

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

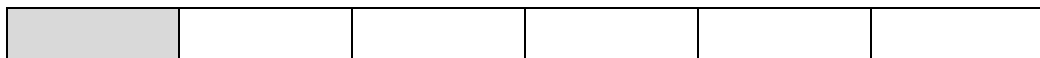
 - Example 2:
 - $\frac{1}{6} + \frac{3}{4} = \frac{2}{12} + \frac{9}{12} = \frac{11}{12}$
 - The denominators were different
 - The least common denominator is 12
 - To change $\frac{1}{6}$ to 12ths, you have to multiply the denominator by 2. Since you multiplied the denominator by 2, you also have to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

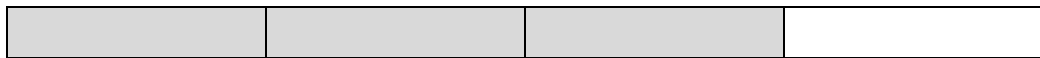
Denominator stays 12.

- 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.”

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



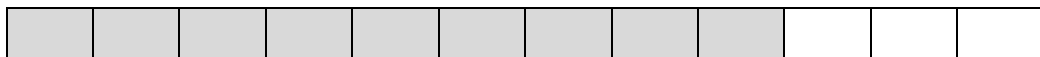
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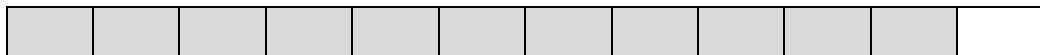
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- Example 3:

- $\frac{2}{3} + \frac{5}{6} = \frac{4}{6} + \frac{5}{6} = \frac{9}{6} = \frac{9 \div 3}{6 \div 3} = \frac{3}{2} = 1\frac{1}{2}$

- 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” 1 whole 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.

$$\frac{\cancel{3}^1}{4_2} \cdot \frac{\cancel{2}_1}{\cancel{3}_1} = \frac{1}{2}$$

- 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

$$\frac{\cancel{3}^1}{4_2} \cdot \frac{\cancel{2}_1}{\cancel{3}_1} = \frac{1}{2}$$

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