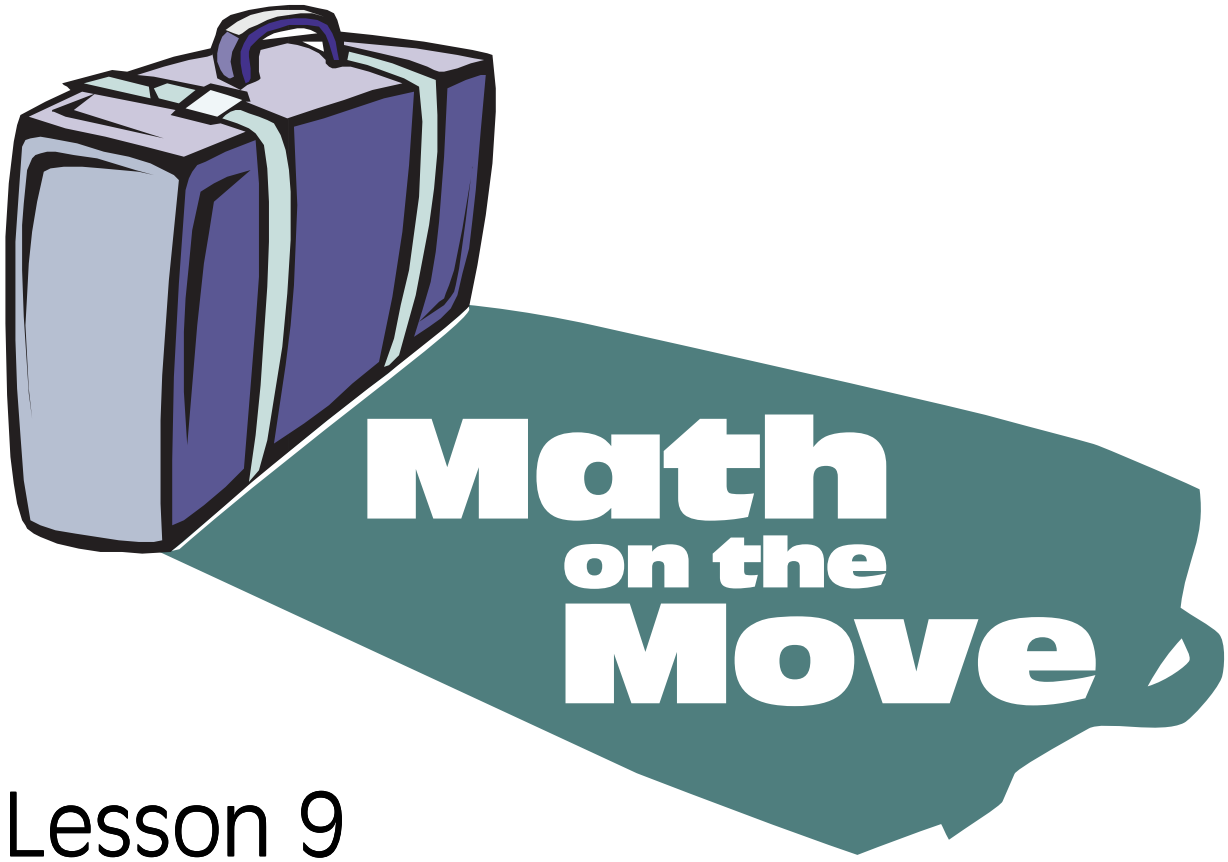
Student Name: _____	Contact Person Name: _____
Date: _____	Phone Number: _____



Lesson 9

Operations with Decimals

Objectives

- Perform addition, subtraction, multiplication, and division with two decimals

Authors:

Jason March, B.A.
Tim Wilson, B.A.

Editor:

Linda Shanks

Graphics:

Tim Wilson
Jason March
Eva McKendry

National PASS Center
BOCES Geneseo Migrant Center
27 Lackawanna Avenue
Mount Morris, NY 14510
(585) 658-7960
(585) 658-7969 (fax)
www.migrant.net/pass

Developed by the National PASS Center under the leadership of the National PASS Coordinating Committee with funding from the Region 20 Education Service Center, San Antonio, Texas, as part of the Mathematics Achievement = Success (MAS) Migrant Education Program Consortium Incentive project. In addition, program support from the Opportunities for Success for Out-of-School Youth (OSY) Migrant Education Program Consortium Incentive project under the leadership of the Kansas Migrant Education Program.

Imagine that you take a part-time job at the local grocery store to earn a little extra money. A customer decides to buy two candy items: a chocolate bar for $1.22 and gummy worms for $1.17. What is the total cost of his purchase?

Just as we can add fractions and mixed numbers, we can also add decimals. We need to know the sum,

$$1.22 + 1.17$$

One of the nice ways decimals work is that they behave like whole numbers when we add or subtract them. In other words, we can solve 1.22 + 1.17 like this,

$$\begin{array}{r} 1.22 \\ +\ 1.17 \\ \hline 2.39 \end{array}$$

We need to line the numbers up carefully in order to add them correctly.

Example

Find the sum of 17.345 and 1.8764.

Solution

First we line up the numbers at the decimal point.

$$\begin{array}{r} 17.345 \\ 1.8764 \end{array}$$

Add zeros if needed.

$$\begin{array}{r} 17.3450 \\ 1.8764 \end{array}$$

Think Back

Any number of zeros may be put at the end of a decimal, and its value is never changed!

Now, add each place value the same as if these were whole numbers.

$$\begin{array}{r} {\scriptstyle 1\ \ 1\ 1\ \ \ } \\ 17.3450 \\ +\ 1.8764 \\ \hline 19.2214 \end{array}$$

Back to our original question: After you find that the candy will cost $2.39, the customer hands you a $5 bill. You type the price into the cash register, but the cash register is broken! You have to find how much change you should give back.

We need to subtract $2.39 from $5.00

$$5.00 - 2.39$$

Fortunately, we can use the algorithm we used for whole numbers once again.

$$\begin{array}{r} {\scriptstyle \ \ \ \ 9\ \ \ } \\ {\scriptstyle 4\ \ \not{1}\not{0}\ \ 10} \\ \not{5}.\not{0}\not{0} \\ -\ \ 2.39 \\ \hline 2.61 \end{array}$$

The only new thing to be careful about is lining up the decimals. After that, you borrow and subtract as you would whole numbers. At the end, bring the decimal down.

Here are the formal step-by-step methods to add and subtract decimals.

Algorithm

To Add or Subtract Decimals:

1. Line up the numbers by place value.

   Make sure the decimal points are on top of each other.
2. Add or subtract, starting with the place value farthest to the right.
3. In your answer, line up the decimal point exactly under the other decimal points.

1. Find the sum or difference.

a) 3.1 + 4.9

b) 2.73 + 3.45

c) 6.97 − 5.45

d) 7.21 − 2.89

We can also extend our knowledge of multiplying and dividing whole numbers to multiply and divide decimals.

Example

Find the product. 3.1×2.25

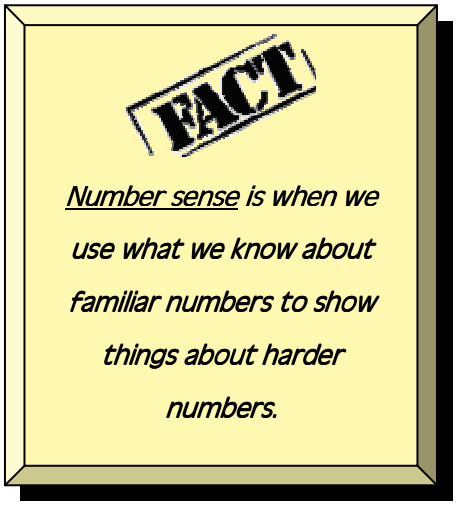
Solution

One way to think about this problem is with number sense.

We know that 3.1 is between 3 and 4, and that 2.25 is between 2 and 3.

Because $3.1 > 3$ and $2.25 > 2$, we know the product 3.1×2.25 must be greater than 3×2.

Thinking in the same way, since $3.1 < 4$ and $2.25 < 3$, then 3.1×2.25 must be less than 4×3.



Therefore, we know that our answer must be between 6 and 12.

Now, if we ignore the decimals and multiply, we get

$$31 \times 225$$
$$= 6975$$

6,975 is way too big to be our answer; we need a decimal point somewhere. Look at the possible places we could put the decimal,

.6975, 6.975 69.75 697.5 6975.0

The only choice that makes sense is 6.975 because it is between 6 and 12. Using number sense, we know 6.975 must be the correct answer.

Using number sense is a great strategy. We can also use our step by step method.

To Multiply Decimals:

1. Ignore the decimal places.
2. Multiply as if you are multiplying whole numbers.
3. Count the number of decimal places in each factor and add them.
4. From the right most digit, move the decimal to the left the same number of decimal places found in step 3.

Example

Simplify 2.51×1.18

Solution

We will use the algorithm.

Step 1: Ignore the decimals

$$251 \times 118$$

Step 2: Multiply

$$\begin{array}{r} 251 \\ \times\ 118 \\ \hline 2008 \\ 2510 \\ +\ 25100 \\ \hline 29618 \end{array}$$

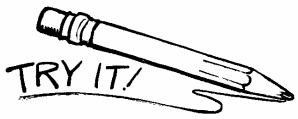
Step 3: Count the number of decimal places in each factor.

There are 2 decimal places in 2.51, and 2 decimal places in 1.18. That's a total of 4 decimal places.

Step 4: From the number you get in *Step 3*, count that many places from the right most digit, and put a decimal point there.

$$2.9618$$
$$4\ \ 3\ \ 2\ \ 1$$

So our answer is 2.9618.



2. Find the product

a) 3.1×4.9

b) 1.175×3.5

c) 6.97×2

d) 3.92×1.11

Now let's learn how to divide decimals.

Example

Find the quotient of $.62 \div .2$

Solution

First we will write it in this form

$$.2\overline{).62}$$

Next, we will move the decimal point in the divisor until it's a whole number.

$$.2\overline{).62}$$

We moved the decimal in the divisor once, so we will also move the decimal in the dividend one place.

$$2\overline{)6.2}$$

Next, we will bring the decimal up to the quotient and line it up with the dividend's decimal point.

$$2\overline{)\overset{.}{6.2}}$$

Lastly, we will divide normally.

$$\begin{array}{r} 3.1 \\ 2\overline{)6.2} \\ -\underline{6} \\ 02 \\ -\underline{2} \\ 0 \end{array}$$

Algorithm

To Divide Decimals:

1. Write the problem in the form $divisor\overline{)dividend}^{quotient}$.
2. Move the decimal point in the divisor until the divisor becomes a whole number.
3. Move the decimal point in the dividend the same number of places.
4. Divide as though you were dividing whole numbers.
5. Put a decimal point in the quotient exactly where it lines up with the decimal point in the dividend.

3. Find the following quotients.

a) $1.2 \div .2$

b) $22.22 \div 1.1$

c) $6.922 \div .2$

Review

1. Highlight all "Algorithm" boxes.

2. Write one question you would like to ask your mentor, or one new thing you learned in this lesson.

Practice Problems

Math On the Move Lesson 9

Directions: Write your answers in your math journal. Label this exercise Math On the Move – Lesson 9, Set A and Set B.

Set A

1. Find the sum, difference, product, or quotient.

a) $14.728 + .336489$ b) $1.4 + 8.56$ c) $6.001 - 2.256$

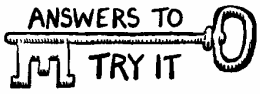
d) $18.711 - 0.9$ e) 3.4×0.1 f) $8.44 \div .04$

g) 30.4×2.6 h) $12.12 \div 0.6$

Set B

1. Estimate the following problems by rounding to the nearest whole number. Then use number sense to determine whether your estimate is higher or lower than the actual value.

a) $8.1 + 4.82$ b) $1.323 + 5.5$ c) $9.5 - 6.9$ d) $9.036 - .3$

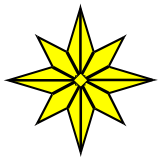


1. a) 8.0 b) 6.18 c) 1.52 d) 4.32

2. a) 15.19 b) 4.1125 c) 13.94 d) 4.3512

3. a) 6 b) 20.2 c) 34.61

NOTES



End of Lesson 9