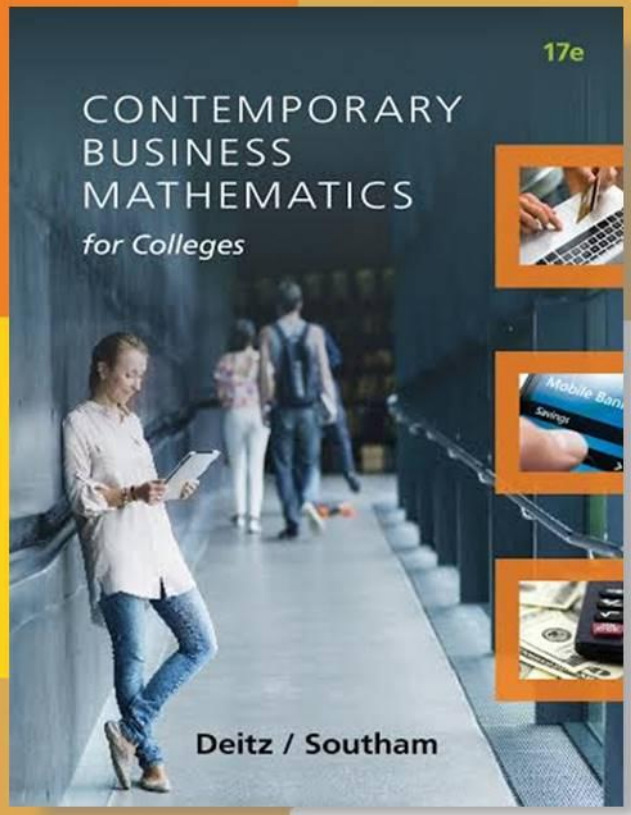


2

Decimals

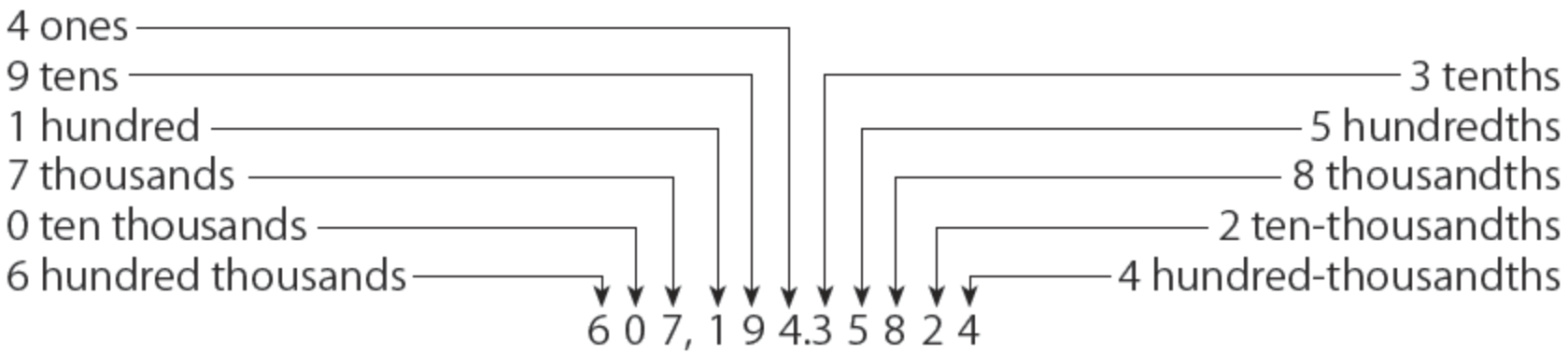
Prepared by Johnny Howard

Learning Objectives

By studying this chapter and completing all assignments, you will be able to:

- Learning Objective 1: Read decimal numbers.
- Learning Objective 2: Round decimal numbers.
- Learning Objective 3: Add two or more decimal numbers.
- Learning Objective 4: Subtract one decimal number from another.
- Learning Objective 5: Multiply two decimal numbers.
- Learning Objective 6: Divide one decimal number by another decimal number.
- Learning Objective 7: Multiply and divide by decimal numbers that end with zeros.
- Learning Objective 8: Approximate products and quotients.

