UNIT 9 – OPERATIONS WITH DECIMALS

INTRODUCTION

In this Unit, we will use our understanding of operations, decimals, and place value to perform operations with decimals.

The table below shows the learning objectives that are the achievement goal for this unit. Read through them carefully now to gain initial exposure to the terms and concept names for the lesson. Refer back to the list at the end of the lesson to see if you can perform each objective.

Learning Objective	Media Examples	You Try
Add decimals in the tenths and hundreds place using decimal grids	1	2
Add decimals using a place value chart	3	5
Use an algorithm to add decimals	4	5
Subtract decimals in the tenths and hundreds place using decimal grids	6	7
Subtract decimals using a place value chart	8	10
Use an algorithm to subtract decimals	9	10
Add and subtract signed decimals	11	12
Multiply a whole number times a decimal using decimal grids	13	15
Multiply two decimals using a decimal grid	14	15
Multiply decimal using place value	16	17
Divide decimals using a decimal grid	18	19
Divide decimals using place value	20	21
Multiply decimals by powers of ten	22	24
Divide decimals by powers of 10	23	24
Perform decimal operations on a calculator	25	26
Solve application problems with decimals	27	28

UNIT 9 – MEDIA LESSON

SECTION 9.1: ADDING DECIMALS USING THE AREA MODEL

In this section, we will learn to visualize the addition of decimals using the area model with the 10 by 10 grid.
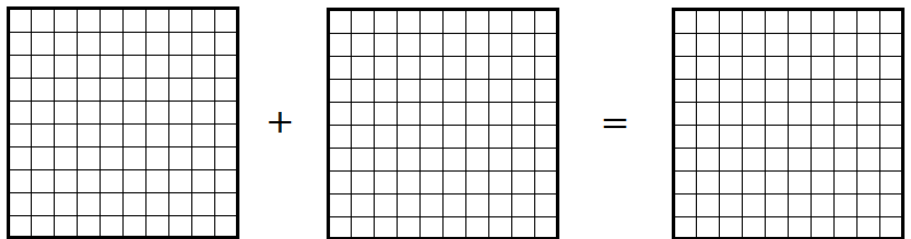
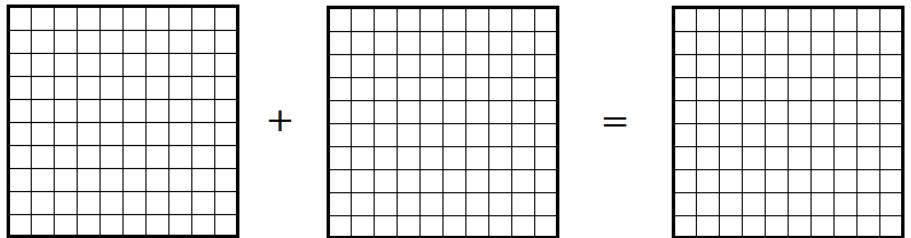| 🖥 Problem 1	MEDIA EXAMPLE – Adding Decimals in the Tenths and Hundredths Place

Use the decimal grids to shade the addends of the addition problem. Then combine your addends in a new grid to find the sum. (Note: We call the numbers we are adding in an addition problem the *addends*. We call the simplified result the *sum*.)
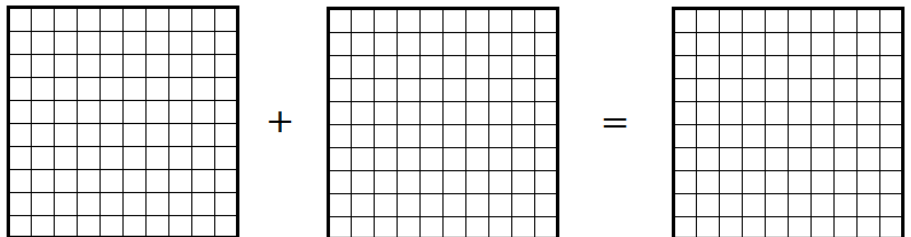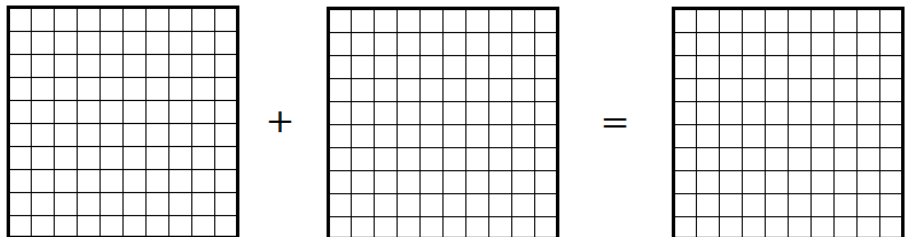
a) $0.3 + 0.5$

