3.3 Addition and Subtraction of Rational Numbers

In this section we consider addition and subtraction of both fractions and decimals. We start with addition and subtraction of fractions with the same denominator. Consider the sum $\frac{1}{8} + \frac{3}{8}$. If you think of eighths as the quantity being added, it makes sense the sum is:

\[
\frac{1}{8} + \frac{3}{8} = \frac{1 + 3}{8} = \frac{4}{8} = \frac{1 \cdot 4}{2 \cdot 4} = \frac{1}{2}
\]

Mathematically, we are actually using the distributive property. Since $\frac{1}{8} = 1 \cdot \frac{1}{8}$ and $\frac{3}{8} = 3 \cdot \frac{1}{8}$, we have the sum:

\[
\frac{1}{8} + \frac{3}{8} = 1 \cdot \frac{1}{8} + 3 \cdot \frac{1}{8} = 4 \cdot \frac{1}{8} = \frac{4}{8} = \frac{1 \cdot 4}{2 \cdot 4} = \frac{1}{2}
\]

Regardless of the way you look at the problem, adding (or subtracting) two fractions with the same denominator simply means to add or subtract their numerators, leaving the denominator untouched.
Example 1  Add or subtract the fractions, as indicated. Be sure to simplify all answers.

a. \( \frac{5}{12} + \frac{1}{12} \)

b. \( \frac{3}{8} - \frac{5}{8} \)

c. \( \frac{-4}{15} - \frac{6}{15} \)

d. \( \frac{-9}{16} + \frac{5}{16} - \frac{3}{16} \)

Solution  

a. Add the two fractions, combine the numerators, then simplify:

\[
\frac{5}{12} + \frac{1}{12} = \frac{5 + 1}{12} \quad \text{combine fractions}
\]

\[
= \frac{6}{12} \quad \text{add numerators}
\]

\[
= \frac{1 \cdot 6}{2 \cdot 6} \quad \text{factor GCF}
\]

\[
= \frac{1}{2} \quad \text{cancel common factors}
\]

b. Subtract the two fractions, combine the numerators, then simplify:

\[
\frac{3}{8} - \frac{5}{8} = \frac{3 - 5}{8} \quad \text{combine fractions}
\]

\[
= \frac{3 + (-5)}{8} \quad \text{rewrite subtraction as addition}
\]

\[
= \frac{-2}{8} \quad \text{add numerators}
\]

\[
= \frac{-1 \cdot 2}{4 \cdot 2} \quad \text{factor GCF}
\]

\[
= \frac{-1}{4} \quad \text{cancel common factors}
\]

Note how we rewrite subtraction as addition in the second step.
c. Subtract the two fractions, combine the numerators, then simplify:

\[-\frac{4}{15} - \frac{6}{15} = \frac{-4 - 6}{15}\]  
combine fractions

\[= \frac{-4 + (-6)}{15}\]  
rewrite subtraction as addition

\[= \frac{-10}{15}\]  
add numerators

\[= \frac{-2 \cdot 5}{3 \cdot 5}\]  
factor GCF

\[= \frac{-2}{3}\]  
cancel common factors

d. Add the three fractions, combine the numerators, then simplify:

\[-\frac{9}{16} + \frac{5}{16} - \frac{3}{16} = \frac{-9 + 5 - 3}{16}\]  
combine fractions

\[= \frac{-9 + 5 + (-3)}{16}\]  
add numerators

\[= \frac{-12 + 5}{16}\]  
add negatives

\[= \frac{-7}{16}\]  
add numbers

Notice that when working with negative fractions such as \(-\frac{9}{16}\), we treat the negative as being with the numerator. This is done to allow the denominator to always be positive, making it easier to compare denominators.