Figure 2-1 Number System on Both Sides of the Decimal Point



EXAMPLE A

Recite orally the number 607,194.35824.

Number	Oral Recitation
607,194.35824	"six zero seven comma one nine four point three five eight two four"

STEPS to Round Decimal Numbers

1. Find the last place, or digit, to be retained.
2. Examine the digit to the right of the last digit to be retained.
3. a. If it is equal to or greater than 5, increase the digit to be retained by 1. Drop all digits to the right of the ones retained.

   b. If it is less than 5, leave the digit to be retained unchanged. Drop all digits to the right of the ones retained.

Learning Objective 2

EXAMPLE B

Round 7.3951 and 148.65392 to one decimal place, to two decimal places, and to three decimal places.

Round to the nearest tenth	$7.\underline{3}951 \longrightarrow 7.4$	$148.\underline{6}5392 \longrightarrow 148.7$
Round to the nearest hundredth	$7.3\underline{9}51 \longrightarrow 7.40$	$148.65\underline{3}92 \longrightarrow 148.65$
Round to the nearest thousandth	$7.39\underline{5}1 \longrightarrow 7.395$	$148.653\underline{9}2 \longrightarrow 148.654$

STEPS to Add Decimal Numbers

1. Arrange the numbers in columns, with the decimal points in a vertical line.
2. Add each column, from right to left, as with whole numbers. Insert the decimal point.

Option: You may want to write zeros in some of the right-hand columns of decimal numbers so that each number shows the same number of decimal places.

Learning Objective 3

EXAMPLE C

Add 4.326, 218.6004, 7.09, 15, and 0.87782.

STEP 1

$$
\begin{array}{r}
4.326 \\
218.6004 \\
7.09 \\
15. \\
0.87782
\end{array}
$$

STEP 2

$$
\begin{array}{r}
4.326 \\
218.6004 \\
7.09 \\
15. \\
+\quad 0.87782 \\
\hline
245.89422
\end{array}
$$

or

STEP 2 WITH OPTION

$$
\begin{array}{r}
4.32600 \\
218.60040 \\
7.09000 \\
15.00000 \\
+\quad 0.87782 \\
\hline
245.89422
\end{array}
$$

STEPS to Subtract Decimal Numbers

1. Arrange the numbers in columns, with the decimal points in a vertical line.
2. If necessary, write enough extra zeros so that both numbers have the same number of decimal places.
3. Subtract each column, from right to left, as with whole numbers. Insert the decimal point.

Learning Objective 4

EXAMPLES D and E

Subtract 4.935 from 12.8.

STEP 1	STEPS 2 & 3
12.8	12.800
− 4.935	− 4.935
	7.865

Subtract 9.4 from 82.113.

STEP 1	STEPS 2 & 3
82.113	82.113
− 9.4	− 9.400
	72.713

STEPS to Multiply Decimal Numbers

1. Multiply the two numbers as if they were whole numbers.
2. Count the total number of decimal places in the two original numbers.
3. a. In the product, place the decimal point so that the number of decimal places is the same as the number in Step 2. (Count from right to left.)

   b. If necessary, insert zeros in front of the left-hand digit to provide enough decimal places. (See example G.)

Learning Objective 5

EXAMPLES F, G, H, I, and J

3.764×2.1

	3.764	(3 places)
	$\times$ 2.1	(1 place)
STEP 1	3764	
	+7528	STEP 2
STEP 3	7.9044	(3 + 1 = 4 places)

3.764×0.0021

	3.764	(3 places)
	$\times$ 0.0021	(4 places)
STEP 1	3764	
	+7528	STEP 2
STEP 3	0.0079044	(3 + 4 = 7 places; insert 2 zeros)

$0.76 \times 0.5 = 0.380$ (3 places)
May be written as 0.38

$12.5 \times 1.6 = 20.00$ (2 places)
May be written as 20

$\$8.40 \times 6.5 = \$54.600$ (3 places)
Should be written as \$54.60

STEPS to Divide one Decimal Number by Another

1. Arrange the divisor, dividend, and division bracket as in whole-number long division.
2. Move the decimal point in the divisor to the right until the divisor is a whole number. (You won't have to move it if the divisor is already a whole number.)
3. Move the decimal point in the dividend to the right exactly the same number of decimal places as you did in Step 2. If necessary, attach more zeros to the right end of the dividend.
4. Write the decimal point in the quotient directly above the new decimal point in the dividend (in Step 3).
5. Write zeros, if necessary, in the quotient between the decimal point and the first nonzero digit.
6. Divide as you would for whole numbers.

Learning Objective 6

EXAMPLES K and L

STEP 1 | STEP 2 | STEP 3 | STEP 4 | STEP 6

$$2.7 \div 0.15 \quad is \quad 0.15\overline{)2.7} = 0.\underline{15}.\overline{)2.\underline{70}.} = 15.\overline{)270.} = 15.\overline{)270.}\,\overset{18.}{}$$

$$\begin{array}{r} -15 \\ \hline 120 \\ -120 \\ \hline 0 \end{array}$$

STEP 1 | STEP 4 | STEPS 5 & 6

$$0.096 \div 4 \quad is \quad 4\overline{)0.096} = 4.\overline{)0.096} = 4.\overline{)0.096}\,\overset{0.024}{}$$

$$\begin{array}{r} -8 \\ \hline 16 \\ -16 \\ \hline 0 \end{array}$$

STEPS to Approximate a Multiplication Problem

1. Round the first nonzero digit from the left end in each factor. (How does the digit to its right compare to 5?)
2. Change all the digits to the right of the first nonzero digit to zero.
3. Multiply the two new factors.
4. Place the decimal point in the product.

Learning Objective 8

EXAMPLES V and W

Approximate 3.764×7.4

	STEP 1	STEPS 2 & 3
3.764	4.000	4
$\times$ 7.4	$\times$ 7.0	$\times$ 7
		28

Approximate 0.089×61.18

	STEP 1	STEPS 2 & 3
0.089	0.090	0.09
$\times$ 61.18	$\times$ 60.00	$\times$ 60
		5.40

STEPS to Approximate a Division Problem

1. Round the divisor to a *single nonzero digit* at the left, followed by all zeros.
2. Round the dividend to a *two-digit number* at the left, followed by all zeros. Select the two-digit number so that it is evenly divisible by the new divisor.
3. Divide the new dividend by the new divisor.
4. Place the decimal point correctly in the quotient.

Learning Objective 8

EXAMPLES X and Y

Approximate $4.764 \div 8.1$

STEP 1	STEP 2	STEPS 3 & 4
$8.1\overline{)4.764}$	$8.0\overline{)4.764}$	$8.\overline{)4.800}$
		0.6
		$8.\overline{)4.8}$
		-4.8
		0

Approximate $61.18 \div 0.089$

STEP 1	STEP 2	STEPS 3 & 4
$0.089\overline{)61.18}$	$0.090\overline{)61.18}$	$0.09\overline{)63.00}$
		$700.$
		$9.\overline{)6300.$
		-63
		0

Chapter Terms for Review

decimal equivalent

decimal places

decimal point

mixed decimal

pure decimal

rounding off

Assignment 2.1: Addition and Subtraction of Decimal Numbers

A **Use digits to write each number that is expressed in words. Use words to write each number that is expressed in digits.**

1. Six hundred thirteen ten-thousandths 0.0613
2. Two hundred nine thousandths 0.209
3. Sixty-four hundredths 0.64
4. Seventy-six and ninety-two ten-thousandths 76.0092
5. Eight hundred sixty and ninety-eight hundred-thousandths 860.00098
6. Thirty and seventeen thousandths 30.017
7. 308.97 three hundred eight and ninety-seven hundredths
8. 0.0014 fourteen ten-thousandths
9. 592.3 five hundred ninety-two and three tenths
10. 0.152 one hundred fifty-two thousandths
11. 42.0481 forty-two and four hundred eighty-one ten-thousandths
12. 6.018 six and eighteen thousandths
13. 1,007.4 one thousand seven and four tenths

Learning Objectives 1 2 3 4

Assignment 2.1: Addition and Subtraction of Decimal Numbers

B **Round as indicated.**

Nearest Tenth

14.	3.1508 oz	3.2 oz
15.	48.97 mi	49.0 mi
16.	3.824 gal	3.8 gal
17.	374.29 lb	374.3 lb
18.	9.449 ft	9.4 ft
19.	6.375 oz	6.4 oz

Nearest Cent

20.	\$4.987	\$4.99
21.	\$0.098	\$0.10
22.	\$942.3449	\$942.34
23.	\$8.1047	\$8.10
24.	\$0.8948	\$0.89
25.	\$52.996	\$53.00

Nearest Thousandth

26.	5.37575 pt	5.376 pt
27.	0.00549 gal	0.005 gal
28.	0.3449 oz	0.345 oz
29.	8.1855 in.	8.186 in.
30.	8.9989 mi	8.999 mi
31.	0.200499 lb	0.200 lb

Up to the *Next* Cent

32.	\$6.462	\$6.47
33.	\$0.159	\$0.16
34.	\$72.535	\$72.54
35.	\$2.0917	\$2.10
36.	\$4.0404	\$4.05
37.	\$0.6545	\$0.66

Assignment 2.1: Addition and Subtraction of Decimal Numbers

C **Write the following numbers in columns, and then add.**

38. 3.84, 42.81, 747.114

$$\begin{array}{r} 3.84 \\ 42.81 \\ +747.114 \\ \hline 793.764 \end{array}$$

39. 0.7323, 4.084, 17.42

$$\begin{array}{r} 0.7323 \\ 4.084 \\ +17.42 \\ \hline 22.2363 \end{array}$$

40. 15.4, 32.574, 9.51, 74.0822

$$\begin{array}{r} 15.4 \\ 32.574 \\ 9.51 \\ +\ 74.0822 \\ \hline 131.5662 \end{array}$$

41. 24.78, 71.402, 8.3176

$$\begin{array}{r} 24.78 \\ 71.402 \\ +\ \ 8.3176 \\ \hline 104.4996 \end{array}$$

42. 24.183, 546.95, 1.0459

$$\begin{array}{r} 24.183 \\ 546.95 \\ +\ \ 1.0459 \\ \hline 572.1789 \end{array}$$

43. 6.4, 3.211, 12.6, 7.07

$$\begin{array}{r} 6.4 \\ 3.211 \\ 12.6 \\ +\ 7.07 \\ \hline 29.281 \end{array}$$

44. 337.51, 6.1761, 16.078

$$\begin{array}{r} 337.51 \\ 6.1761 \\ +\ 16.078 \\ \hline 359.7641 \end{array}$$