Sum: _____

b) $0.04 + 0.07$

Sum: _____
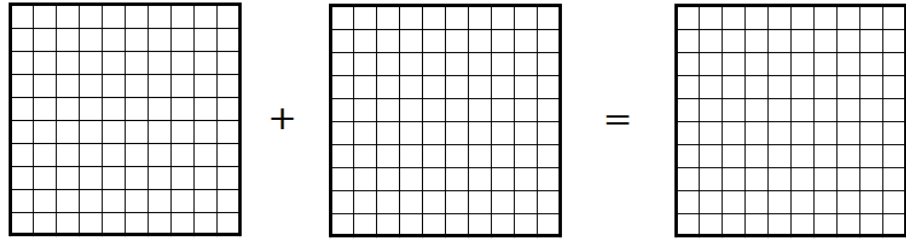
c) $0.3 + 0.06$

Sum: _____

d) $0.35 + 0.18$

Sum: _____

✏️ Problem 2	YOU TRY - Adding Decimals Using the Area Model

Use the decimal grids to shade the decimal portions of the addends of the addition problem. Then combine your addends in a new grid to find the sum.

a) $0.47 + 0.29$

Sum: _____

SECTION 9.2: ADDING DECIMALS USING PLACE VALUE

In the last section, we were actually using place value to add decimals by grouping according to the place value of the decimals. In this section, we will streamline this process, by adding using a place value chart and then learning how to add without the place value chart.

💻 Problem 3	MEDIA EXAMPLE – Adding Decimals Using a Place Value Chart

Place the numbers in the place value chart and then use the chart as an aid to add the numbers.

$32.456 + 7.98$

Sum: _____

💻 Problem 4	MEDIA EXAMPLE – Adding Decimals Using Place Value

Add the decimals without a place value chart by aligning the decimals points and adding.

$5.09 + 62.784$

	Problem 5	You Try – Adding Decimals Using Place Value

In the first problem, add the decimals using the place value chart. In the second problem, align the decimal points to add.

a) $15.397 + 6.91$

b) $437.9 + 52.438$

Ones			.	Decimals		
Hundreds	Tens	Ones	.	Tenths	Hundredths	Thousandths
			.			
			.			
			.			

+

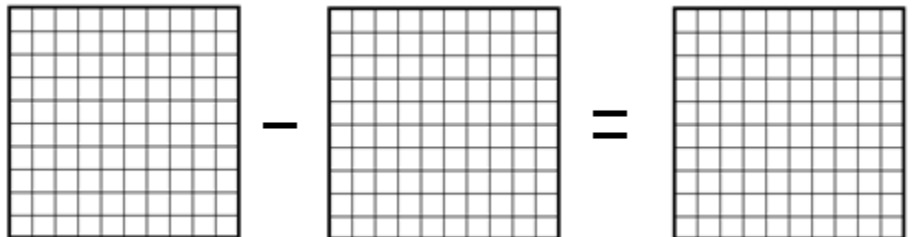## SECTION 9.3: SUBTRACTING DECIMALS USING THE AREA MODEL

In this section, we will learn to visualize the subtraction of decimals using the 10 by 10 grid.

	Problem 6	MEDIA EXAMPLE – Subtracting Decimals in the Tenths and Hundredths Place

