Arithmetic Review: Decimal Fractions*

Wade Ellis
Denny Burzynski

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Abstract

This module is from Elementary Algebra by Denny Burzynski and Wade Ellis, Jr. This chapter contains many examples of arithmetic techniques that are used directly or indirectly in algebra. Since the chapter is intended as a review, the problem-solving techniques are presented without being developed. Therefore, no work space is provided, nor does the chapter contain all of the pedagogical features of the text. As a review, this chapter can be assigned at the discretion of the instructor and can also be a valuable reference tool for the student.

1 Overview

- Decimal Fractions
- Adding and Subtracting Decimal Fractions
- Multiplying Decimal Fractions
- Dividing Decimal Fractions
- Converting Decimal Fractions to Fractions
- Converting Fractions to Decimal Fractions

2 Decimal Fractions

Fractions are one way we can represent parts of whole numbers. Decimal fractions are another way of representing parts of whole numbers.

Decimal Fractions

A **decimal fraction** is a fraction in which the denominator is a power of 10.

A decimal fraction uses a **decimal point** to separate whole parts and fractional parts. Whole parts are written to the **left** of the decimal point and fractional parts are written to the **right** of the decimal point. Just as each digit in a whole number has a particular value, so do the digits in decimal positions.

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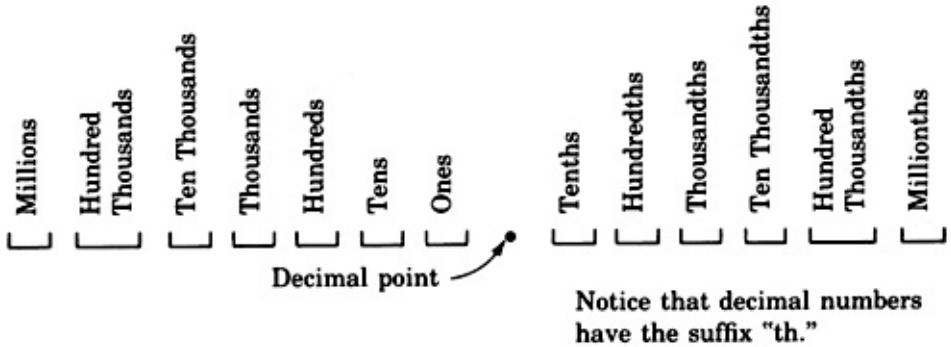

3 Sample Set A

The following numbers are decimal fractions.

Example 1

57.9

The 9 is in the *tenths* position. $57.9 = 57\frac{9}{10}$.

Example 2

6.8014

The 8 is in the *tenths* position.

The 0 is in the *hundredths* position.

The 1 is in the *thousandths* position.

The 4 is in the ten *thousandths* position.

$6.8014 = 6\frac{8014}{10000}$.

4 Adding and Subtracting Decimal Fractions

Adding/Subtracting Decimal Fractions
To add or subtract decimal fractions,

1. Align the numbers vertically so that the decimal points line up under each other and corresponding decimal positions are in the same column. Add zeros if necessary.
2. Add or subtract the numbers as if they were whole numbers.
3. Place a decimal point in the resulting sum or difference directly under the other decimal points.

5 Sample Set B

Find each sum or difference.

Example 3

$$9.183 + 2.140$$

$\downarrow$ The decimal points are aligned in the same column.

$$\begin{array}{r} 9.183 \\ +\,2.\underset{\Psi}{1}40 \\ \hline 11.323 \end{array}$$

Example 4

$$841.0056 + 47.016 + 19.058$$

$\downarrow$ The decimal points are aligned in the same column.

$$\begin{array}{rl} 841.0056 & \\ 47.016 & \text{Place a 0 into the thousandths position.} \\ +\,19.\underset{\Psi}{0}58 & \text{Place a 0 into the thousandths position.} \end{array}$$

$\downarrow$ The decimal points are aligned in the same column.

$$\begin{array}{r} 841.0056 \\ 47.0160 \\ +\,19.\underset{\Psi}{0}580 \\ \hline 907.0796 \end{array}$$

Example 5

$$16.01 - 7.053$$

$\downarrow$ The decimal points are aligned in the same column.

$$\begin{array}{rl} 16.01 & \text{Place a 0 into the thousandths position.} \\ -\,7.\underset{\Psi}{0}53 & \end{array}$$

$\downarrow$ The decimal points are aligned in the same column.

$$\begin{array}{r} 16.010 \\ -\,7.\underset{\Psi}{0}53 \\ \hline 8.957 \end{array}$$

6 Multiplying Decimal Fractions

Multiplying Decimal Fractions

To multiply decimals,

1. Multiply tbe numbers as if they were whole numbers.
2. Find the sum of the number of decimal places in the factors.
3. The number of decimal places in the product is the sum found in step 2.

