ to 12ths, you have to multiply the denominator by 2. Since you multiplied the denominator by 2, you also have to multiply the numerator by 2. $\frac{1\cdot 2}{6\cdot 2}=\frac{2}{12}$
    - To change $\frac{3}{4}$ to 12ths, you must multiply the denominator by 3. Since you multiplied the denominator by 3, you also have to multiply the numerator by 3. $\frac{3\cdot 3}{4\cdot 3}=\frac{9}{12}$

- Add $\frac{2}{12}+\frac{9}{12}=\frac{11}{12}$. You add the numerators. Denominator stays 12.

- The reason you need a common denominator is that you can only add if the "pieces" are the same size. Here's example 2 with "candy bars."

- $\frac{1}{6}+\frac{3}{4}=\frac{2}{12}+\frac{9}{12}=\frac{11}{12}$



- *Example 3*:

- $\frac{2}{3}+\frac{5}{6}=\frac{4}{6}+\frac{5}{6}=\frac{9}{6}=\frac{9\div3}{6\div3}=\frac{3}{2}=1\frac{1}{2}$
- Common denominator is 6. Reduce answer and then convert to a mixed number.

- Addition with mixed numbers
  - To add mixed numbers, you can add the whole numbers and fractions separately. Then combine.

- *Example 4*:
- $1\frac{1}{2}+2\frac{2}{3}$
  - 1+2=3
  - $\frac{1}{2}+\frac{2}{3}=\frac{3}{6}+\frac{4}{6}=\frac{7}{6}=1\frac{1}{6}$
  - $3+1\frac{1}{6}=4\frac{1}{6}$

Subtraction:

- Subtraction is like addition
- Must convert the fractions to a common denominator
- Subtract the numerators
- Common denominator stays the same

  - *Example 1*:
  - $\frac{5}{8}-\frac{1}{3}=\frac{15}{24}-\frac{8}{24}=\frac{7}{24}$
  - Common denominator is 24
  - To convert 5/8 to 24ths: $\frac{5\cdot 3}{8\cdot 3}=\frac{15}{24}$
  - To convert 1/3 to 24ths: $\frac{1\cdot 8}{3\cdot 8}=\frac{8}{24}$

- With mixed numbers, you can subtract the whole numbers and fractions separately, and then combine.

  - *Example 2*:
  - $3\frac{2}{3}-1\frac{1}{2}=$
    - 3-1=2
    - $\frac{2}{3}-\frac{1}{2}=\frac{4}{6}-\frac{3}{6}=\frac{1}{6}$
    - $2+\frac{1}{6}=2\frac{1}{6}$

- Sometimes with mixed numbers, you will have to "borrow" from the whole number

    - *Example 3*:
    - $3\frac{1}{3}-1\frac{1}{2}=$
    - Look at the fractions first. Since $\frac{1}{3}$ is less than $\frac{1}{2}$ we will "borrow" 1whole from the 3. The 3 therefore becomes 2. Add the 1 whole in the form of $\frac{3}{3}$ to $\frac{1}{3}$ to get $\frac{4}{3}$. Our new problem becomes: $2\frac{4}{3}-1\frac{1}{2}=$
    - 2-1=1
    - $\frac{4}{3}-\frac{1}{2}=\frac{8}{6}-\frac{3}{6}=\frac{5}{6}$
    - $1+\frac{5}{6}=1\frac{5}{6}$

Multiplication:

- Multiple numerators
- Multiply denominators

    - *Example 1*:
    - $\frac{3}{4}\cdot\frac{3}{8}=\frac{9}{32}$

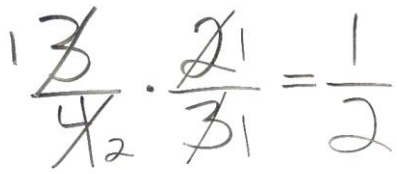
- Reduce if possible

    - *Example 2*:
    - $\frac{3}{4}\cdot\frac{2}{3}=\frac{6}{12}=\frac{1}{2}$

- Reducing can be avoided if you "cross cancel."

    - *Example 3*:

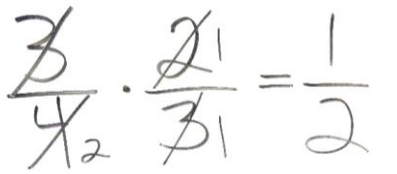
- $\frac{3}{4} \cdot \frac{2}{3} =$ The common factors of 3 cancel. 2 is also a common factor. 2 goes into 2 once. 2 goes into 4 twice.



- To multiply mixed numbers, you **must** first convert the mixed numbers into improper fractions!
    - *Example 4*:
    - $1\frac{3}{8} \cdot 2\frac{1}{4} = \frac{11}{8} \cdot \frac{9}{4} = \frac{99}{32} = 3\frac{3}{32}$

Division:

- Multiply by the reciprocal of the second fraction
    - *Example 1*:
    - $\frac{2}{3} \div \frac{3}{4} = \frac{2}{3} \cdot \frac{4}{3} = \frac{8}{9}$
    - *Example 2*:
    - $\frac{3}{4} \div \frac{3}{2} = \frac{3}{4} \cdot \frac{2}{3} = \frac{6}{12} = \frac{1}{2}$
    - Note when at $\frac{3}{4} \cdot \frac{2}{3}$ you can cross cancel



    - You can never cross cancel until you get to the multiplication, however.