45. 36.7, 208.51, 3.992

$$\begin{array}{r} 36.7 \\ 208.51 \\ +\ \ 3.992 \\ \hline 249.202 \end{array}$$

46. 9.7, 0.084, 2.99, 0.089

$$\begin{array}{r} 9.7 \\ 0.084 \\ 2.99 \\ +0.089 \\ \hline 12.863 \end{array}$$

Assignment 2.1: Addition and Subtraction of Decimal Numbers

D **Subtract the following.**

47. $0.734 - 0.37 = 0.364$

48. $0.05155 - 0.00497 = 0.04658$

49. $26.04 - 8.625 = 17.415$

50. $0.7212 - 0.034 = 0.6872$

51. $6.1 - 2.418 = 3.682$

52. $724.13 - 47.59 = 676.54$

53. $3.2525 - 2.843 = 0.4095$

54. $708.932 - 339.999 = 368.933$

55. $0.365 - 0.189 = 0.176$

56. $4.37 - 1.9055 = 2.4645$

57. $7.624 - 5.947 = 1.677$

58. $7.5454 - 4.7987 = 2.7467$

Assignment 2.2: Multiplication of Decimal Numbers

A **Multiply the following. Round monetary products to the nearest cent. Do not round nonmonetary products.**

1. $15.67 × 83.7

10 969
47 01
+1253 6
$1,311.579

$1,311.58

2. $329.68 × 4.98

26 3744
296 712
+ 1318 72
$1,641.8064

$1,641.81

3. $420.00 × 0.806

2 52000
00 0000
+336 000
$338.52000

$338.52

4. $48.40 × 0.65

2 4200
+ 29 40
$31.4600

$31.46

5. 107.21 × 0.74

4 2884
+75 047
79.3354

79.3354

6. 96.88 × 0.79

8 7192
+67 816
76.5352

76.5352

7. 285.70326 × 0.28

22 8562608
+57 140652
79.9969128

79.9969128

8. 816.04 × 0.403

2 44812
00 0000
+326 416
328.86412

328.86412

Assignment 2.2: Division of Decimal Numbers

B **Divide the following. Round monetary products to the nearest cent. Do not round nonmonetary products.**

9. $7)\$12.95$

$$\begin{array}{r} \$\ 1.85 \\ 7\overline{)\$12.95} \\ -7 \\ \hline 59 \\ -56 \\ \hline 35 \\ -35 \\ \hline \end{array}$$

$\$1.85$

10. $0.32)\$3.600$

$$\begin{array}{r} \$\ 11.25 \\ 0.32\overline{)\$3.600} \\ -32 \\ \hline 40 \\ -32 \\ \hline 80 \\ -64 \\ \hline 160 \\ -160 \\ \hline \end{array}$$

$\$11.25$

11. $1.2)\$54.300$

$$\begin{array}{r} \$\ 45.25 \\ 1.2\overline{)\$54.300} \\ -48 \\ \hline 63 \\ -60 \\ \hline 30 \\ -24 \\ \hline 60 \\ -60 \\ \hline \end{array}$$

$\$45.25$

12. $1.5)2.5\,900$

$$\begin{array}{r} 1.726 \\ 1.5\overline{)2.5\,900} \\ -15 \\ \hline 109 \\ -105 \\ \hline 40 \\ -30 \\ \hline 100 \\ -90 \\ \hline \end{array}$$

1.73

13. $0.11)0.67350$

$$\begin{array}{r} 6.122 \\ 0.11\overline{)0.67350} \\ -66 \\ \hline 13 \\ -11 \\ \hline 25 \\ -22 \\ \hline 30 \\ -22 \\ \hline \end{array}$$

6.12

14. $2.3)3.400$

$$\begin{array}{r} 1.478 \\ 2.3\overline{)3.400} \\ -23 \\ \hline 110 \\ -92 \\ \hline 180 \\ -161 \\ \hline 190 \\ -184 \\ \hline \end{array}$$

1.48

Assignment 2.2: Multiplication and Division of Decimal Numbers

C **Multiply and/or divide by just moving the decimal point or by doing some simple multiplication/division and moving the decimal point. Round monetary answers to the nearest cent. Do not round nonmonetary answers.**

