Whole and Decimal Numbers

Based on power point presentations by Pearson Education, Inc.
Revised by Ingrid Stewart, Ph.D.

Learning Objectives

1. Memorize some vocabulary and symbols.
2. Define *natural* and *whole numbers*.
3. Round whole numbers.
4. Define *decimal numbers*.
5. Memorize the three different types of decimal numbers (terminating/non-repeating, non-terminating/repeating, and non-terminating/non-repeating).
6. Round decimal numbers.

1. Vocabulary and Symbols (1 of 3)

Addition

Given 8 + 2 = 10, the 8 and the 2 are called **Addend 1 and Addend 2**. The *10* is called **Sum**.

Subtraction

Given 8 – 2 = 6, the 8 is called the **Minuend** and the 2 is called the **Subtrahend**. The 6 is called **Difference**.

Grouping Symbols

In (8 + 2), the ( ) are called **Parentheses** and ONE is called a **parenthesis**.

In [8 + 2], the [ ] are called **Brackets**.

In {8 + 2}, the { } are called **Braces**.

Vocabulary and Symbols (2 of 3)

Multiplication

$8 \cdot 2$ or 8×2 or $8(2)$ equals 16. The 8 is called **Multiplicand** and the 2 is called the **Multiplier**. The 16 is called **Product**.

NOTE: In higher mathematics we usually express multiplication using parentheses and not the multiplication symbols $\cdot$ or $\times$.

That is, 8(2), which is pronounced "8 times 2", is the preferred form.

Vocabulary and Symbols (3 of 3)

Division

8 ÷ 2 = 4. The 8 is called **Dividend** and the 2 is called the **Divisor**. The 4 is called **Quotient**.

Factors

Factors of any number are other numbers that divide evenly into this number.

For example, since 1, 2, 4, and 8 divide evenly into 8, they are called factors of 8.

8 ÷ 1 = 8

8 ÷ 2 = 4

8 ÷ 4 = 2

8 ÷ 8 = 1

2. Introduction to Whole Numbers (1 of 2)

The set of Whole Numbers include all the *Natural Numbers* {1, 2, 3, 4, 5, ...} and the number 0. It is expressed by using the bold face letter ***W***.

W = {0, 1, 2, 3, 4, 5, ...}

The three dots indicate that this set does not have a final element and that the listing goes on forever. They are called an "ellipsis". The set of *Whole Numbers* is an infinite set!

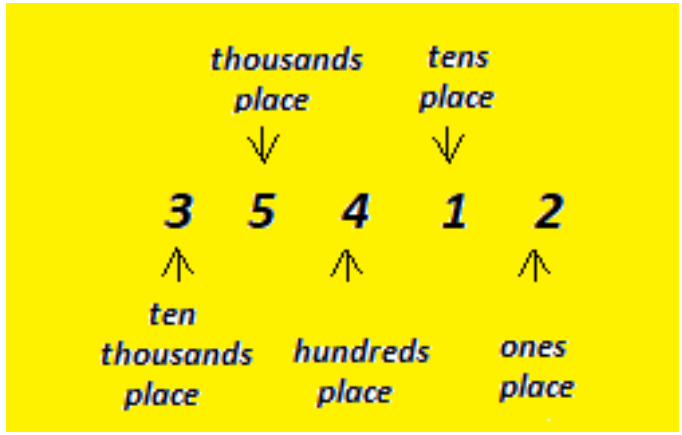
Whole Numbers can be arranged on a number line to show a visual representation of the relationship of their size.

Introduction to Whole Numbers (2 of 2)

In our number system, the value of a digit depends on its place, or position, in the number. Each place has a value of 10 times the place to its right. A whole number in standard form is separated into groups of three digits from right to left using commas.

Place Value of Whole Numbers

Given the number ***35,412***, we say it has five digits whose respective places or place values are as follows:



3. Whole Numbers and Rounding

Rounding a whole number to a certain place value means that we want to find an **approximation** of the number. Rounding is the process for anyone who doesn't care to be exact. That's okay to a point because there are many different uses for numbers. Generally, the size of the number and its use dictates the place to which it should be rounded.

Rounding Rule

Step 1 - Locate the digit that occupies the rounding place.

Step 2 - Examine the digit to the right of the rounding place.

- If the digit to the right of the rounding place is less than 5, leave the digit in the rounding place unchanged. Fill the remaining places with 0s. This is also called “rounding down”.
- If the digit to the right of the rounding place is greater than 5 or equal to 5, add 1 to the digit in the rounding place. Fill the remaining places with 0s. This is also called ”rounding up”.

Example 1: Round a Whole Number

Round the number 7,476,254,056 to the following:

1. the nearest hundred million

   The digit occupying the rounding place is 4. The digit to the right of it is 7 which is more than 5. We add 1 to the digit in the rounding place and fill the remaining places with 0s. That is, we are ”rounding up”.

   7,476,254,056 ≈ 7,500,000,000

   NOTE: The symbol ≈ means “is approximately equal to”

2. the nearest million

   The digit occupying the rounding place is 6. The digit to the right of it is 2 which is less than 5. We leave the digit in the rounding place unchanged and fill the remaining places with 0s. That is, we are ”rounding down”.

   7,476,254,056 ≈ 7,476,000,000

Example 2: Round a Whole Number

Round the number 7,476,254,056 to the following:

1. the nearest hundred thousand

   The digit occupying the rounding place is 2. The digit to the right of it is 5. We add 1 to the digit in the rounding place and fill the remaining places with 0s. That is, we are ”rounding up”.

   7,476,254,056 ≈ 7,476,300,000

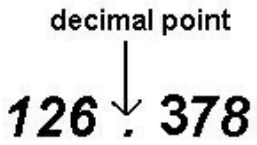
2. the nearest ten thousand

   The digit occupying the rounding place is 5. The digit to the right of it is 4 which is less than 5. We leave the digit in the rounding place unchanged and fill the remaining places with 0s. That is, we are ”rounding down”.

   7,476,254,056 ≈ 7,476,250,000

4. Introduction to Decimal Numbers (1 of 3)

Our counting system lets us write fractional amounts of whole numbers using a clever symbol called the **decimal point**. When a number contains a decimal point, we call it a **decimal number** or simply a **decimal**.



Whole numbers can be written as decimal numbers by using zeros in the decimal places. We can add as many decimal places as needed depending on a particular situation.

For example, the number ***45*** can be written as ***45.0*** or ***45.00*** or ***45.000***, and so on.

Decimal numbers can be (a) terminating; (b) non-terminating and non-repeating; or (c) non-terminating and repeating.

Introduction to Decimal Numbers (2 of 3)

(a) Terminating, Non-Repeating Decimal Number – The number 0.75 is a terminating, non-repeating decimal number.

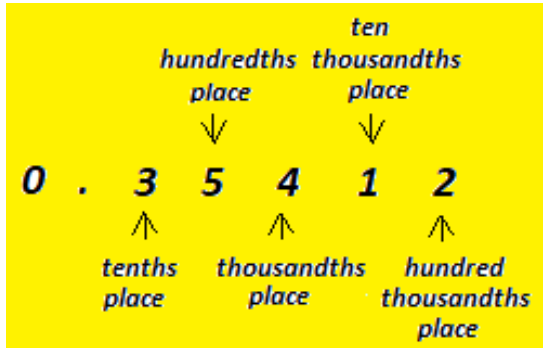
(b) Non-Terminating, Repeating Decimal Number – The number $0.\overline{81}$ is a non-terminating, repeating decimal. It is equal to 0.81 81 81 81 81 81 81... .

(c) Non-Terminating, Non-Repeating Decimal Number – The value of the Greek number Pi, whose symbol is π, is a non-terminating, non-repeating decimal number approximately equal to 3.141592654... or better known as 3.14.

Introduction to Decimal Numbers (3 of 3)

Place Value of Decimal Numbers

Given the number ***0.35412***, we say it has five decimal places whose respective places or place values are as follows:



Please note that when there is no number to the right of the decimal place, we can express this as either ***0.35412*** or simply as ***.35412*** leaving off the ***0*** in the ones place.

5. Decimal Numbers and Rounding

Rounding Rule

Step 1 - Locate the digit that occupies the rounding place.

Step 2 - Examine the digit to the right of the rounding place.

- If the digit to the right of the rounding place is less than 5, leave the digit in the rounding place unchanged and drop the remaining decimal places. This is also called “rounding down”.
- If the digit to the right of the rounding place is greater than 5 or equal to 5, add 1 to the digit in the rounding place and drop the remaining decimal places. This is also called “rounding up.”

Example 3: Round the Decimal Part of a Number

Round the number 3.141592 to the following:

1. the nearest tenth (one decimal place)

   The digit occupying the rounding place is 1. The digit to the right of it is 4 which is less than 5. We leave the digit in the rounding place unchanged and drop the remaining decimal places. That is, we are ”rounding down”.

   $3.141592 \approx 3.1$

2. the nearest hundredth (two decimal places)

   The digit occupying the rounding place is 4. The digit to the right of it is 1 which is less than 5. We leave the digit in the rounding place unchanged and drop the remaining decimal places. That is, we are ”rounding down”.

   $3.141592 \approx 3.14$

Example 4: Round the Decimal Part of a Number

Round the number 3.141592 to the following:

1. the nearest thousandth (three decimal places)

   The digit occupying the rounding place is 1. The digit to the right of it is 5. We add 1 to the digit in the rounding place and drop the remaining decimal places. That is, we are ”rounding up”.

   $3.141592 \approx 3.142$

2. the nearest ten-thousandth (four decimal places)

   The digit occupying the rounding place is 5. The digit to the right of it is 9 which is greater than 5. We add 1 to the digit in the rounding place and drop the remaining decimal places. That is, we are ”rounding up”.

   $3.141592 \approx 3.1416$

Example 5: Round the Decimal Part of a Number

Round the number 136.92 to a whole number.

The digit occupying the rounding place is 6. The digit to the right of it is 9. We add 1 to the digit in the rounding place and drop the remaining decimal places. That is, we are ”rounding up”.

136.92 ≈ 137

Example 6: Round the Decimal Part of a Number

Round the number 622.87 to the hundreds place.

The digit occupying the rounding place is 6. The digit to the right of it is 2 which is less than 5. We leave the digit in the rounding place unchanged and fill the remaining places with 0s. We drop any decimal places. That is, we are ”rounding down”.

$622.92 \approx 600$

Example 7: Round the Decimal Part of a Number

Round the number 197.12 up to a whole number.

Note on Rounding UP:

Especially when computing a value needed to achieve a financial goal, we often round this value UP ignoring all usual rounding conventions. In this way, we won't fall slightly short of being able to meet this goal.

The digit occupying the rounding place is 7. The digit to the right of it is 1 which is less than 5. However, we are asked to round up. Therefore, we ignore the usual rounding convention, which would have us round down.

$197.12 \approx 198$