When two denominators are not the same, we need to build each fraction to a common denominator. For example, suppose we are adding the two fractions \(\frac{5}{6} + \frac{3}{8}\). Can we find a denominator that both fractions can be built up to? Since the least common multiple (LCM) of 6 and 8 is 24, then both fractions can be converted to one with a denominator of 24. That will allow us to add the two fractions using the least common denominator (fraction terminology for LCM).
Converting each fraction:

\[
\frac{5}{6} + \frac{3}{8} = \frac{5 \cdot 4}{6 \cdot 4} + \frac{3 \cdot 3}{8 \cdot 3}
\]

converting to common denominators

\[
= \frac{20}{24} + \frac{9}{24}
\]

building fractions

\[
= \frac{20 + 9}{24}
\]

combining fractions

\[
= \frac{29}{24} \text{ or } 1 \frac{5}{24}
\]

adding fractions

Fractions can actually be built to any common denominator (such as 48 in the previous example), however the LCM will provide the smallest denominator to use, which usually results in less errors and simplifying of answers. Note that we gave the mixed form of the answer also.

Generally we do not give mixed form answers, unless they are asked for or mixed numbers were used originally in the problem.

**Example 2** Add or subtract the fractions, as indicated. Be sure to simplify all answers.

a. \(\frac{3}{4} + \frac{5}{6}\)

b. \(\frac{7}{8} - \frac{5}{16}\)

c. \(\frac{5}{12} - \frac{2}{3} + \frac{3}{8}\)

d. \(\frac{7}{10} - \frac{13}{15} - \frac{9}{20}\)
Solution  

a. The LCM of 4 and 6 is 12. Converting each fraction to the common denominator of 12, then combining numerators and simplifying:

\[
\frac{3}{4} + \frac{5}{6} = \frac{3 \cdot 3 + 5 \cdot 2}{4 \cdot 3 + 6 \cdot 2}
\]

converting to common denominators

\[
= \frac{9 + 10}{12}
\]

building fractions

\[
= \frac{-9 + 10}{12}
\]

combining fractions

\[
= \frac{1}{12}
\]

adding fractions

b. The LCM of 8 and 16 is 16. Converting each fraction to the common denominator of 16, then combining numerators and simplifying:

\[
\frac{-7}{8} - \frac{5}{16} = \frac{-7 \cdot 2 - 5}{8 \cdot 2 - 16}
\]

converting to common denominators

\[
= \frac{-14 - 5}{16}
\]

building fractions

\[
= \frac{-14 - 5}{12}
\]

combining fractions

\[
= \frac{-14 + (-5)}{12}
\]

converting to addition

\[
= \frac{-19}{12} \text{ or } -1 \frac{7}{12}
\]

adding fractions
c. The LCM of 12, 3, and 8 is 24. Converting each fraction to the common denominator of 24, then combining numerators and simplifying:

\[-\frac{5}{12} - \frac{2}{3} + \frac{3}{8}\]

\[= -\frac{5 \cdot 2}{12} - \frac{2 \cdot 8}{3} + \frac{3 \cdot 3}{8} \quad \text{converting to common denominators}\]

\[= -\frac{10 - 16 + 9}{24} \quad \text{building fractions}\]

\[= \frac{-10 + (-16) + 9}{24} \quad \text{combining fractions}\]

\[= -\frac{17}{24} \quad \text{converting to addition}\]

\[= -\frac{17}{24} \quad \text{adding fractions}\]

d. The LCM of 10, 15, and 20 is 60. Converting each fraction to the common denominator of 60, then combining numerators and simplifying:

\[-\frac{7}{10} - \frac{13}{15} + \frac{9}{20}\]

\[= -\frac{7 \cdot 6}{10} - \frac{13 \cdot 4}{15} + \frac{9 \cdot 3}{20} \quad \text{converting to common denominators}\]

\[= -\frac{42 - 52 - 27}{60} \quad \text{building fractions}\]

\[= \frac{-42 + (-52) + (-27)}{60} \quad \text{combining fractions}\]

\[= -\frac{121}{60} \quad \text{converting to addition}\]

\[= -2 \frac{1}{60} \quad \text{adding fractions}\]
Recall that the least common multiple of numbers cannot always be found easily. In such cases, using primes to find the LCM is a faster method. Suppose we want to add the two fractions:

\[
\frac{17}{84} + \frac{19}{72}
\]