15. $0.0625 \times 1{,}000 =$ 62.5

16. $41.127 \times 100 =$ 4,112.7

17. $0.047 \times 10{,}000 =$ 470

18. $763 \div 100 =$ 7.63

19. $6.32 \div 10 =$ 0.632

20. $432.671 \div 1{,}000 =$ 0.432671

21. $\$72.41 \times 300 =$ $21,723.00

22. $\$32.25 \times 20 =$ $645.00

23. $\$0.12 \times 6{,}000 =$ $720.00

24. $\$40.00 \times 80 =$ $3,200.00

25. $\$86.50 \div 200 =$ $0.43

26. $\$963 \div 30 =$ $32.10

Assignment 2.2: Multiplication and Division of Decimal Numbers

D **For each of the following problems, underline the estimate that is most nearly correct.**

27.	0.077×0.52	(a)	4.0	(b)	0.4	(c)	0.04	(d)	0.004
28.	5.78×0.9345	(a)	5.4	(b)	0.54	(c)	0.054	(d)	0.0054
29.	0.38×71.918	(a)	0.28	(b)	2.8	(c)	28	(d)	280
30.	0.00912×5.09	(a)	0.0045	(b)	0.045	(c)	0.45	(d)	4.5
31.	0.0782×0.5503	(a)	0.0048	(b)	0.048	(c)	0.48	(d)	4.8
32.	0.0417×0.0957	(a)	0.04	(b)	0.004	(c)	0.0004	(d)	0.00004
33.	268.25×0.9175	(a)	27,000	(b)	2,700	(c)	270	(d)	27
34.	0.0487×0.0059	(a)	0.000003	(b)	0.00003	(c)	0.0003	(d)	0.003
35.	19.1×6104	(a)	120	(b)	1,200	(c)	12,000	(d)	120,000
36.	$6.275 \div 0.69$	(a)	90	(b)	9	(c)	0.9	(d)	0.09
37.	$3.575 \div 893.12$	(a)	0.004	(b)	0.04	(c)	0.4	(d)	4
38.	$0.0064 \div 0.897$	(a)	7.1	(b)	0.71	(c)	0.071	(d)	0.0071
39.	$8.397 \div 7.12$	(a)	0.12	(b)	1.2	(c)	12	(d)	120
40.	$0.0492 \div 0.794$	(a)	6.0	(b)	0.6	(c)	0.06	(d)	0.006
41.	$5.112 \div 0.0692$	(a)	70	(b)	7	(c)	0.7	(d)	0.07
42.	$2.671 \div 0.0926$	(a)	300	(b)	30	(c)	3	(d)	0.3

Assignment 2.3: Decimal Numbers in Business

A **Business Applications and Critical Thinking. Solve the following. Do not round your final answers.**

1. Charlie Krentz had 24.75 feet of rope. He cut off a piece 16.5 feet long. How much did he have left?

8.25 ft

$$\begin{array}{r} 24.75 \\ -16.5 \\ \hline 8.25 \end{array}$$

2. La Perla Jewelers had only 14.3 ounces of gold on hand, so it bought 27.75 ounces more to make Christmas items. It used 19.95 ounces for gold rings. How much gold did it have left?

22.1 oz

$$\begin{array}{r} 14.3 \\ +27.75 \\ \hline 42.05 \end{array} \qquad \begin{array}{r} 42.05 \\ -19.95 \\ \hline 22.10 \end{array}$$

3. Judy Tyler reads meters for the gas and electric company. She walked 3.6 miles on Monday; 3.7 miles on Tuesday, 2.9 miles on Wednesday, 3.25 miles on Thursday, and 3.4 miles on Friday. What was her total distance for the week?

16.85 mi

$$\begin{array}{r} 3.6 \\ 3.7 \\ 2.9 \\ 3.25 \\ +\ 3.4 \\ \hline 16.85 \end{array}$$

4. Four drivers for Secure Document Delivery need gasoline for their cars. Individually, they buy 9.8, 10.4, 11.7, and 13.9 gallons. How much do they purchase all together?

