To multiply and divide decimal numbers, you multiply as if they were whole numbers. After that, the only question is: *Where do you put the decimal point?!*

Decimal Numbers

Multiplication: Whole Number and Decimal

Example: Kevin owns a chicken farm. One day he decided to sell four of his prize birds. On average his chickens weigh 4.36 pounds each. If the market were paying $1.23 per pound, how much money would Kevin receive for the four birds? Round your answer to the nearest penny.

Solution: First we need to find the total weight.
Multiply the average weight by the number of birds, as if it were a whole number.

multiplicand ⇨	4.36
multiplier ⇨	× 4
product ⇨	**1744**

Now, where does the decimal go?

First method for placing decimal point: *Estimate!*
4 x 4 = 16, so the answer must be a little bigger than 16, that is **17.44**.

Estimation is reliable and safe, and keeps you in charge throughout the problem! Estimation also helps you check your answer.

Second method for placing decimal point: *Count* the number of positions after the decimal points, and cut that many off the answer. The number 4.36 has two positions to the right of the decimal, and the number 4 has none. So cut two positions off from 1744 to get: **17.44**

Multiplication: Two Decimal Numbers

Example: The total weight is 17.44 pounds, so how much money will Kevin receive?

Solution: Multiply weight by price per pound.

total pounds =	17.44	⇦ multiplicand
price per pound =	× 1.23	⇦ multiplier
	5232	
	34880	
	174400	
	214512	⇦ product

Where do you put the decimal? Here are the two methods.

1. *Estimate:* About 1 x 17 is a little bigger than 17, so use **21.4512**.

2. *Count:* Count the number of decimal places in multiplicand and multiplier together. Place the decimal point that many places from the right in the product. Here we have two places (weight) and two places (price), or four decimal places, so the answer must be **21.4512:**

17.44	⇦ 2 decimal places
× 1.23	⇦ 2 decimal places
21.4512	⇦ 4 decimal places

To round to the nearest penny means we will round the answer to $**21.45**.

Multiplication: Zeros in the Product

Example: A human hair is about 0.04 as thick as the wire in a paper clip. What is the actual thickness of a human hair?

Solution: Suppose wire in a paper clip is about 0.1 centimeter thick.
We're given that a human hair is about 0.04 as thick as this wire.

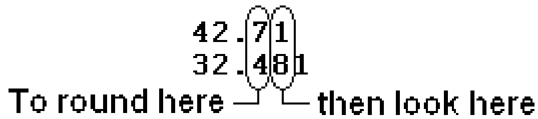
To find how thick a human hair is, multiply the thickness of the wire by the decimal part of that wire representing the human hair.

> *Note!* If there are not enough places in the product, add zeros to the left of the number before placing the decimal point.

thickness of wire =	0.1	1 decimal place
comparative size of hair =	× 0.04	2 decimal places
	0.004	3 decimal places

Rounding Decimals

To round a number to a particular place value, locate the digit to be rounded. Suppose we are to round these numbers to the nearest tenth:



If the digit to the <u>right</u> is 0, 1, 2, 3 or 4, the digit we are rounding stays the same. Drop all the digits to the right.

If the digit to the right is 5, 6, 7, 8 or 9, the digit we are rounding is raised by one. Drop all the digits to the right.

Example: 42.71 rounded to the nearest tenth is <u>42.7</u>
32.481 rounded to the nearest tenth is <u>32.5</u>

When Do We Use Rounding?

There are many cases where a result might have too many digits to conveniently handle.

For example, when totaling the fans at all the Mariners games for the season, it is not important to know the total to the last individual. (Unless of course you were promised a percentage of the gate receipts!) This makes rounding a handy method for working with very large numbers.

Notice that multiplying two decimal numbers together results in a product with even more decimal places. In fact, the product has the same number of decimal places as the sum of all the decimal factors.

For example, multiplying a dollar amount (2 decimal places) by the Issaquah tax of 0.088 (with 3 decimal places) results in a product that has 5 decimal places! Since we don't carry thousandths of a penny in our pockets, we always round to the nearest cent.

Example:	$12.99	price	2 decimal places
	× 0.088	tax rate	3 decimal places
	10392		
	10392		
	$1.11714	tax	5 decimal places

The tax you pay is rounded to the nearest penny, or $1.12.

Dividing a Decimal by a Whole Number

Example: Divide a **decimal** by **whole number**:

Divide 20.46 by 66 $= \dfrac{20.46}{66}$

$$\begin{array}{r} \textit{quotient} \\ \textit{divisor}\overline{)\textit{dividend}} \end{array}$$

$$\begin{array}{r} 0.31 \\ 66\overline{)20.46} \\ \underline{19.8} \\ .66 \end{array}$$

Note! Put the decimal point in quotient directly **above** decimal point in dividend.

Dividing by a Decimal Number

What do you do with the decimal point in division?

In division, a quotient (the result) is not changed when the dividend and divisor are both multiplied by the same number. This is another use for the identity element.

Example: Divide 7.2 (dividend) by 0.9 (divisor)

Note! Change the divisor (bottom) to a whole number. Do this by multiplying both top and bottom by 10 enough times to make the divisor into a whole number.

If we multiply both the dividend and divisor by 10, the new division allows us to divide by whole numbers.

$$\frac{7.2}{0.9} = \frac{7.2}{0.9} \times \frac{10}{10}$$

$$= \frac{7.2 \times 10}{0.9 \times 10}$$

$$= \frac{72}{9} = 8$$

Check: 8 x 0.9 = 7.2? *Yes!*

Example: Divide a **decimal** by another **decimal**:

Divide 131.88 by 4.2 $= \frac{131.88}{4.2}$

Remember the identity element? Choose an identify element to make the denominator a whole number. For this example let's use $1 = \frac{10}{10}$.

Multiply numerator by 10: $131.88 \times 10 = 1318.8$
Multiply denominator by 10: $4.2 \times 10 = 42$

$$
\begin{array}{r}
31.4 \\
42\overline{)1318.8} \\
\underline{126} \\
58 \\
\underline{42} \\
168 \\
\underline{168}
\end{array}
$$

Note! Move the decimal to the right enough to make the divisor (bottom) a whole number. Move the dividend's (top) decimal the same amount.

Note! Place decimal point in quotient directly **above** new decimal location in dividend.

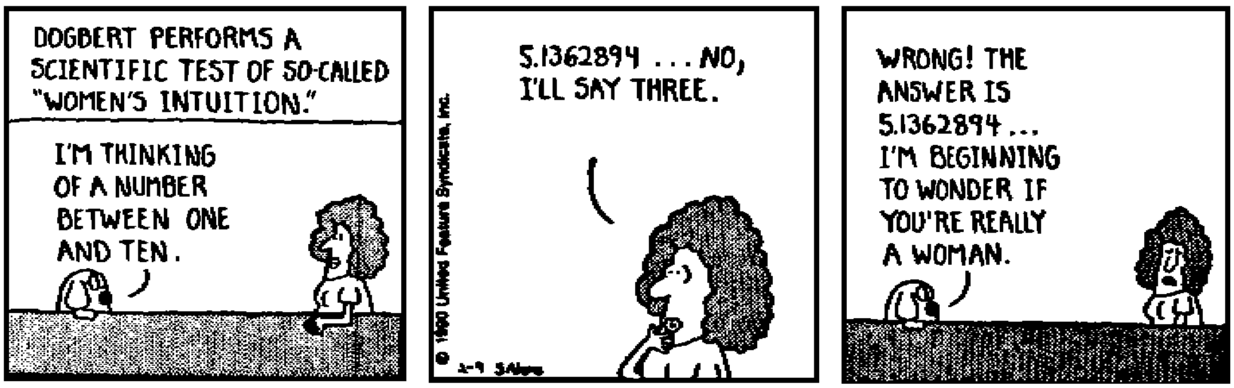
Vocabulary

- *Quotient* - the result of a division
- *Rounding* -finding the nearest number; not exact
- *Multiplicand* - the left side of multiplication
- *Multiplier* - the right side of multiplication
- *Product* - the result of multiplication
- *Rational numbers* - numbers that are the result of a ratio or division. When you find the decimal result of any ratio, there is often a pattern of repeating decimals. For example, $\frac{1}{3} = 0.333\overline{3}$ and $\frac{1}{11} = 0.090909\overline{09}$
- *Irrational numbers* - numbers that cannot be expressed as a ratio of two numbers. When you find the decimal result of irrational numbers, there is no pattern or repeating, and the digits go on forever. For example, Π (pi) is about 3.1415926535… and although computers have calculated several million digits, mathematicians know there is no repeating pattern.

- *Imaginary number* - a mathematical concept that cannot be represented with digits. For example, the square root of -1, which is shown as $\sqrt{-1}$ does not have a real answer, because there are no two number that you can multiply together and get negative one. (Note that -1 × -1 = +1)

- *Saturday* - the seventh day of the week. It comes from 'dies Saturni' the Latin phrase meaning "Saturn's Day." Saturn was the Roman name of the ancient god of agriculture and is the name of the sixth planet from the sun in our solar system.

Dilbert by Scott Adams



Luann, by Greg Evans

1) Round these decimal numbers to the nearest tenth:

a) 47.74 __________

b) 30.04 __________

c) 62.51 __________

d) 12.05 __________

e) 26.492 __________

f) 91.105 __________

g) 20.99 __________

h) 66.667 __________

2) Round these decimal numbers to the nearest hundredth:

a) 6.189 __________

b) 9.999 __________

c) 24.765 __________

d) 13.009 __________

e) 11.006 __________

f) 0.005 __________

g) 1.234 __________

h) 5.432 __________

3) Put the decimal point into these products:

a)
```
    6.7
×   3.2
2 1 4 4
```

b)
```
     2.78
×     7.3
2 0 2 9 4
```

c)
```
        1.924
×        8.51
1 6 3 7 3 2 4
```

d)
```
        31.25
×        33.3
1 0 4 0 6 7 5
```

4) Put the decimal point into these products:

a)
```
      0.7
×     0.1
---------
0  0  0  7
```

b)
```
     0.05
×      10
---------
0  0  5  0
```

c)
```
        0.003
×        0.02
-------------
0  0  0  0  0  6
```

d)
```
       0.07
×        30
-----------
0  0  2  1  0
```

5) Copy these problems onto a separate sheet of paper. Multiply these decimal numbers. Show your work. Check your answer with a calculator.

a) 3.7×6.3

b) 12.48×3.2

c) $.006 \times .008$

d) 3.63×1.1

6) Solve these problems using decimal numbers and rounding.

a) If a sheet of paper is 0.005 inches thick, how high is a stack of 500 sheets?

b) In one recent year, Americans consumed an average of 24.32 pounds of cheese per person. In a family of six, what is the weight of the cheese eaten? Round your final answer to the nearest pound.

c) A *very* lazy ant travels at a steady rate of 28.1 centimeters per minute. (Eager ants can go much faster!) To the nearest tenth of a minute, how long does it take for the ant to travel 206.6 centimeters to get home for lunch?

d) Mr. Hansen's motorcycle (a beautiful BMW K1200LTc) averages 47.6 miles per gallon of gas. The gas tank holds 6.5 gallons. To the nearest 10 miles, how far can he travel on a tank of gas?

7) Mental Math: do these in your head, and write down the answer. When you're done, check your answer with pencil and paper, or with a calculator.

a) Three and a half dozen pencils. How many is that?

b) How many nickels in $8?

c) What is 5×25, then + 10?

d) What is $120 \div 4$, then minus 10?

e) What is 6×6, then $\div$ 3, then $\times$ 10?

f) What is your name?
What is your name, plus 10?

g) What is one-half of 600, then $\div$ 6, then $\div$ 10?

h) Suppose hot dogs come in packages of 10. The buns come in packages of 12. How many hotdogs will I have after buying enough to have the same number of hotdogs as buns?

i) Did you check your work? Of course you did! Good job!

You're done! Detach the homework from the lesson, and turn in just the *homework*.