Use the decimal grids to shade the given decimals in the subtraction problem. Then find the difference by taking away the second quantity from the first quantity.
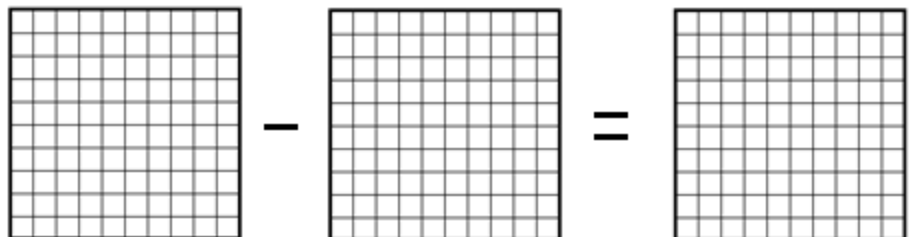
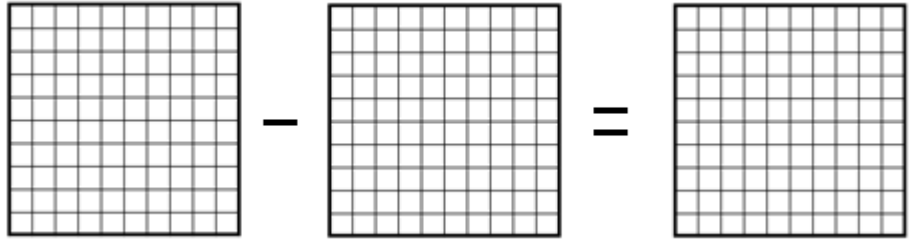a) $0.7 - 0.4$

Difference: _____
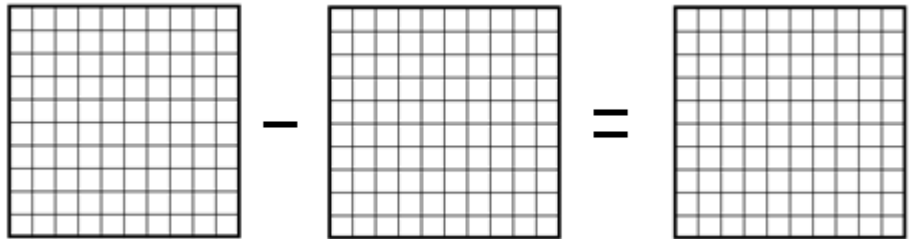
b) $0.09 - 0.06$

Difference: _____

c) $0.3 - 0.06$
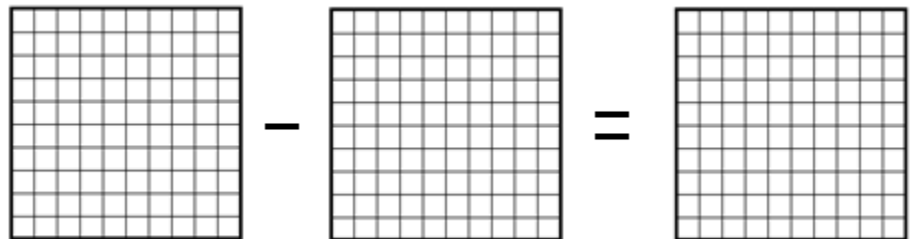

Difference: _____

d) $0.47 - 0.28$

Difference: _____

🖊 Problem 7	YOU TRY - Subtracting Decimals Using the Area Model

Use the decimal grids to shade the given decimals in the subtraction problem. Then find the difference by taking away the second quantity from the first quantity.

$0.56 - 0.24$

Difference: _____

SECTION 9.4: SUBTRACTING DECIMALS USING PLACE VALUE

In the last section, we were actually using place value to subtract decimals by grouping according to the place value of the decimals. In this section, we will streamline this process, by subtracting using a place value chart and then learning how to subtract without the place value chart.

🖥️	Problem 8	MEDIA EXAMPLE – Subtracting Decimals Using a Place Value Chart

Place the numbers in the place value chart and then use the chart as an aid to subtract the numbers.

$21.456 - 8.89$

Ones			.	Decimals		
Hundreds	Tens	Ones	.	Tenths	Hundredths	Thousandths
			.			
			.			
			.			

Difference: _____

🖥️	Problem 9	MEDIA EXAMPLE – Subtracting Decimals Using Place Value

Subtract the decimals without a place value chart by aligning the decimals points and subtracting.

$$52.634 - 7.09$$

✏️	Problem 10	You Try – Subtracting Decimals Using Place Value

In the first problem, subtract the decimals using the place value chart. In the second problem, align the decimal points to subtract.

a) $18.547 - 6.82$ b) $371.9 - 342.5$

Ones			.	Decimals		
Hundreds	Tens	Ones	.	Tenths	Hundredths	Thousandths
			.			
			.			
			.			

6

SECTION 9.5: ADDING AND SUBTRACTING SIGNED DECIMALS

In this section, we will add and subtract signed decimals. The same rules that apply to these processes on integers can be extended to decimals. These procedures are summarized below.

