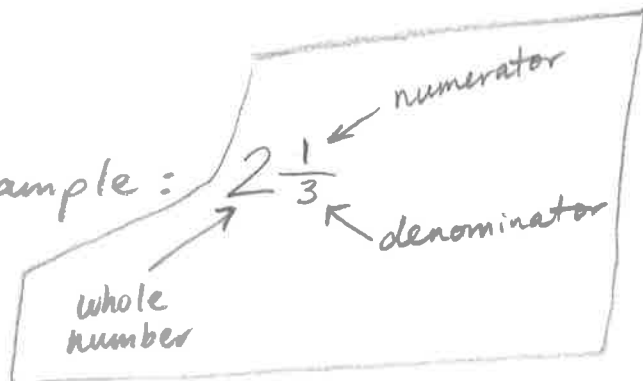


## Ch. 3.3 - Adding and Subtracting Fractions

Converting MIXED FRACTIONS to IMPROPER FRACTIONS:

A mixed fraction example:



An improper fraction's numerator is larger than its denominator.

Steps to convert:

- ① Multiply the whole number by the denominator;
- ② Add the product to the numerator;
- ③ The sum is the 'new' numerator. Keep the same denominator.

eg!: Convert each mixed fraction to an improper fraction:

a)  $4\frac{3}{5}$

$$= \frac{(4 \times 5 + 3)}{5}$$

$$= \boxed{\frac{23}{5}}$$

b)  $-9\frac{2}{7}$

$$= \frac{-(9 \times 7 + 2)}{7}$$

$$= \boxed{\frac{-65}{7}}$$

Keep the neg. separate!

error:

$$\frac{-9 \times 7 + 2}{7} = \frac{-61}{7}$$

x  
wrong!

## Converting Improper Fractions to Mixed Fractions:

- ① Divide the denominator into the numerator to produce the whole number;
- ② Multiply the deduced whole number by the denominator and subtract this product from the numerator.
- ③ Write the remainder in the numerator and keep the same denominator.

eg2: Convert each improper fraction into a mixed fraction:

a)  $\frac{23}{5}$

$$23 \div 5 = 4$$

$$4 \times 5 = 20$$

$$23 - 20 = 3$$

$$\boxed{4 \frac{3}{5}}$$

b)  $\frac{37}{6}$

$$37 \div 6 = 6$$

$$6 \times 6 = 36$$

$$37 - 36 = 1$$

$$\boxed{6 \frac{1}{6}}$$

c)  $-\frac{29}{3}$

## Adding Fractions with Like Denominators

- Steps:
- ① Add the numerators
  - ② Keep denominator the same
  - ③ Simplify, if possible.

eg 3: Add the following:

\*HINT: when adding mixed fractions, first convert to improper fractions.

$$a) \frac{5}{3} + \frac{2}{3}$$

$$= \frac{5+2}{3} = \boxed{\frac{7}{3}}$$

$$b) 1\frac{2}{9} + 2\frac{4}{9}$$

$$= \frac{11}{9} + \frac{22}{9} = \frac{33}{9} = \frac{11 \cdot 3}{3 \cdot 3} = \boxed{\frac{11}{3}}$$

$$c) \frac{5}{9} + \left(-\frac{7}{9}\right)$$

$$= \frac{5+(-7)}{9} = \frac{5-7}{9} = \boxed{\frac{-2}{9}}$$

Note:  $-\frac{7}{9} = -\frac{7}{9} = \frac{7}{-9} \neq \frac{-7}{-9}$

## Subtracting Fractions with Like Denominators

- Steps:
- ① Subtract the numerators
  - ② Keep denominator the same
  - ③ Simplify, if possible

eg4: Subtract the following:

$$a) \frac{4}{9} - \frac{1}{9}$$

$$= \frac{4-1}{9} = \frac{3 \div 3}{9 \div 3} = \boxed{\frac{1}{3}}$$

$$b) \frac{5}{7} - \left(-\frac{4}{7}\right)$$

$$= \frac{5 - (-4)}{7} = \frac{5+4}{7}$$
$$= \frac{9}{7} \text{ or } 1\frac{2}{7}$$

$$c) 3\frac{1}{5} - 5\frac{3}{5}$$

$$= \frac{3 \cdot 5 + 1}{5} - \frac{5 \cdot 5 + 3}{5}$$
$$= \frac{16}{5} - \frac{28}{5}$$
$$= \frac{-12}{5} \text{ or } -2\frac{2}{5}$$

## Adding and Subtracting Fractions with Unlike Denominators

- requires re-writing the fractions with a COMMON denominator (preferably, the L.C.D. - Lowest Common Denominator).

↳ requires finding the L.C.M. - Least Common Multiple of all denominators involved.

## Finding the LCM of a Set of Numbers

LCM - the smallest number that is a multiple of each number.

Prime Number - a number is considered to be PRIME if it is divisible only by 1 and itself.

eg: 2, 3, 5, 7, 11, 13, 17, 19, 23, 29, etc.

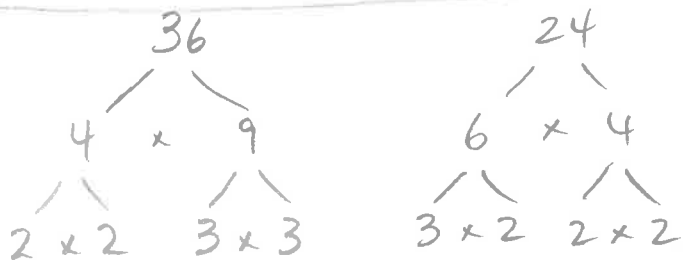
Note: 1 is not prime.

