Operations with Rational Numbers

The four operations, addition, subtraction, multiplication, and division can be performed on rational numbers.

ADDITION AND SUBTRACTION OF WHOLE NUMBERS

EXAMPLE A

Add or subtract.

$$385 + 737 \qquad\qquad\qquad 481 - 228$$

Step 1: Line up the place values vertically.

$$
\begin{array}{r}
385 \\
+\ 737 \\
\hline
\end{array}
\qquad\qquad
\begin{array}{r}
481 \\
-\ 228 \\
\hline
\end{array}
$$

Step 2: Starting with the ones column, add or subtract each column.

$$
\begin{array}{r}
{}^{11} \\
385 \\
+\ 737 \\
\hline
1122
\end{array}
\qquad\qquad
\begin{array}{r}
{}^{3}{}^{7}{}^{1} \\
\cancel{4}\ \cancel{8}\ 1 \\
-\ 2\ 2\ 8 \\
\hline
1\ 5\ 3
\end{array}
$$

Solution: $385 - 8737 = 1122 \qquad\qquad 481 - 228 = 153$

MULTIPLICATION OF WHOLE NUMBERS

EXAMPLE B

Multiply.

149×23

Step 1: Line up the place values vertically.

$$
\begin{array}{r}
149 \\
\times\ 23 \\
\hline
\end{array}
$$

Step 2: Multiply 149 by 3.

$$
\begin{array}{r}
{}^{1\ 2} \\
149 \\
\times\ 23 \\
\hline
447
\end{array}
$$

Step 3: Multiply 149 by 20.

$$
\begin{array}{r}
{}^{1} \\
149 \\
\times\ 23 \\
\hline
447 \\
\underline{2980}
\end{array}
$$

Operations with Rational Numbers (continued)

Step 4: Add the products.	$\begin{array}{r} {\scriptstyle 1} \\ 149 \\ \times\ 23 \\ \hline 447 \\ 2980 \\ \hline 3427 \end{array}$

Solution: $149 \times 23 = 3427$

DIVISION OF WHOLE NUMBERS

EXAMPLE C

Divide.

$285 \div 12$

Step 1: Set up as long division. Divide 12 into 18. Write the quotient of 2 above the 8. Multiply 12 and 2 to get 24. Subtract 24 from 18. Write the difference of 4.

$$\begin{array}{r} 2 \\ 12\overline{)285} \\ -24 \\ \hline 4 \end{array}$$

Step 2: Bring down the 5 to make 45. Divide 12 into 45. Write the quotient above the 5. Multiply to get 36. Subtract 35 from 45 to get 9. Write 9 down.

$$\begin{array}{r} 43 \\ 12\overline{)285} \\ -24 \\ \hline 45 \\ -36 \\ \hline 9 \end{array}$$

Step 3: The remainder is 9 because 12 does not divide into 9.

Solution: $285 \div 12 = 43$ R 9.

Operations with Rational Numbers (continued)

ADDITION AND SUBTRACTION OF DECIMALS

EXAMPLE D

Add or subtract.

$$42.9 + 23.82 \qquad\qquad 65.5 - 49.33$$

Step 1: Line up the place values at the decimal points. Add zeros as place holders, if needed.

$$\begin{array}{r} 42.90 \\ + \underline{23.82} \end{array} \qquad\qquad \begin{array}{r} 65.50 \\ - \underline{49.33} \end{array}$$

Step 2: Starting with the rightmost column, add or subtract as with whole numbers.

$$\begin{array}{r} {}^{1} \\ 42.90 \\ + \underline{23.82} \\ 76.72 \end{array} \qquad\qquad \begin{array}{r} {}^{5}\,{}^{1}.\,{}^{4}\,{}^{1} \\ 6\,5.\,5\,0 \\ - \underline{4\;9.\;3\;3} \\ \cancel{1}\,3.\,\cancel{1}\,7 \end{array}$$

Solution: $42.9 + 23.82 = 76.72$ $\qquad\qquad 65.5 - 49.33 = 13.17$

MULTIPLICATION OF DECIMALS

EXAMPLE E

Multiply.

2.3×4.8

Step 1: Write the problem vertically. Multiply as if the numbers are whole numbers.

$$\begin{array}{r} 2.3 \\ \times \underline{4.8} \\ 184 \\ \underline{920} \\ 1104 \end{array}$$

Step 2: Count the number of decimal places in each factor. There is one decimal place in each factor for a total of 2 decimal places. Move the decimal point 2 places to the left in the product.

$$\begin{array}{r} 2.3 \quad \text{1 decimal place} \\ \times \underline{4.8} \quad \text{1 decimal place} \\ 184 \phantom{\quad \text{1 decimal place}} \\ \underline{920} \phantom{\quad \text{1 decimal place}} \\ 11.\underline{04} \quad \text{Move 2 decimal places to the left.} \end{array}$$

Solution: $2.3 \times 4.8 = 11.04$

Operations with Rational Numbers (continued)

DIVISION OF WHOLE NUMBERS

EXAMPLE F

Divide.

$7.98 \div 2.1$

Step 1: *Set up as long division. If there is a decimal point in the divisor, move it to the right until the divisor is a whole number. Move the decimal point in the dividend the same number of places to the right. Add zeros as needed for place holders.*

$$2.\underline{1})\overline{6.8\underline{25}} \longrightarrow 21)\overline{68.25}$$

Step 2: *Divide as with whole numbers.*

$$
\begin{array}{r}
325 \\
21)\overline{68.25} \\
-63 \\
\hline
52 \\
-42 \\
\hline
105 \\
-105 \\
\hline
0 \\
\end{array}
$$

Step 3: *Place the decimal point in the quotient above the decimal point in the dividend.*

$$
\begin{array}{r}
3.25 \\
21)\overline{68.25} \\
-63 \\
\hline
52 \\
-42 \\
\hline
105 \\
-105 \\
\hline
0 \\
\end{array}
$$

Solution: $6.825 \div 2.1 = 3.25$

PRACTICE

Find the value of each expression.

1. $36.1 \div 3.8$

2. $45.9 + 23$

3. 583×82

4. $762.32 - 425$

5. $873 + 628$

6. $7420 - 2731$

7. 33.6×0.23

8. $9372 \div 9$

9. $753.3 + 87.26$

10. $83 - 27.45$