Start by finding the prime factorizations of 84 and 72:

\[
84 = 4 \cdot 21 = (2 \cdot 2) \cdot (3 \cdot 7) = 2 \cdot 2 \cdot 3 \cdot 7
\]

\[
72 = 8 \cdot 9 = (2 \cdot 4) \cdot (3 \cdot 3) = 2 \cdot 2 \cdot 2 \cdot 3 \cdot 3
\]

Since the LCM must have three 2’s, two 3’s, and one 7, it is:

\[
\text{LCM} = 2 \cdot 2 \cdot 2 \cdot 3 \cdot 3 \cdot 7 = 504
\]

Now build up the fractions using the prime factors:

\[
\frac{17}{84} + \frac{19}{72} = \frac{17 \cdot 6}{84 \cdot 6} + \frac{19 \cdot 7}{72 \cdot 7}
\]

converting to common denominators

\[
= \frac{102}{504} + \frac{133}{504}
\]

building fractions

\[
= \frac{102 + 133}{504}
\]

combining fractions

\[
= \frac{235}{504}
\]

adding numerators

\[
= \frac{5 \cdot 47}{2 \cdot 2 \cdot 2 \cdot 3 \cdot 3 \cdot 7}
\]

prime factorizations

\[
= \frac{235}{504}
\]

multiplying factors

Note a few advantages in using primes for the common denominator. In building the fractions, the forms of 1 used which were \(\frac{6}{6}\) and \(\frac{7}{7}\) can be found by just looking at the prime factorizations, rather than by using division. Also, in the step of simplifying the resulting fraction, the prime factorization for the denominator is already known (that is how we got the denominator!), so only the numerator needs to be factored in order for the fraction to be reduced. For these reasons, many students find that using primes to obtain common denominators (rather than by guessing) is a better approach.
Example 3  Add or subtract the fractions, as indicated. Use primes to find the least common denominator. Be sure to simplify all answers.

a. \[ \frac{5}{8} + \frac{17}{36} \]

b. \[ \frac{31}{40} - \frac{19}{28} \]

c. \[ \frac{5}{12} + \frac{13}{20} = \frac{17}{45} \]

d. \[ \frac{5}{8x} + \frac{7}{12y} \]

Solution  a. Start by finding the prime factorizations of 8 and 36:
\[ 8 = 2 \cdot 4 = 2 \cdot 2 \cdot 2 \]
\[ 36 = 4 \cdot 9 = 2 \cdot 2 \cdot 3 \cdot 3 \]
The LCM must have three 2’s and two 3’s, which is:
\[ \text{LCM} = 2 \cdot 2 \cdot 2 \cdot 3 \cdot 3 = 72 \]
Now build the fractions to the LCM, combine numerators, and simplify:
\[ \frac{5}{8} + \frac{17}{36} = \frac{5 \cdot 9}{8 \cdot 9} + \frac{17 \cdot 2}{36 \cdot 2} \quad \text{converting to common denominators} \]
\[ = \frac{45 + 34}{72} \quad \text{building fractions} \]
\[ = \frac{45 + 34}{72} \quad \text{combining fractions} \]
\[ = \frac{11}{72} \quad \text{adding numerators} \]
b. Start by finding the prime factorizations of 40 and 28:
   \[40 = 4 \cdot 10 = 2 \cdot 2 \cdot 2 \cdot 5\]
   \[28 = 4 \cdot 7 = 2 \cdot 2 \cdot 7\]
   The LCM must have three 2’s, one 5, and one 7, which is:
   \[\text{LCM} = 2 \cdot 2 \cdot 2 \cdot 5 \cdot 7 = 280\]
   Now build the fractions to the LCM, combine numerators, and simplify:
   \[- \frac{31}{40} - \frac{19}{28} = - \left( \frac{31}{40} \cdot \frac{7}{7} - \frac{19}{28} \cdot \frac{10}{10} \right)\]
   converting to common denominators
   \[= - \frac{217}{280} - \frac{190}{280}\]
   building fractions
   \[= - \frac{217 - 190}{280}\]
   combining fractions
   \[= - \frac{217 + (-190)}{280}\]
   changing to addition
   \[= - \frac{407}{280}\]
   adding numerators