45.8 gal

$$\begin{array}{r} 9.8 \\ 10.4 \\ 11.7 \\ +13.9 \\ \hline 45.8 \end{array}$$

Assignment 2.3: Decimal Numbers in Business

A **Business Applications and Critical Thinking. Solve the following. Do not round your final answers. (cont'd)**

5. Ally Katz owes a total of $226.54 on her department store account. She visits the store to return an item that cost $47.79. While there, she buys two items that cost $55.88 and $67.50. What is Ally's new account balance at the store?

$302.13

$226.54
− 47.79
$178.75

$178.75
55.88
+ 67.50
$302.13

6. Perdue Paving Co. delivered 8.5 tons of concrete. It used 5.7 tons for a long driveway and 2.5 tons for a patio. How much concrete was left?

0.3 t

5.7
+2.5
8.2

8.5
−8.2
0.3

Assignment 2.3: Decimal Numbers in Business

B **Business Applications and Critical Thinking. Solve the following business problems. Use shortcuts where possible. If necessary, round answers to two decimal places.**

7. Bill Wells Hardware sells $\frac{5}{8}$-inch plastic tubing for $1.59 per foot and copper tubing for $3.99 per foot. How much will Kathy Fogg save by using plastic tubing if she needs 300 feet of tubing? $720

$3.99 − 1.59 = $2.40

$2.40 × 3 = $7.20

Move decimal point 2 places right

$7.20 ⟶ $720

8. Bay Landscaping sent three truckloads of organic mulch to a job. The mulch cost $38.50 per cubic yard. Two trucks carried 8.75 cubic yards each; a third carried 9.75 cubic yards. What was the total cost of all the mulch? $1,049.13

8.75 + 8.75 + 9.75 = 27.25

$38.50 × 27.25 = 1 9250 + 7 700 + 269 50 + 770 0 = $1,049.1250

9. Wholesale, 1,000 2-ounce plastic bottles cost 3.5 cents each, and 2,000 4-ounce bottles cost 4.5 cents each. What is the total cost of all 3,000 bottles? $125

3.5¢ = $0.035

$0.035 × 1,000 = $35

4.5¢ = $0.045

$0.045 × 2,000 = $90

$35 + $90 = $125

10. Evelyn Haynes often used her motorcycle as a delivery vehicle. One Monday, when gasoline was priced at $4.659 per gallon, Evelyn bought 1.64 gallons. The following Thursday, gasoline prices rose to $4.859 per gallon and she bought 1.92 gallons. What was the total amount that Evelyn spent for gasoline those two days? $16.97

1.64 × $4.659 = $7.64076, or $7.64

1.92 × $4.859 = $9.32928, or + 9.33

$16.97

Assignment 2.3: Decimal Numbers in Business

B **Business Applications and Critical Thinking. Solve the following problems. Use shortcuts where possible. If necessary, round answers to two decimal places. (cont'd)**

11. Electrician Tom Stewart paid $134.50 for 200 feet of three-strand electrical cable. What was the cost per foot for this particular cable? $0.67

$134.50 ÷ 2 = $67.25
Move decimal point 2 places left
$67.25 ⟶ $0.6725 or $0.67

12. A pizza chef has 24 pounds of flour on hand. He needs 3.75 pounds of flour for one large recipe of pizza dough. How many recipes can he make with the flour on hand? (Round to the nearest tenth.) 6.4 recipes

```
      6.4
3.75.)24.00.0
   −2250
    1500
   −1500
       0
```

13. Paint thinner costs $8.47 per gallon. How many gallons can a painting contractor buy for $200? (Round to the nearest tenth.) 23.6 gal

```
      23.61
8.47.)200.00.00
   −1694
    3060
   −2541
    5190
   −5082
    1080
    −847
```

14. Alma White earns $23.40 per hour. How many hours did she work during a partial day for which her pay was $169.65? 7.25 hr

```
      7.25
23.40)169.65.00
   −163.80
     5850
    −4680
     11700
    −11700
         0
```