A. When adding two or more numbers, all with the same sign,
1. Add the absolute values of the numbers
2. Keep the common sign of the numbers

B. When adding two numbers with different signs.
1. Find the absolute value of the numbers
2. Subtract the smaller absolute value from the larger absolute value
3. Keep the original sign of the number with the larger absolute value.

C. When subtracting two decimals, we can use following fact.
   Fact: Subtracting a decimal from a number is the same as adding the decimal's opposite to the number.
1. If given a subtraction problem, rewrite it as an addition problem.
2. Use the rules for addition to add the signed numbers as summarized above.

| | Problem 11 | MEDIA EXAMPLE – Adding and Subtracting Signed Decimals |

Use the rules for signed numbers to add or subtract the decimals.

a) $-0.14 + (-0.27)$ b) $5.63 + (-7.24)$ c) $-4.2 - (-3.8)$

| | Problem 12 | You Try – Adding and Subtracting Signed Decimals |

Use the rules for signed numbers to add or subtract the decimals.

a) $0.7 + (-0.14)$ b) $-4.63 + 2.61$ c) $5.2 - (-2.7)$

SECTION 9.6: MULTIPLYING DECIMALS USING THE AREA MODEL

In this section, we will learn to visualize the multiplication of decimals using the area model with the 10 by 10 grid.

🖥	Problem 13	MEDIA EXAMPLE – Multiplying a Whole Number Times a Decimal

Rewrite the multiplication statements using *copies of* language and word names. Then represent the decimal problems using the decimal grids.
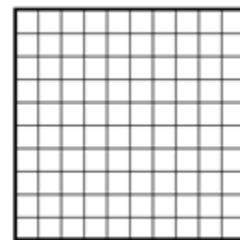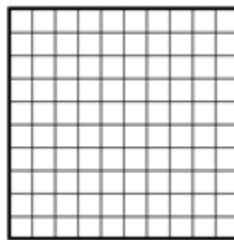
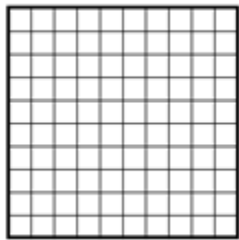a) $3 \cdot 4$ Copies Language:

Picture:

Product: _____

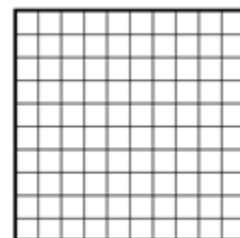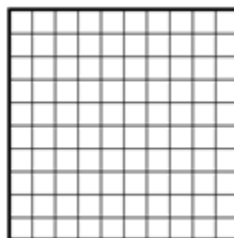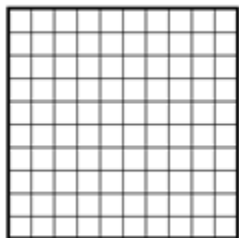b) $3 \cdot 0.4$ Copies Language:

Product: _____

c) $3 \cdot 0.04$ Copies Language:

Product: _____

d) Describe the pattern that you see in a through c.

💻 Problem 14	MEDIA EXAMPLE – Multiplying Two Decimals

Rewrite the multiplication statements using *copies of* language and word names. Then represent the decimal problems using the decimal grids.

a) $0.3 \cdot 0.4$
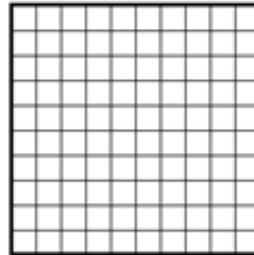
    Copies Language:
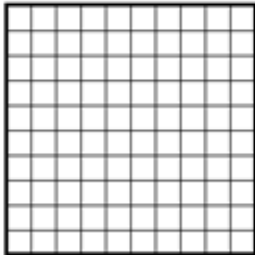
    Product: _____

b) $0.6 \cdot 0.2$

    Copies Language:

    Product: _____

c) Describe the pattern that you see.

✏️ Problem 15	You Try – Multiplying Two Decimals

Rewrite the multiplication statements using *copies of* language and word names. Then represent the decimal problems using the decimal grids.

