

Multiplicative Patterns on the Place Value Chart

Unit 2 Lesson 1

Multiplicative Patterns on the Place Value Chart

Students will be able to:

- Understand the place value system.
- Recognize that a digit in one place is ten times bigger as much as that to its right.
- Recognize that a digit in one place is ten times smaller as much as that to its right.
- Complete place value charts from millions to thousandths.
- Compose and decompose units by applying the knowledge of 10 and $1/10$ times depending on the digit's place value.

Multiplicative Patterns on the Place Value Chart

Key Vocabulary:

Place Value

Place Value Chart

Powers of Ten

Digit

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Place Value System



All numbers are made up of **digits** from **1 to 9**. Each of these digits has its place and value. The **place value** of particular digit relies on its position. The last digit starts with ones, the next would be tens, and so on.

Multiplicative Patterns on the Place Value Chart

Place Value System



The place of a digit is **10 times bigger** than the place value of the **digit to its right**. For example, the place value of 4 in the picture is ten times bigger than that of 5.

Multiplicative Patterns on the Place Value Chart

Place Value System

The place of a digit is **10 times bigger** than the place value of the **digit to its right**.

Example 1:

Hundreds = 10 x Ones

One thousands = 10 x Hundreds

Place Value System

Similarly, the place of a digit is **10 times smaller** or $\frac{1}{10}$ than the place value of the **digit to its left**.

Example 2:

$$\text{Thousands} = \frac{1}{10} \times \text{Ten Thousands}$$

$$\text{Hundred Thousands} = \frac{1}{10} \times \text{Millions}$$

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Sample Problem 1:

Determine whether the place value of 4 is ten times smaller or bigger than the place value of 6.

- a. 123, 465
- b. 64, 389
- c. 154, 678

Multiplicative Patterns on the Place Value Chart

Sample Problem 1:

Determine whether the place value of 4 is ten times smaller or bigger than the place value of 6.

- a. 123, 465
- b. 64, 389
- c. 154, 678

Solution:

- a. Ten times bigger
- b. Ten times smaller
- c. Ten times bigger

Multiplicative Patterns on the Place Value Chart

Sample Problem 2:

Complete the sentences to make them true.

a. Hundreds = _____ Tens

b. Ten Thousands = _____ Hundred Thousands

c. Thousands = _____ Hundreds

Multiplicative Patterns on the Place Value Chart

Sample Problem 2:

Complete the sentences to make them true.

a. Hundreds = _____ Tens

b. Ten Thousands = _____ Hundred Thousands

c. Thousands = _____ Hundreds

Solution:

a. Hundreds = $10 \times$ Tens

b. Ten Thousands = $1/10 \times$ Hundred Thousands

c. Thousands = $10 \times$ Hundreds

Multiplicative Patterns on the Place Value Chart

Decimal Place Values



Decimals is expressed in the form of whole number the a dot and followed by one or more digits representing the decimal places. The decimal places also represent the digits' places as shown below.

Value of Digits Based on their Place Values

We can read and write out a particular digit's exact value by locating its place value.

Example:

To find the value of **3** in **53467**, first locate the place value of **3**. In this case, it's **ten thousands**. Hence, the value of **3** is **3 ten thousands** or **30 thousands**.

Using the same idea, the value of **4** in **23.647** is **4 hundredths**.

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Sample Problem 3:

Determine the value of 5 from given the numbers below.

a. 156.78

c. 45678.92

b. 20.865

d. 2.386759

Multiplicative Patterns on the Place Value Chart

Sample Problem 3:

Determine the value of 5 from given the numbers below.

a. 156.78

c. 45678.92

b. 20.865

d. 2.386759

Solution:

a. 5 tens

c. 5 thousands

b. 5 thousandths

d. 5 hundred thousandths

Multiplicative Patterns on the Place Value Chart

Place Value Charts

Using place value charts make it easier to know the place values of all the given digits.

Millions	Hundred Thousands	Ten Thousands	Thousands	Hundreds	Tens	Ones
1,000,000	100,000	10,000	1,000	100	10	1

The chart above shows the place value chart for whole numbers from ones to millions. The values of the digits can also be found by multiplying the digit to its place value.