7 Sample Set C

Find the following products.

Example 6
6.5×4.3

6.5 × 4.3

```
  6.5        ← 1 decimal place  } 1 + 1 = 2 decimal places in the
  4.3        ← 1 decimal place  } product.
  195
 260
27.95        ← 2 decimal places
```

$6.5 \times 4.3 = 27.95$

Example 7
23.4×1.96

23.4 × 1.96

```
  23.4       ← 1 decimal place  } 1 + 2 = 3 decimal places in the
  1.96       ← 2 decimal places } product.
  1404
 2106
 234
45.864       ← 3 decimal places
```

$23.4 \times 1.96 = 45.864$

8 Dividing Decimal Fractions

Dividing Decimal Fractions
To divide a decimal by a nonzero decimal,

1. Convert the divisor to a whole number by moving the decimal point to the position immediately to the right of the divisor's last digit.
2. Move the decimal point of the dividend to the right the same number of digits it was moved in the divisor.
3. Set the decimal point in the quotient by placing a decimal point directly above the decimal point in the dividend.
4. Divide as usual.

9 Sample Set D

Find the following quotients.

Example 8
$32.66 \div 7.1$

```
7.1)32.66          The divisor has one decimal place.
     4.6
71.)326.6          Move the decimal point of both the divisor and the dividend 1
    284            place to the right.
     42.6          Set the decimal point.
     42.6          Divide as usual.
        0
```

$32.66 \div 7.1 = 4.6$

$Check: \quad 32.66 \div 7.1 = 4.6 \text{ if } 4.6 \times 7.1 = 32.66$

$$\begin{array}{l} 4.6 \\ 7.1 \\ \Psi \\ 4.6 \\ 322 \\ \Psi \\ 32.66 \end{array} \qquad \text{True}$$

Example 9

1.0773 ÷ 0.513

```
                   The divisor has 3 decimal places.
       2.1
.513)1.077.3       Move the decimal point of both the divisor and the dividend 3
     1 026         places to the right.
       51 3        Set the decimal place and divide.
```

1.0773 ÷ 0.513 = 2.1

Check by multiplying 2.1 and 0.513. This will show that we have obtained the correct result.

Example 10

```
0.00032)12          The divisor has 5 decimal places.
0.00032)12.00000    Move the decimal point of both the divisor and the dividend 5
                    places to the right. We will need to add 5 zeros to 12.
      37500.
32)1200000.         Set the decimal place and divide.
   96
   240
   224
    160
    160
      000
```

12÷0.00032

10 Converting Decimal Fractions to Fractions

We can convert a decimal fraction to a fraction by reading it and then writing the phrase we have just read. As we read the decimal fraction, we note the place value farthest to the right. We may have to reduce the

fraction.

11 Sample Set E

Convert each decimal fraction to a fraction.

Example 11

$$0.6$$

$$0.\underset{\Psi}{6} \rightarrow \text{tenths position}$$

Reading: six tenths $\rightarrow \frac{6}{10}$

Reduce: $0.6 = \frac{6}{10} = \frac{3}{5}$

Example 12

$$21.903$$

$$21.90\underset{\Psi}{3} \rightarrow \text{thousandths position}$$

Reading: twenty-one and nine hundred three thousandths $\rightarrow 21\frac{903}{1000}$

12 Converting Fractions to Decimal Fractions

13 Sample Set F

Convert the following fractions to decimals. If the division is nonterminating, round to 2 decimal places.

Example 13

$\frac{3}{4}$

```
   .75
4)3.00
  28
   20
   20
    0
```

Divide 3 by 4.

$\frac{3}{4} = 0.75$

Example 14

$\frac{1}{5}$

```
   .2
5)1.0
  10
   0
```

Divide 1 by 5.

$\frac{1}{5} = 0.2$

Example 15

$\frac{5}{6}$

$$\begin{array}{r} .833 \\ 6\overline{)5.000} \\ \underline{4\,8} \\ 20 \\ \underline{18} \\ 20 \end{array}$$

Divide by 6.

This recurring remainder indicates that the division is nonterminating.

$\frac{5}{6} = 0.833...$

We are to round to 2 decimal places.

$\frac{5}{6} = 0.83$ to 2 decimal places.

Example 16

$5\frac{1}{8}$

Note that $5\frac{1}{8} = 5 + \frac{1}{8}$.

$$\begin{array}{r} .125 \\ 8\overline{)1.000} \\ \underline{8} \\ 20 \\ \underline{16} \\ 40 \\ \underline{40} \\ 0 \end{array}$$

Convert $\frac{1}{8}$ to a decimal.

$\frac{1}{8} = .125$

Thus, $5\frac{1}{8} = 5 + \frac{1}{8} = 5 + .125 = 5.125$.

Example 17

$0.16\frac{1}{4}$

This is a complex decimal. The "6" is in the hundredths position. The number $0.16\frac{1}{4}$ is read as "sixteen and one-fourth hundredths."

$$\begin{aligned} 0.16\tfrac{1}{4} = \frac{16\frac{1}{4}}{100} = \frac{\frac{16\cdot 4+1}{4}}{100} &= \frac{\frac{65}{4}}{\frac{100}{1}} \\ &= \frac{\overset{13}{\cancel{65}}}{4} \cdot \frac{1}{\underset{20}{\cancel{100}}} = \frac{13\times 1}{4\times 20} = \frac{13}{80} \end{aligned}$$

Now, convert $\frac{13}{80}$ to a decimal.

$$\begin{array}{r} .1625 \\ 80\overline{)13.0000} \\ \underline{8\,0} \\ 5\,00 \\ \underline{4\,80} \\ 160 \\ \underline{160} \\ 400 \\ \underline{400} \\ 0 \end{array}$$

$0.16\frac{1}{4} = 0.1625$.

14 Exercises

For the following problems, perform each indicated operation.

Exercise 1 *(Solution on p. 10.)*
$1.84 + 7.11$

Exercise 2
$15.015 - 6.527$

Exercise 3 *(Solution on p. 10.)*
$4.904 - 2.67$

Exercise 4
$156.33 - 24.095$

Exercise 5 *(Solution on p. 10.)*
$.0012 + 1.53 + 5.1$

Exercise 6
$44.98 + 22.8 - 12.76$

Exercise 7 *(Solution on p. 10.)*
$5.0004 - 3.00004 + 1.6837$

Exercise 8
$1.11 + 12.1212 - 13.131313$

Exercise 9 *(Solution on p. 10.)*
$4.26 \cdot 3.2$

Exercise 10
$2.97 \cdot 3.15$

Exercise 11 *(Solution on p. 10.)*
$23.05 \cdot 1.1$

Exercise 12
$5.009 \cdot 2.106$

Exercise 13 *(Solution on p. 10.)*
$0.1 \cdot 3.24$

Exercise 14
$100 \cdot 12.008$

Exercise 15 *(Solution on p. 10.)*
$1000 \cdot 12.008$

Exercise 16
$10,000 \cdot 12.008$

Exercise 17 *(Solution on p. 10.)*
$75.642 \div 18.01$

Exercise 18
$51.811 \div 1.97$

Exercise 19 *(Solution on p. 10.)*
$0.0000448 \div 0.014$

Exercise 20
$0.129516 \div 1004$

For the following problems, convert each decimal fraction to a fraction.

Exercise 21 *(Solution on p. 10.)*
0.06

Exercise 22
0.115

Exercise 23 *(Solution on p. 10.)*
3.7

Exercise 24
48.1162

Exercise 25 *(Solution on p. 10.)*
712.00004

For the following problems, convert each fraction to a decimal fraction. If the decimal form is nonterminating,round to 3 decimal places.

Exercise 26
$\frac{5}{8}$

Exercise 27 *(Solution on p. 10.)*
$\frac{9}{20}$

Exercise 28
$15 \div 22$

Exercise 29 *(Solution on p. 10.)*
$\frac{7}{11}$

Exercise 30
$\frac{2}{9}$

Solutions to Exercises in this Module

Solution to Exercise (p. 8)
8.95
Solution to Exercise (p. 8)
2.234
Solution to Exercise (p. 8)
6.6312
Solution to Exercise (p. 8)
3.68406
Solution to Exercise (p. 8)
13.632
Solution to Exercise (p. 8)
25.355
Solution to Exercise (p. 8)
0.324
Solution to Exercise (p. 8)
$12,008$
Solution to Exercise (p. 8)
4.2
Solution to Exercise (p. 8)
0.0032
Solution to Exercise (p. 8)
$\frac{3}{50}$
Solution to Exercise (p. 9)
$3\frac{7}{10}$
Solution to Exercise (p. 9)
$712\frac{1}{25000}$
Solution to Exercise (p. 9)
0.45
Solution to Exercise (p. 9)
0.636