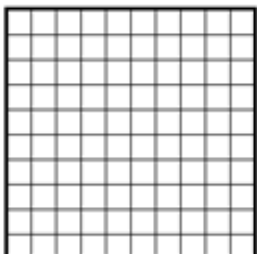a) $2 \cdot 0.08$ Copies Language: Product:_____
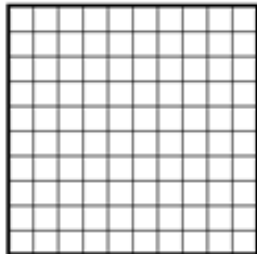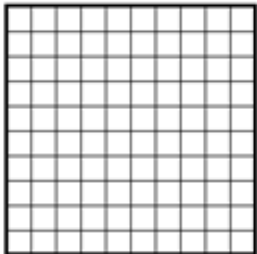
b) $0.2 \cdot 0.8$ Copies Language: Product:_____

SECTION 9.7: MULTIPLYING DECIMALS USING PLACE VALUE

In this section, we will multiply decimals by using the patterns we saw in Section 4.1. In particular, we will use the strategy below.

To multiply two decimals:
1. Multiply the two numbers as if they were whole numbers (disregard the decimals for now).
2. Determine the total number of digits that were to the right of the decimal points in your two original factors and add them.
3. Take your product from step one. Starting from the right, count as many place values as you found in step 2 and place the decimal point in this spot.

Problem 16	MEDIA EXAMPLE – Multiplying Decimals Using Place Value

Multiply the decimals.

a) $1.4 \cdot 3 =$ b) $1.4 \cdot 0.3 =$ c) $0.14 \cdot 0.3 =$

a) $0.3 \cdot 0.8 =$ e) $0.3 \cdot 0.08 =$ f) $0.03 \cdot 0.8 =$

g) $4 \cdot 2.1 =$ e) $0.4 \cdot 2.1 =$ f) $0.4 \cdot 0.21 =$

Problem 17	You Try – Multiplying Decimals Using Place Value

Multiply the decimals.

a) $1.2 \cdot 6 =$ b) $1.2 \cdot 0.6 =$ c) $0.12 \cdot 0.6 =$

SECTION 9.8: DIVIDING DECIMALS USING THE AREA MODEL

Problem 18	MEDIA EXAMPLE – Dividing Decimals using the Area Model

Rewrite the division statements using *copies of* language and word names. Then represent the decimal problems using the decimal grids.

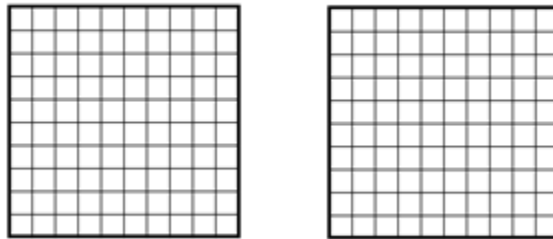a) $12 \div 3$ Copies Language:

Picture:

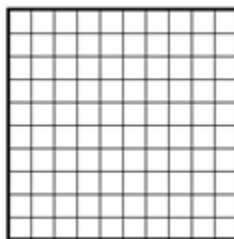Quotient _____

b) $1.2 \div 0.3$ Copies Language:

Quotient: _____

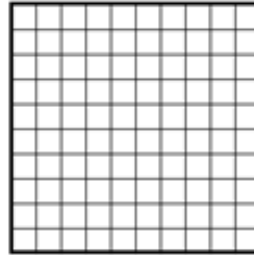c) $0.12 \div 0.03$ Copies Language:

Quotient: _____

	Problem 19	You Try – Dividing Decimals Using the Area Model

Rewrite the division statements using *copies of* language and word names. Then represent the decimal problems using the decimal grids.

$1.6 \div 0.8$ Copies Language: Quotient: _____
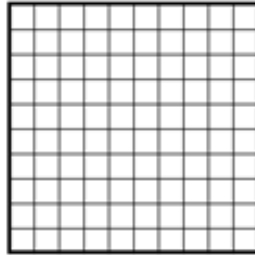
	SECTION 9.9: DIVIDING DECIMALS USING PLACE VALUE	

In this section, we will look at quotients that are not whole numbers. We will use the patterns developed to create a general method for dividing numbers involving decimals.