Multiplicative Patterns on the Place Value Chart

Place Value Charts

For example, the digits of **405 789** can be filled in the table as shown below.

Millions	Hundred Thousands	Ten Thousands	Thousands	Hundreds	Tens	Ones
	4	0	5	7	8	9

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Place Value Charts

A similar place value chart shown below can be made for numbers with decimal places.

Hundreds	Tens	Ones	.	Tenths	Hundredths	Thousandths
100	10	1	.	$1/10$	$1/100$	$1/1000$

Multiplicative Patterns on the Place Value Chart

Place Value Charts

This means that for **309.16**, we can fill in the place value chart shown below.

Hundreds	Tens	Ones	.	Tenths	Hundredths	Thousandths
3	0	9	.	1	6	0

Multiplicative Patterns on the Place Value Chart

Sample Problem 4:

Fill in the place value chart below for the following numbers.

1.

	Millions	Hundred Thousands	Ten Thousands	Thousands	Hundreds	Tens	Ones
23,467							
3,067,128							
145,398							

2.

	Hundreds	Tens	Ones	.	Tenths	Hundredths	Thousandths
12.507							
3.14							
225.079							

Multiplicative Patterns on the Place Value Chart

Sample Problem 4:

Fill in the place value chart below for the following numbers.

1.

	Millions	Hundred Thousands	Ten Thousands	Thousands	Hundreds	Tens	Ones
23,467			2	3	4	6	7
3,067,128	3	0	6	7	1	2	8
145,398		1	4	5	3	9	8

2.

	Hundreds	Tens	Ones	.	Tenths	Hundredths	Thousandths
12.507		1	2	.	5	0	7
3.14			3	.	1	4	
225.079	2	2	5	.	0	7	9

Multiplying and Dividing Numbers by 10, 100, and 1000

Multiplying and dividing numbers by 10, 100, and 1000 can be easily be done by moving the place values of the digits to the left or right, depending on the operation.

Observe the three numbers **1.567**, **15.67**, and **156.7**. If we place each of the digits on a place value chart, we'll have the following.

Multiplicative Patterns on the Place Value Chart

Multiplying and Dividing Numbers by 10, 100, and 1000

Hundreds	Tens	Ones	.	Tenths	Hundredths	Thousandths
		1	.	5	6	7
	1	5	.	6	7	
1	5	6	.	7		

Notice that as the digits move one place to left, the value increases ten times.

Multiplicative Patterns on the Place Value Chart

Multiplying and Dividing Numbers by 10, 100, and 1000

This means that we have:

$$15.67 = 1.567 \times 10$$

$$156.7 = 1.567 \times 100$$

Multiplicative Patterns on the Place Value Chart

Multiplying and Dividing Numbers by 10, 100, and 1000

Using the same idea, we can easily divide numbers by 10 by moving the digits' decimal place one step to the right.

Hundreds	Tens	Ones	.	Tenths	Hundredths	Thousandths
2	4	6	.	8		
	2	4	.	6	8	
		2	.	4	6	8

Multiplicative Patterns on the Place Value Chart

Multiplying and Dividing Numbers by 10, 100, and 1000

Using 246.8, 24.68, and 2.468, as an example as shown below.

$$24.68 = 246.8 \div 10$$


$$2.468 = 246.8 \div 100$$


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Sample Problem 5:

Move the place values of the digits to solve the following problems.

1. $21.034 \times 100 =$

3. $137.48 \div 10 =$

2. $456.089 \times 10 =$

4. $9105.123 \div 100 =$

Multiplicative Patterns on the Place Value Chart

Sample Problem 5:

Move the place values of the digits to solve the following problems.

1. $21.034 \times 100 =$

3. $137.48 \div 10 =$

2. $456.089 \times 10 =$

4. $9105.123 \div 100 =$

Solution:

1. $21.034 \times 100 = 2103.4$

3. $137.48 \div 10 = 13.748$

2. $456.089 \times 10 = 4560.89$

4. $9105.123 \div 100 = 91.05123$

Multiplicative Patterns on the Place Value Chart

Powers of 10

Recall that we have

$$10 \times 1 = 10 = 10^1$$

$$10 \times 10 = 100 = 10^2$$

$$10 \times 10 \times 10 = 1000 = 10^3$$

This pattern continues for powers of 10.

Multiplicative Patterns on the Place Value Chart

Powers of 10


As a matter of fact, if we need to multiply 10 n times to itself, we'll have

$$\underbrace{10 \times 10 \times 10 \times \dots \times 10}_{\text{There are } n \text{ 10's here.}} = \underbrace{100000\dots000}_{n \text{ zeroes}} = 10^n$$

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Multiplying and Dividing Numbers by a Power of Ten

Using our knowledge about powers of ten, we can multiply and divide numbers (both whole numbers and those with decimals) by moving the place values of the numbers.

$$348 \times 1000 = \begin{array}{|c|c|c|c|c|c|} \hline 3 & 4 & 8 & 0 & 0 & 0 \\ \hline \end{array}$$


Move the places to the right depending on power of 10 or the number of zeroes present.


Multiplicative Patterns on the Place Value Chart

Multiplying and Dividing Numbers by a Power of Ten

Example:

$$348 \times 1000$$

For whole numbers, we start moving starting from the ones place. Since $1000 = 10^3$ and has three zeroes, we move three places from 8 to the right.

$$348 \times 1000 = \begin{array}{|c|c|c|c|c|c|} \hline 3 & 4 & 8 & 0 & 0 & 0 \\ \hline \end{array}$$


This means that $348 \times 1000 = 348,000$.

Multiplying and Dividing Numbers by a Power of Ten

A similar process can be performed when multiplying decimals by a power of ten.

Example:

$$234.56 \times 100$$

Start from the decimal point this time when moving the place values. Place the decimal point to its new position after moving.


Multiplicative Patterns on the Place Value Chart

Multiplying and Dividing Numbers by a Power of Ten

Since $100 = 10^2$ or has two zeroes present, we move the decimal point two places to the right.

$$23.456 \times 100 =$$

2	3	.	4	5	6
---	---	---	---	---	---



This gives us $23.456 \times 100 = 2345.6$ now.

Multiplicative Patterns on the Place Value Chart

Multiplying and Dividing Numbers by a Power of Ten

Use the same process when dividing numbers by powers of ten. The only difference is to move the place values to the left instead.

Example:

$$33548 \div 10,000 = \begin{array}{|c|c|c|c|c|} \hline 3 & 3 & 5 & 4 & 8 \\ \hline \end{array}$$

This means that $33548 \div 10000 = 3.3458$.

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Sample Problem 6:

Find the product or quotient of the following by moving the decimal places.

1. $5.17895 \times 10000 =$

3. $56374.8 \div 10000 =$

2. $30.348 \times 1000 =$

4. $4572394.23 \div 10000 =$

Multiplicative Patterns on the Place Value Chart

Sample Problem 6:

Solution:

$$1. 5.17895 \times 10000 = 51789.5$$

$$2. 30.348 \times 1000 = 30348$$

$$3. 56374.8 \div 10000 = 5.63748$$

$$4. 4572394.23 \div 10000 = 457.239423$$

Fractions with Denominators as Powers of Ten

Changing fractions with denominators as powers of ten to decimals can be done easily by moving the place values of the digits as we have done in the previous section.

Remember that given a fraction A/B , we can express it as $A \div B$ to find its decimal counterpart.

Fractions with Denominators as Powers of Ten

So, if B is a power of ten, we can simply move the decimal places to the left depending on the number of zeroes or its power.

Example:

$$45678 / 100 = 45678 \div 100$$

$$45678 / 100 = 45678 = 456.78$$

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Sample Problem 7:

Change the following fractions to decimals.

1. $34\ 567 / 100 =$

3. $4\ 334\ 098 / 10000 =$

2. $5\ 433 / 1000 =$

4. $9\ 823\ 743 / 100000 =$

Multiplicative Patterns on the Place Value Chart

Sample Problem 7:

Solution:

$$1. 34\ 567 / 100 = 34\ 567 \div 100 = 345.67$$

$$2. 5433 / 100 = 5\ 433 \div 1000 = 5.433$$

$$3. 4\ 334\ 098 / 10000 = 4\ 334\ 098 \div 10000 = 433.4098$$

$$4. 9\ 823\ 743 / 100000 = 9\ 823\ 743 \div 100000 = 98.2374$$