c. Start by finding the prime factorizations of 12, 20, and 45:
   \[12 = 4 \cdot 3 = 2 \cdot 2 \cdot 3\]
   \[20 = 4 \cdot 5 = 2 \cdot 2 \cdot 5\]
   \[45 = 9 \cdot 5 = 3 \cdot 3 \cdot 5\]
   The LCM must have two 2’s, two 3’s, and one 5, which is:
   \[\text{LCM} = 2 \cdot 2 \cdot 3 \cdot 3 \cdot 5 = 180\]
Now build the fractions to the LCM, combine numerators, and simplify:

\[
\frac{5}{12} + \frac{13}{20} \cdot \frac{17}{45} \]

\[
= \frac{5 \cdot 15}{12 \cdot 15} + \frac{13 \cdot 9}{20 \cdot 9} - \frac{17 \cdot 4}{45 \cdot 4} \quad \text{converting to common denominators}
\]

\[
= \frac{75 + 117 - 68}{180} \quad \text{building fractions}
\]

\[
= \frac{75 + 117 - 68}{180} \quad \text{combining fractions}
\]

\[
= \frac{75 + 117 + (-68)}{180} \quad \text{changing to addition}
\]

\[
= \frac{26}{180} \quad \text{adding numerators}
\]

\[
= \frac{2 \cdot 13}{2 \cdot 2 \cdot 3 \cdot 3 \cdot 5} \quad \text{cancelling common factors}
\]

\[
= \frac{13}{90} \quad \text{multiplying factors}
\]

d. Start by finding the prime factorizations of $8x$ and $12y$:

$8x = 2 \cdot 2 \cdot 2 \cdot x$

$12y = 2 \cdot 2 \cdot 3 \cdot y$

The LCM must have three 2’s, one 3, one $x$, and one $y$, which is:

$\text{LCM} = 2 \cdot 2 \cdot 2 \cdot 3 \cdot x \cdot y = 24xy$

Now build the fractions to the LCM and combine numerators:

\[
\frac{5}{8x} + \frac{7}{12y} = \frac{5}{8x} \cdot \frac{3y}{3y} + \frac{7}{12y} \cdot \frac{2x}{2x} \quad \text{converting to common denominators}
\]

\[
= \frac{15y}{24xy} + \frac{14x}{24xy} \quad \text{building fractions}
\]

\[
= \frac{15y + 14x}{24xy} \quad \text{combining fractions}
\]

Notice how we cannot do any further simplification of this resulting fraction. In algebra you will learn some techniques which can be applied to simplify fractions such as this one.
When dealing with mixed numbers, two different approaches can be used. If we are adding two mixed numbers, both of which are positive, the easiest approach is to add the whole number and fraction portions separately. For example, to add \( \frac{2}{3} + \frac{1}{2} \), we first add the two fractions:

\[
\frac{2}{3} + \frac{1}{2} = \frac{2}{3} \cdot \frac{2}{2} + \frac{1}{2} \cdot \frac{3}{3}
\]

converting to common denominators

\[
= \frac{4}{6} + \frac{3}{6}
\]

building fractions

\[
= \frac{4+3}{6}
\]

combining fractions

\[
= \frac{7}{6}
\]

adding fractions

\[
= 1 \frac{1}{6}
\]

converting to mixed number

Now adding the mixed numbers:

\[
\frac{2}{3} + \frac{1}{2} = 7 + 1 \frac{1}{6} = 8 \frac{1}{6}
\]
However, when negative numbers become involved, this method becomes rather tricky. Thus, to compute the subtraction \(3 \frac{1}{4} - 6 \frac{3}{5}\), it is best to convert the mixed numbers to fractions and compute directly:

\[
3 \frac{1}{4} - 6 \frac{3}{5} = \frac{13}{4} - \frac{33}{5}
\]

converting to fractions

\[
= \frac{13 \cdot 5}{4 \cdot 5} - \frac{33 \cdot 4}{5 \cdot 4}
\]

converting to common denominators

\[
= \frac{65 - 132}{20}
\]

building fractions

\[
= \frac{65 - 132}{20}
\]

combining fractions

\[
= -\frac{67}{20}
\]

subtracting fractions

\[
= -3 \frac{7}{20}
\]

converting to mixed number

Unless we are adding positive mixed numbers, it is this second approach we will use to combine mixed numbers.

**Example 4** Combine the mixed numbers, as indicated. Be sure to simplify any answers and convert answers to mixed numbers.

a. \(8 \frac{5}{6} + 5 \frac{3}{4}\)

b. \(3 \frac{1}{8} - 7 \frac{9}{16}\)

c. \(-4 \frac{1}{3} + 2 \frac{3}{5}\)

d. \(-5 \frac{3}{4} - 3 \frac{2}{3}\)
**Solution**

a. Since we are adding positive mixed numbers, we can use the first approach. Start by adding the two fractions:

\[
\frac{5}{6} + \frac{3}{4} = \frac{5 \times 2}{6 \times 2} + \frac{3 \times 3}{4 	imes 3} \quad \text{converting to common denominators}
\]

\[
= \frac{10}{12} + \frac{9}{12} \quad \text{building fractions}
\]

\[
= \frac{10 + 9}{12} \quad \text{combining fractions}
\]

\[
= \frac{19}{12} \quad \text{adding fractions}
\]

\[
= 1\frac{7}{12} \quad \text{converting to mixed number}
\]

Now adding the mixed numbers:

\[
\frac{8}{5} + \frac{3}{4} = 13 + \frac{7}{12} = 14\frac{7}{12}
\]

b. Converting the mixed numbers to fractions, then combining:

\[
\frac{3}{8} - \frac{7}{16} = \frac{25}{8} - \frac{121}{16} \quad \text{converting to fractions}
\]

\[
= \frac{25 \times 2}{8 \times 2} - \frac{121}{16} \quad \text{converting to common denominators}
\]

\[
= \frac{50}{16} - \frac{121}{16} \quad \text{building fractions}
\]

\[
= \frac{50 - 121}{16} \quad \text{combining fractions}
\]

\[
= -\frac{71}{16} \quad \text{subtracting fractions}
\]

\[
= -4\frac{7}{16} \quad \text{converting to mixed number}
\]
c. Converting the mixed numbers to fractions, then combining:

\[-4 \frac{1}{3} + 2 \frac{3}{5} = -\frac{13}{3} + \frac{13}{5}\]

converting to fractions

\[-\frac{13 \cdot 5}{3 \cdot 5} + \frac{13 \cdot 3}{5 \cdot 3}\]

converting to common denominators

\[-\frac{65}{15} + \frac{39}{15}\]

building fractions

\[\frac{-65 + 39}{15}\]

combining fractions

\[\frac{-26}{15}\]

adding fractions

\[\frac{-11}{15}\]

converting to mixed number

d. Converting the mixed numbers to fractions, then combining:

\[-5 \frac{3}{4} - 3 \frac{2}{3} = -\frac{23}{4} - \frac{11}{3}\]

converting to fractions

\[-\frac{23 \cdot 3}{4 \cdot 3} - \frac{11 \cdot 4}{3 \cdot 4}\]

converting to common denominators

\[-\frac{69}{12} - \frac{44}{12}\]

building fractions

\[\frac{-69 - 44}{12}\]

combining fractions

\[\frac{-69 + (-44)}{12}\]

converting to addition

\[\frac{-113}{12}\]

adding fractions

\[\frac{-95}{12}\]

converting to mixed number
Whereas adding and subtracting fractions and mixed numbers involves a number of steps in finding the common denominator, the same operations for decimals are fairly easy to apply. Since the decimal system involves tenths, hundredths, thousandths, etc, the place-values used already represent common denominators. Thus, to compute 15.89 + 7.643, we only need to be sure the decimal points are lined up so that the place-values are also lined up. Usually we insert place-value holders (0), line up the decimal points, then just add as with whole numbers. The sum is therefore:

\[
\begin{array}{c}
111 \\
15.890 \\
+7.643 \\
23.533 \\
\end{array}
\]

Subtraction is performed similarly, except that borrowing (rather than carrying) is involved.

**Example 5** Perform the following additions and subtractions.

- a. \(45.982 + 6.57\)
- b. \(9.9 + 23.864\)
- c. \(5.07 – 3.295\)
- d. \(6.4 – 9.86\)

**Solution**

a. Lining up the decimal and inserting place-value holders:

\[
\begin{array}{c}
111 \\
45.982 \\
+6.570 \\
\hline
52.552 \\
\end{array}
\]

b. Lining up the decimal and inserting place-value holders:

\[
\begin{array}{c}
11 \\
9.900 \\
+23.864 \\
\hline
33.764 \\
\end{array}
\]
c. Lining up the decimal and inserting place-value holders:

\[
\begin{array}{c}
4.96 \\
5.070 \\
-3.295 \\
1.775
\end{array}
\]

d. This is actually trickier than it looks. Since 9.86 is larger than 6.4, this subtraction will result in a negative number. To find out how much it will be negative, we actually need to reverse the subtraction:

\[
\begin{array}{c}
9.86 \\
-6.40 \\
3.46
\end{array}
\]

Since the value is actually negative, \(6.4 - 9.86 = -3.46\).

**Terminology**

least common denominator

**Exercise Set 3.3**

Add or subtract the fractions, as indicated. Be sure to simplify all answers.

\[
\begin{array}{c}
\text{1. } \frac{7}{12} + \frac{1}{12} \\
\text{2. } \frac{4}{15} + \frac{8}{15} \\
\text{3. } \frac{5}{16} - \frac{11}{16} \\
\text{4. } \frac{7}{24} - \frac{13}{24} \\
\text{5. } \frac{17}{25} - \frac{8}{25} \\
\text{6. } \frac{19}{30} - \frac{11}{30} \\
\text{7. } -\frac{23}{30} + \frac{7}{30} \\
\text{8. } -\frac{13}{24} + \frac{5}{24} \\
\text{9. } -\frac{5}{12} + \frac{7}{12} - \frac{11}{12} \\
\text{10. } -\frac{13}{24} - \frac{7}{24} + \frac{11}{24} \\
\text{11. } \frac{7}{30} - \frac{11}{30} - \frac{17}{30} \\
\text{12. } \frac{13}{48} - \frac{17}{48} - \frac{5}{48}
\end{array}
\]
Add or subtract the fractions, as indicated. Be sure to simplify all answers.

15. \( \frac{2}{3} + \frac{5}{6} \)
17. \( \frac{1}{4} - \frac{7}{16} \)
19. \( \frac{5}{8} - \frac{13}{15} \)
21. \( -\frac{5}{6} + \frac{2}{3} \)
23. \( -\frac{3}{4} + \frac{1}{6} \)
25. \( -\frac{5}{8} + \frac{3}{4} \)
27. \( -\frac{3}{8} - \frac{7}{12} \)
29. \( -\frac{5}{8} - \frac{5}{12} + \frac{17}{24} \)
31. \( -\frac{7}{20} + \frac{13}{30} - \frac{11}{15} \)

Add or subtract the fractions, as indicated. Use primes to find the least common denominator. Be sure to simplify all answers.