	Problem 20	MEDIA EXAMPLE – Dividing Decimals Using Place Value

Divide the decimals.

a) $24 \div 8 =$ 　　　　　 b) $2.4 \div 0.8 =$ 　　　　　 c) $0.24 \div 0.8 =$

d) $0.42 \div 0.07 =$ 　　　　 e) $4.2 \div 0.7 =$ 　　　　　 f) $0.42 \div 0.7 =$

	Problem 21	You Try – Dividing Decimals Using Place Value

Divide the decimals.

a) $56 \div 8 =$ 　　　　　 b) $5.6 \div 0.8 =$ 　　　　　 c) $0.56 \div 8 =$

SECTION 9.10: MULTIPLYING AND DIVIDING DECIMALS BY POWERS OF 10

In this section, we will investigate patterns when multiplying or dividing by powers of ten. Some examples of powers of ten are $10^1 = 10$, $10^2 = 100$, and $10^3 = 1000$.

	Problem 22	MEDIA EXAMPLE – Multiplying by Powers of Ten

Multiply the numbers by the given powers of 10 by moving the decimal point the appropriate number of places.

a) $4.23 \cdot 10 =$ _____

b) $0.037 \cdot 1000 =$ _____

c) $29.5 \cdot 100 =$ _____

d) $3.1415 \cdot 1000 =$ _____

e) $5.24 \cdot 10 =$ _____

f) $0.076 \cdot 100 =$ _____

	Problem 23	MEDIA EXAMPLE – Dividing by Powers of Ten

Divide the numbers by the given powers of 10 on your calculator then look for patterns to make a general strategy.

a) $4.23 \div 10 =$ _____

b) $3.7 \div 1000 =$ _____

c) $29.5 \div 100 =$ _____

d) $3.1415 \div 1000 =$ _____

e) $5.24 \div 10 =$ _____

f) $0.67 \div 100 =$ _____

g) Look for patterns in the examples above and complete the statement below.
   To divide a decimal number by a power of 10, you move the decimal place

	Problem 24	YOU TRY - Multiplying and Dividing by Powers of Ten

Multiply the numbers by the given powers of 10 by moving the decimal point the appropriate number of places.

a) $1.126 \cdot 100 =$ _____

b) $0.049 \cdot 1000 =$ _____

c) $5.7 \cdot 10 =$ _____

d) $1.126 \div 100 =$ _____

e) $4.9 \div 1000 =$ _____

f) $5.7 \div 10 =$ _____

SECTION 9.11: DECIMAL OPERATIONS ON THE CALCULATOR

When performing the mathematical operations of addition, subtraction, multiplication, and division using decimals, our calculator is a great support tool. Once the given numbers are combined, *rounding* often comes into play when presenting the final result.

| Problem 25 | MEDIA EXAMPLE – Decimal Operations on the Calculator |

Use your calculator to compute each of the following. Round as indicated.

a) Multiply $4.32 \cdot 3.17$ then round the result to the nearest tenth.

b) Divide $523.14 \div 23.56$ then round the result to the nearest thousandth.

c) Evaluate $(0.1)^2$. Write your result first in decimal form. Then, convert to a simplified fraction.

d) Combine the numbers below. Round your final result to the nearest whole number.

$$3.721 + 4.35 \cdot 21.72 - 0.03$$

| Problem 26 | YOU TRY - Decimal Operations on the Calculator |

Use your calculator to combine the numbers below. Round your final result to the nearest hundredth. When computing, try to enter the entire expression all at once.

$$(6.41)^2 - 5.883 \div 2.17$$

SECTION 9.12: APPLICATIONS WITH DECIMALS

| 🖥 | Problem 27 | MEDIA EXAMPLE – Applications with Decimals |

In preparation for mailing a package, you place the item on your digital scale and obtain the following readings: 6.51 ounces, 6.52 ounces, and 6.60 ounces. What is the average of these weights? Round to the nearest hundredth of an ounce.

GIVEN:

GOAL:

MATH WORK:

CHECK:

FINAL ANSWER AS A COMPLETE SENTENCE:

| ✏ | Problem 28 | YOU TRY - Applications with Decimals |

Rally went to Target with $40 in his wallet. He bought items that totaled $1.45, $2.15, $7.34, and $14.22. If the tax comes to $2.26, how much of his $40 would he have left over? Round to the nearest cent (hundredths place).

GIVEN:

GOAL:

MATH WORK:

CHECK:

FINAL ANSWER AS A COMPLETE SENTENCE: