

Indicator 3 Class Notes by Mrs. Joshi

Operations with Decimals-(6. Add, subtract, multiply, and divide decimals using a standard algorithm.)

● Adding and Subtracting Decimals

Example 3 Find $1.57 + 2.003$.

$$\begin{array}{r} 1.570 \\ + 2.003 \\ \hline 3.573 \end{array}$$

Insert a zero so the numbers have the same number of decimal places.

Example 4 Find $1.8 - 0.59$.

$$\begin{array}{r} 1.80 \\ - 0.59 \\ \hline 1.21 \end{array}$$

Try It Yourself

Find the sum or difference.

9. $1.63 + 0.004$

10. $1.5 - 1.06$

11. $3.62 + 0.001$

12. $2.025 + 0.09$

13. $5.23 - 0.009$

14. $4.21 - 3.002$

15. $1.701 + 2.3$

16. $2.053 - 1.9$

3.2 Lesson

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Key Idea

Multiplying Decimals by Whole Numbers

Words Multiply as you would with whole numbers. Then count the number of decimal places in the decimal factor. The product has the same number of decimal places.

Numbers

$$\begin{array}{r} 13.91 \\ \times 7 \\ \hline 97.37 \end{array} \left. \begin{array}{l} \text{2 decimal places} \end{array} \right\}$$
$$\begin{array}{r} 6.218 \\ \times 4 \\ \hline 24.872 \end{array} \left. \begin{array}{l} \text{3 decimal places} \end{array} \right\}$$

EXAMPLE 1 Using Estimation to Find a Product

Find 15.8×4 .

Estimate $16 \times 4 = 64$

$$\begin{array}{r} 15.8 \\ \times 4 \\ \hline 63.2 \end{array}$$

Multiply as you would with whole numbers.

The estimate is 64. So, place the decimal point after the 3.

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EXAMPLE 2 Multiplying Decimals and Whole Numbers

a. Find 8.7×5 .

Estimate $9 \times 5 = 45$

$$\begin{array}{r} 8.7 \\ \times 5 \\ \hline 43.5 \end{array}$$

One decimal place

Count one decimal place from right to left.

So, $8.7 \times 5 = 43.5$.

Reasonable? $43.5 \approx 45$ ✓

b. Find 6×0.91 .

Estimate $6 \times 1 = 6$

$$\begin{array}{r} 0.91 \\ \times 6 \\ \hline 5.46 \end{array}$$

Two decimal places

Count two decimal places from right to left.

So, $6 \times 0.91 = 5.46$.

Reasonable? $5.46 \approx 6$ ✓

EXAMPLE 3 Inserting Zeros in the Product

Study Tip

When multiplying, you may not have enough decimal places in the product. In this case, insert one or more zeros in the product.

Find 3×0.016 .

$$\begin{array}{r} 0.016 \\ \times 3 \\ \hline 0.048 \end{array}$$

Three decimal places

To have three decimal places, insert zeros to the left of 48.

So, $3 \times 0.016 = 0.048$.

EXAMPLE 4 Standardized Test Practice

Which expression is equivalent to $7(n + 0.0013)$?

- (A) $n + 0.0091$ (B) $7n + 0.091$
(C) $7n + 0.0091$ (D) $7n + 0.91$

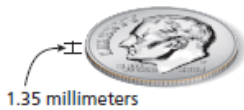
$$\begin{aligned} 7(n + 0.0013) &= 7(n) + 7(0.0013) && \text{Distributive Property} \\ &= 7n + 0.0091 && \text{Multiply 7 and 0.0013.} \end{aligned}$$

The correct answer is (C).

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EXAMPLE 5 Use Mental Math

How high is a stack of 100 dimes?



Method 1: Multiply 1.35 by 100.

$$\begin{array}{r}
 1.35 \\
 \times 100 \\
 \hline
 000 \\
 000 \\
 \hline
 135 \\
 \hline
 135.00
 \end{array}$$

Two decimal places

Method 2: You are multiplying by a power of 10. Use mental math.

There are **two** zeros in 100. So, move the decimal point in 1.35 **two** places to the right.

$$1.35 \times 100 = 135. = 135$$

So, a stack of 100 dimes is 135 millimeters high.

3.3 Lesson



The rule for multiplying two decimals is similar to the rule for multiplying a decimal by a whole number.

Key Idea

Multiplying Decimals by Decimals

Words Multiply as you would with whole numbers. Then add the number of decimal places in the factors. This sum gives you the number of decimal places in the product.

Numbers

$$\begin{array}{r}
 4.716 \leftarrow 3 \text{ decimal places} \\
 \times 0.2 \leftarrow + 1 \text{ decimal place} \\
 \hline
 0.9432 \leftarrow 4 \text{ decimal places}
 \end{array}$$

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EXAMPLE 1 Multiplying Decimals

- a. Find 4.8×7.2 . **Estimate** $5 \times 7 = 35$

$$\begin{array}{r} 4.8 \leftarrow 1 \text{ decimal place} \\ \times 7.2 \leftarrow + 1 \text{ decimal place} \\ \hline 96 \\ 336 \\ \hline 34.56 \leftarrow 2 \text{ decimal places} \end{array}$$

∴ So, $4.8 \times 7.2 = 34.56$. **Reasonable?** $34.56 \approx 35$ ✓

- b. Find 3.1×0.05 . **Estimate** $3 \times 0 = 0$

$$\begin{array}{r} 3.1 \leftarrow 1 \text{ decimal place} \\ \times 0.05 \leftarrow + 2 \text{ decimal places} \\ \hline 0.155 \leftarrow 3 \text{ decimal places} \end{array}$$

∴ So, $3.1 \times 0.05 = 0.155$. **Reasonable?** $0.155 \approx 0$ ✓

EXAMPLE 2 Evaluating Expressions

Evaluate the expression $2.4x$ for the given value of x .

a. $x = 3.95$

$2.4x = 2.4(3.95)$ Substitute.

$$\begin{array}{r} 3.95 \leftarrow 2 \text{ decimal places} \\ \times 2.4 \leftarrow + 1 \text{ decimal place} \\ \hline 1580 \\ 790 \\ \hline 9.480 \leftarrow 3 \text{ decimal places} \end{array}$$

∴ So, $2.4x = 9.48$ when $x = 3.95$.

b. $x = 0.016$

$2.4x = 2.4(0.016)$ Substitute.

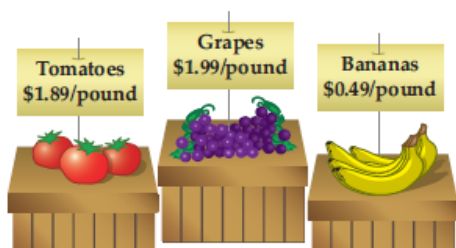
$$\begin{array}{r} 0.016 \leftarrow 3 \text{ decimal places} \\ \times 2.4 \leftarrow + 1 \text{ decimal place} \\ \hline 64 \\ 32 \\ \hline 0.0384 \leftarrow 4 \text{ decimal places} \end{array}$$

∴ So, $2.4x = 0.0384$ when $x = 0.016$.

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EXAMPLE 3 Real-Life Application

You buy 2.75 pounds of tomatoes. You hand the cashier a \$10 bill. How much change will you get back?



Step 1: Multiply 1.89 by 2.75.

$$\begin{array}{r} 1.89 \leftarrow 2 \text{ decimal places} \\ \times 2.75 \leftarrow + 2 \text{ decimal places} \\ \hline 945 \\ 1323 \\ \underline{378} \\ 51975 \leftarrow 4 \text{ decimal places} \end{array}$$

The cost of 2.75 pounds of tomatoes is \$5.20.

Step 2: Subtract \$5.20 from \$10.

$$\begin{array}{r} 10.00 \\ - 5.20 \\ \hline 4.80 \end{array}$$

So, you will get \$4.80 back.

3.4 Lesson

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Key Idea

Dividing Decimals by Whole Numbers

Words Place the decimal point in the quotient above the decimal point in the dividend. Then divide as you would with whole numbers.

Numbers

$$\begin{array}{r} 1.83 \\ 4 \overline{) 7.32} \end{array}$$

Place the decimal point in the quotient above the decimal point in the dividend.

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EXAMPLE 1 Dividing Decimals by Whole Numbers

a. Find $7.6 \div 4$.

Estimate $8 \div 4 = 2$

$$\begin{array}{r} 1.9 \\ 4 \overline{)7.6} \\ \underline{-4} \\ 36 \\ \underline{-36} \\ 0 \end{array}$$

Place the decimal point in the quotient above the decimal point in the dividend.

∴ So, $7.6 \div 4 = 1.9$.

Reasonable? $1.9 \approx 2$ ✓

Remember

Another way to check your answer is to multiply the quotient by the divisor.
Example 1(b):

$$\begin{array}{r} 6.35 \\ \times 5 \\ \hline 31.75 \end{array} \quad \checkmark$$

The product is the dividend.

b. Find $31.75 \div 5$.

Estimate $30 \div 5 = 6$

$$\begin{array}{r} 6.35 \\ 5 \overline{)31.75} \\ \underline{-30} \\ 17 \\ \underline{-15} \\ 25 \\ \underline{-25} \\ 0 \end{array}$$

Place the decimal point in the quotient above the decimal point in the dividend.

∴ So, $31.75 \div 5 = 6.35$.

Reasonable? $6.35 \approx 6$ ✓

EXAMPLE 2 Inserting a Zero in the Dividend

Find $4.38 \div 12$.

$$\begin{array}{r} 0.365 \\ 12 \overline{)4.380} \\ \underline{-36} \\ 78 \\ \underline{-72} \\ 60 \\ \underline{-60} \\ 0 \end{array}$$

Place the decimal point in the quotient above the decimal point in the dividend.

Insert a zero and continue to divide.

∴ So, $4.38 \div 12 = 0.365$.

Check $0.365 \times 12 = 4.38$ ✓

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EXAMPLE 3 Real-Life Application

Which pack of sports drinks is the better buy? Explain.



To find the better buy, divide each price by the number of bottles. Continue dividing until the quotient can be rounded to the nearest cent.

6-pack

$$\begin{array}{r} 0.991 \\ 6 \overline{)5.950} \\ \underline{-54} \\ 55 \\ \underline{-54} \\ 10 \\ \underline{-6} \\ 4 \end{array}$$

Rounds to 0.99.

8-pack

$$\begin{array}{r} 0.968 \\ 8 \overline{)7.750} \\ \underline{-72} \\ 55 \\ \underline{-48} \\ 70 \\ \underline{-64} \\ 6 \end{array}$$

Rounds to 0.97.

- The price per bottle is \$0.99 for the 6-pack and \$0.97 for the 8-pack. So, the 8-pack is the better buy.

3.5 Lesson

Check It Out
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Key Idea

Dividing Decimals by Decimals

Words Multiply the divisor *and* dividend by 10, 100, or 1000 to make the divisor a whole number. Then place the decimal point in the quotient and divide as you would with whole numbers.

Numbers $1.2 \overline{)4.56} \longrightarrow 12 \overline{)45.6}$

Multiply each number by 10.

Place the decimal point above the decimal point in the dividend 45.6.

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EXAMPLE 1 Dividing Decimals

a. Find $18.2 \div 1.4$.

Study Tip

Multiplying the divisor and dividend by 10, 100, or 1000 does not change the quotient.

For example:

$$18.2 \div 1.4 = 13$$

$$182 \div 14 = 13$$

$$1820 \div 140 = 13$$

$$1.4 \overline{)18.2}$$

Multiply each number by 10.

$$\begin{array}{r} 13. \\ 14 \overline{)182.} \\ \underline{-14} \\ 42 \\ \underline{-42} \\ 0 \end{array}$$

Place the decimal point above the decimal point in the dividend 182.

So, $18.2 \div 1.4 = 13$.

Check $13 \times 1.4 = 18.2$ ✓

b. Find $0.273 \div 0.39$.

$$0.39 \overline{)0.273}$$

Multiply each number by 100.

$$\begin{array}{r} 0.7 \\ 39 \overline{)27.3} \\ \underline{-27.3} \\ 0 \end{array}$$

So, $0.273 \div 0.39 = 0.7$.

Check $0.7 \times 0.39 = 0.273$ ✓

EXAMPLE 2 Inserting Zeros in the Dividend and Quotient

Find $2.45 \div 0.007$.

Study Tip

Remember to check your answer by multiplying the quotient by the divisor.

$$0.007 \overline{)2.450}$$

Multiply each number by 1000. Insert a zero in the dividend.

$$\begin{array}{r} 350 \\ 7 \overline{)2450} \\ \underline{-21} \\ 35 \\ \underline{-35} \\ 00 \end{array}$$

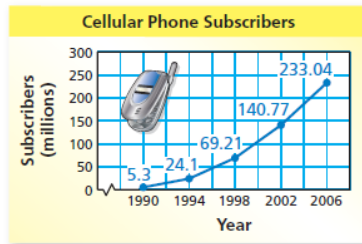
$0 \div 7 = 0$. So, insert a zero in the quotient.

So, $2.45 \div 0.007 = 350$.

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EXAMPLE 3 Real-Life Application

How many times more cellular phone subscribers were there in 2006 than in 1990? Round to the nearest whole number.



From the graph, there were 233.04 million subscribers in 2006 and 5.3 million in 1990. So, divide 233.04 by 5.3.

Estimate $230 \div 5 = 46$

$$\begin{array}{r} 5.3 \overline{)233.04} \longrightarrow 53 \overline{)2330.4} \quad \leftarrow \text{Rounds to 44.} \\ \underline{-212} \\ 210 \\ \underline{-159} \\ 514 \\ \underline{-477} \\ 37 \end{array}$$

∴ So, there were about 44 times more subscribers in 2006 than in 1990.

Reasonable? $44 \approx 46$ ✓