33. \( \frac{7}{8} + \frac{19}{36} \)
35. \( -\frac{26}{35} + \frac{11}{15} \)
37. \( -\frac{27}{40} - \frac{16}{30} \)
39. \( -\frac{23}{48} + \frac{17}{30} \)
41. \( -\frac{7}{12} + \frac{11}{20} - \frac{19}{45} \)

34. \( \frac{13}{32} + \frac{17}{36} \)
36. \( -\frac{23}{35} - \frac{13}{15} \)
38. \( -\frac{29}{40} - \frac{18}{25} \)
40. \( \frac{13}{48} - \frac{23}{30} \)
42. \( -\frac{11}{12} + \frac{17}{20} - \frac{24}{35} \)
Combine the mixed numbers, as indicated. Be sure to simplify any answers and convert answers to mixed numbers.

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<td>43.</td>
<td>$\frac{-13}{18} - \frac{11}{12} + \frac{1}{8}$</td>
<td>44.</td>
<td>$\frac{-17}{18} - \frac{19}{24} + \frac{8}{27}$</td>
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<td>45.</td>
<td>$\frac{3}{8x} - \frac{5}{12x}$</td>
<td>46.</td>
<td>$\frac{7}{10x} - \frac{11}{15x}$</td>
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<tr>
<td>47.</td>
<td>$\frac{5}{12a} - \frac{8}{15b}$</td>
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Perform the following additions and subtractions.

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<tr>
<td>65.</td>
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<td>67.</td>
<td>$6.99 + 25.808$</td>
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<td>$32 - 16.85$</td>
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<td>$102 - 28.407$</td>
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<td>$115 - 65.749$</td>
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<td>76.</td>
<td>$6.7 - 14.826$</td>
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<td>$5.2 - 13.104$</td>
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<td>80.</td>
<td>$-14.56 - 29.859$</td>
<td></td>
</tr>
</tbody>
</table>
Answer each of the following application questions. Be sure to read the question, interpret the problem mathematically, solve the problem, then answer the question. You should answer the question in the form of a sentence.

81. Maurice has $458.62 in his checking account, and writes checks for $15.87, $132.45, and $88.60. What is his new balance in the account?

82. Sylvia has $682.36 in her checking account, and writes checks for $45.86, $102.39, $23.69, and $16.70. What is her new balance in the account?

83. After writing a check for $78.97, Carolyn has $196.87 in her checking account. How much was in her account before writing the check?

84. After writing a check for $199.68, Mary has $679.54 in her checking account. How much was in her account before writing the check?

85. After depositing a check for $795.84 in his checking account, Alfred has $1669.86 in his savings account. How much was in his account before depositing the check?

86. After depositing two checks for $186.52 and $337.50 in her account, Norma has $1156.40 in her savings account. How much was in her account before depositing the checks?

87. John buys a stock at a price of $146\frac{3}{8}$. During the next day it rises $2\frac{1}{4}$, then it drops $6\frac{7}{8}$ the following day. What is the price of the stock after these two days?

88. Dennis buys a stock at a price of $46\frac{1}{2}$. During the next day it drops $1\frac{5}{16}$, then it rises $3\frac{1}{4}$ the following day. What is the price of the stock after these two days?

89. Three pieces of lumber are stacked on top of each other. The first piece is $3\frac{1}{2}$ inches thick, the next piece is $1\frac{3}{4}$ inches thick, and the third piece is $\frac{7}{8}$ inches thick. How thick is the stack of three pieces of lumber?

90. Three pieces of lumber are stacked on top of each other. The first piece is $5\frac{3}{4}$ inches thick, the next piece is $1\frac{1}{2}$ inches thick, and the third piece is $2\frac{1}{8}$ inches thick. How thick is the stack of three pieces of lumber?