ARITHMETIC OF FRACTIONS

ADDITION AND SUBTRACTION

If the denominators are the same:

1. Add or subtract the numerators
2. Leave the denominator the same

Examples: $\frac{3}{10}+\frac{4}{10}=\frac{7}{10}$ $\frac{4}{7}-\frac{3}{7}=\frac{1}{7}$

Note: You may need to reduce the answer even if the original parts are in lowest terms.

Example: $\frac{1}{12}+\frac{5}{12}=\frac{6}{12}$ $\frac{6}{12}=\frac{1}{2}$

If the denominators are different:

You need to convert each fraction to an equivalent fraction that has the lowest common denominator.

1. Find the lowest common denominator (LCD), which is the least common multiple (LCM) of the denominators.
2. Divide the LCD by the denominator of the first fraction
3. Multiply the numerator and denominator of the fraction by the result in part 2. You should now have a fraction that is equivalent to your original fraction but has the LCD. **Important: Always multiply the numerator & denominator by the same number!**
4. Repeat steps 2 and 3 for each fraction you need to convert.

Examples: $\frac{1}{3}+\frac{2}{5}$

The LCD is 15, so covert as follows:

$15\div 3=5$ $15\div 5=3$

$\frac{1}{3}\times\frac{5}{5}=\frac{5}{15}$ $\frac{2}{5}\times\frac{3}{3}=\frac{6}{15}$

Once the fractions are converted, add or subtract as usual (and reduce, if necessary).

$$\frac{1}{3}+\frac{2}{5}=\frac{5}{15}+\frac{6}{15}=\frac{11}{15}$$

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

The LCD is 12, so convert as follows:

$12 \div 4 = 3$ $\qquad$ $12 \div 3 = 4$ $\qquad$ $12 \div 6 = 2$

$$\frac{1}{4} = \frac{1\times 3}{4\times 3} = \frac{3}{12} \qquad \frac{2}{3} = \frac{2\times 4}{3\times 4} = \frac{8}{12} \qquad \frac{1}{6} = \frac{1\times 2}{6\times 2} = \frac{2}{12}$$

Add or subtract as usual (reduce if necessary):

$$\frac{1}{4}+\frac{2}{3}-\frac{1}{6} = \frac{3}{12}+\frac{8}{12}-\frac{2}{12} = \frac{9}{12} \rightarrow \frac{9}{12} = \frac{3}{4}$$

MULTIPLICATION

When multiplying fractions, you do not need a common denominator. Just multiply the numerators and the denominators.

Examples: $\frac{1}{2}\times\frac{1}{3} = \frac{1\times 1}{2\times 3} = \frac{1}{6}$ $\qquad$ $\frac{3}{4}\times\frac{1}{5} = \frac{3\times 1}{4\times 5} = \frac{3}{20}$

Sometimes you will need to reduce. You may reduce either before or after multiplying, although it is often easier to reduce first. Cancel any one factor in the numerator of either fraction with a like factor in the denominator of either fraction.

Examples: $\frac{1}{3}\times\frac{3}{5} = \frac{1}{\cancel{3}_{1}}\times\frac{\cancel{3}^{1}}{5} = \frac{1}{1}\times\frac{1}{5} = \frac{1}{5}$

$$\frac{2}{5}\times\frac{3}{4} = \frac{\cancel{2}^{1}}{5}\times\frac{3}{\cancel{4}_{2}} = \frac{1\times 3}{5\times 2} = \frac{3}{10}$$

$$\frac{6}{7}\times\frac{7}{9} = \frac{6}{\cancel{7}_{1}}\times\frac{\cancel{7}^{1}}{9} = \frac{\cancel{6}^{2}}{1}\times\frac{1}{\cancel{9}_{3}} = \frac{2\times 1}{1\times 3} = \frac{2}{3}$$

DIVISION

To divide fractions, invert (flip over) the second fraction and change to multiplication. The inverted fraction is called the reciprocal. NOTE: <u>Never invert the first fraction – only the second.</u>

Examples: $\frac{3}{7}\div\frac{1}{2} = \frac{3}{7}\times\frac{2}{1} = \frac{3\times 2}{7\times 1} = \frac{6}{7}$

$$\frac{3}{4}\div 5 = \frac{3}{4}\div\frac{5}{1} = \frac{3}{4}\times\frac{1}{5} = \frac{3\times 1}{4\times 5} = \frac{3}{20}$$