Method 1 - Works for two or more numbers...

- ① Write each number as a product of prime factors.
- ② Select the greatest number of times each prime factor occurs in any one number.
- ③ Multiply the values.

eg5: Determine the LCM of 24 and 36.

Using a Factor Tree



$$36 = 2 \times 2 \times 3 \times 3$$

$$24 = 2 \times 2 \times 2 \times 3$$

$$36 = 3^2 \times 2^2$$

$$24 = 3 \times 2^3$$

$$\text{LCM} = 3^2 \times 2^3$$

$$= 9 \times 8 = \boxed{72}$$

eg6: Determine the LCM of 12, 25, and 35.

$$\begin{array}{c} 12 \\ / \quad \backslash \\ 4 \times 3 \\ / \quad \backslash \\ 2 \times 2 \\ \hline 2 \times 2 \times 3 \end{array}$$

$$\begin{array}{c} 25 \\ / \quad \backslash \\ 5 \times 5 \\ \hline 5 \times 5 \end{array}$$

$$\begin{array}{c} 35 \\ / \quad \backslash \\ 5 \times 7 \\ \hline 5 \times 7 \end{array}$$

$$\left. \begin{array}{l} 2^2 \times 3 \\ 5^2 \\ 5 \times 7 \end{array} \right\} \begin{array}{l} \hline 2^2 \times 3 \times 5^2 \times 7 \\ \hline \end{array} = \boxed{2100}$$

eg7: Find:

a)  $\frac{7}{12} + \frac{3}{5}$

$$= \frac{7 \times 5}{12 \times 5} + \frac{3 \times 12}{5 \times 12}$$

$$= \frac{35}{60} + \frac{36}{60}$$

$$= \boxed{\frac{71}{60}}$$

b)  $\frac{7}{8} - \frac{1}{3}$

$$= \frac{7 \times 3}{8 \times 3} - \frac{1 \times 8}{3 \times 8}$$

$$= \frac{21}{24} - \frac{8}{24}$$

$$= \boxed{\frac{13}{24}}$$

$$c) 3\frac{2}{3} + 4\frac{5}{6}$$

$$= \frac{11}{3} + \frac{29}{6}$$

$$= \frac{11 \times 2}{3 \times 2} + \frac{29}{6}$$

$$= \frac{22}{6} + \frac{29}{6}$$

$$= \frac{51}{6}$$

$$= \frac{51 \div 3}{6 \div 3}$$

$$= \boxed{\frac{17}{2}}$$

$$d) \frac{19}{7} - \frac{13}{12}$$

$$= \frac{19}{7} \times \frac{12}{12} - \frac{13}{12} \times \frac{7}{7}$$

$$= \frac{228}{84} - \frac{91}{84}$$

$$= \boxed{\frac{137}{84}}$$

P. 105 - 109  
# 1 - 18

## Ch. 3.4 - Multiplying and Dividing Rational Numbers

\* see p. 110 for a visual tutorial.

### Multiplying Fractions

- simply multiply the numerators, multiply the denominators, and simplify (if possible).

↳ put fraction into LOWEST TERMS

ex 1: Find:

$$a) \frac{2}{3} \times \frac{5}{7} = \frac{2 \times 5}{3 \times 7} = \boxed{\frac{10}{21}}$$

\* multiplying a number by something less than one will make the number smaller.

$$b) 3 \times \frac{2}{7} = \frac{3}{1} \times \frac{2}{7} = \boxed{\frac{6}{7}}$$

### Dividing Fractions

- multiply by the reciprocal

↳ a "flipped-over" fraction

ex 2: Find:

$$a) \frac{3}{4} \div \frac{2}{5} = \frac{3}{4} \times \frac{5}{2}$$

$$= \boxed{\frac{15}{8}}$$

$$b) \frac{4}{7} \div 3 = \frac{4}{7} \div \frac{3}{1} = \frac{4}{7} \times \frac{1}{3}$$

$$= \boxed{\frac{4}{21}}$$

\*  $\frac{5}{2}$  is the reciprocal of  $\frac{2}{5}$   
and vice versa.



eg 3: Find:

$$a) \frac{3}{8} \times \frac{4}{15} = \frac{3 \times 4}{8 \times 15} = \frac{12}{120} = \boxed{\frac{1}{10}}$$

OR

$$= \frac{3 \times 2 \times 2}{2 \times 2 \times 2 \times 5 \times 3} = \frac{\cancel{3} \times \cancel{2} \times \cancel{2}}{\cancel{2} \times \cancel{2} \times 2 \times 5 \times \cancel{3}} = \boxed{\frac{1}{10}}$$

$$b) \frac{12}{25} \times \frac{8}{15} = \frac{12 \times 8}{25 \times 15} = \frac{96}{375} = \boxed{\frac{32}{125}}$$

OR

$$= \frac{2 \times 2 \times \cancel{3} \times 2 \times 2 \times 2}{5 \times 5 \times \cancel{3} \times 5} = \boxed{\frac{32}{125}}$$

$$c) 5\frac{2}{3} \times 1\frac{2}{5} \quad \text{MUST convert to improper!}$$

$$= \frac{17}{3} \times \frac{7}{5} = \boxed{\frac{119}{15}} = \boxed{7\frac{14}{15}}$$

$$d) 5\frac{2}{3} \div 1\frac{2}{5}$$

$$= \frac{17}{3} \div \frac{7}{5} = \frac{17}{3} \times \frac{5}{7} = \frac{85}{21} = \boxed{4\frac{1}{21}}$$