Population Explosion

The World Factbook estimates the 2008 world population to be about 6.7 billion people. This number can be written many ways:

<table>
<thead>
<tr>
<th>In Words</th>
<th>six billion seven hundred million</th>
</tr>
</thead>
<tbody>
<tr>
<td>In Standard Form</td>
<td>6 700 000 000</td>
</tr>
<tr>
<td>In Expanded Form</td>
<td>6 000 000 000 + 700 000 000</td>
</tr>
</tbody>
</table>

Using the birth and death rates from the World Factbook we can figure out how the population changes. About three people are added to the population every second. That is 180 people in one minute:

<table>
<thead>
<tr>
<th>In Words</th>
<th>one hundred eighty</th>
</tr>
</thead>
<tbody>
<tr>
<td>In Standard Form</td>
<td>180</td>
</tr>
<tr>
<td>In Expanded Form</td>
<td>100 + 80</td>
</tr>
</tbody>
</table>

Three people every second is 10 800 people every hour:

<table>
<thead>
<tr>
<th>In Words</th>
<th>ten thousand eight hundred</th>
</tr>
</thead>
<tbody>
<tr>
<td>In Standard Form</td>
<td>10 800</td>
</tr>
<tr>
<td>In Expanded Form</td>
<td>10 000 + 800</td>
</tr>
</tbody>
</table>
This means that every day there are 259 200 people added to the world population:

<table>
<thead>
<tr>
<th>In Words</th>
<th>two hundred fifty-nine thousand two hundred</th>
</tr>
</thead>
<tbody>
<tr>
<td>In Standard Form</td>
<td>259 200</td>
</tr>
<tr>
<td>In Expanded Form</td>
<td>200 000 + 50 000 + 9 000 + 200</td>
</tr>
</tbody>
</table>

These numbers used to describe population growth are very large. You will explore large and small numbers in this lesson.

Reflection

What are some other real life situations that involve large numbers?

Objectives for this Lesson

In this lesson you will explore the following concepts:

- Use the place value system to read large and small numbers
- Provide examples of how large and small numbers are used

- Go online to complete the Concept Capsule: Place Value to 100 000.
Place Value Charts

You need to be able to read and write large or small numbers. The base-ten number system creates an order to place values. The **periods** and order help you with reading the numbers to the left of the decimal.

You should recall the use of place value charts from earlier grades:

<table>
<thead>
<tr>
<th>Millions</th>
<th>Thousands</th>
<th>Ones</th>
<th>Decimals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hundred Millions</td>
<td>Ten Millions</td>
<td>Millions</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hundred Thousands</td>
<td>Ten Thousands</td>
<td>One Thousands</td>
</tr>
<tr>
<td></td>
<td>Hundreds</td>
<td>Tens</td>
<td>Ones</td>
</tr>
</tbody>
</table>

Each period to the left of the decimal is characterized by three place values. For example, the thousands period starts with one thousands then has ten thousands and hundred thousands. The millions period has the same pattern.

The following names are used, in this order, after the millions place:

- billions, trillions, quadrillions, quintillions, and so on.

**Reflection**

What do you think the period for the trillions would look like?
• Go online to watch the Notepad Tutor Lesson: Place Value to 100,000,000.

If you look at the decimals, they follow a similar pattern. This pattern goes in the opposite direction. Within the decimals period you can almost see the forming of the pattern.

The pattern goes like this: tenths, hundredths, thousandths, ten thousandths, hundred thousandths, millionths, ten millionths, hundred millionths, and so on.

The possible place values go on and on and never end.

Understanding the pattern to the place value chart will help you identify numbers that are extremely large or very small.

Now It’s Your Turn
Write these standard form numbers in word form.

a. 12,300,000,000  b. 320,200,100  c. 200,000.003

Solutions
a. twelve billion three hundred million
b. three hundred twenty million two hundred thousand one hundred
c. two hundred thousand and three thousandths

• Go online to complete the Concept Capsule: Super Large Numbers.
Writing Numbers

Writing numbers in expanded form is another way you can pick up on the pattern of the place value system.

Example 1

Write the number shown in the place value chart in standard form and expanded form.

<table>
<thead>
<tr>
<th>Millions</th>
<th>Thousands</th>
<th>Ones</th>
<th>.</th>
<th>Decimals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hundred Millions</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ten Millions</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Millions</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hundred Thousands</td>
<td>Ten Thousands</td>
<td>One Thousands</td>
<td>Hundreds</td>
<td>Tens</td>
</tr>
<tr>
<td>3</td>
<td>2</td>
<td>0</td>
<td>5</td>
<td>1</td>
</tr>
</tbody>
</table>

In **standard form** you should leave a space between periods, and place a decimal after the ones period.

320 516 470.08

For **expanded form** you should write the value of each digit other than 0 and add these values together:

300 000 000 + 20 000 000 + 500 000 + 10 000 + 6 000 + 400 + 70 + 0.08
**Example 2**

Write the number given in word form in standard form and expanded form.

**three hundred fifty-eight million two hundred thirty thousand five hundred and fourteen ten thousandths**

Take the words apart carefully as you read:

**three hundred fifty-eight million**

The “million” at the end tells you this is the end of the millions period. You can think of this in short form: 358 million

**two hundred thirty thousand**

The “thousand” at the end of this phrase tells you this is the end of the thousands period. You can think of this as 230 thousand.

**five hundred and fourteen ten thousandths**

The number after “thousand” and before “and” (if there is a decimal) tells you your ones period. Think: 500

The “and” tells you this is the beginning of the decimal period.

The "ten thousandths" tells you the place value of the last digit. The last digit of fourteen is $4$ so it will go in the ten thousandths place.
The 1 has to go in the place before the 4 and the rest of the places after the decimal become 0:

\[ .001 \ 4 \]

Now you need to put all that together:

Standard form:

\[ 358 \ 230 \ 500.001 \ 4 \]

Expanded form:

\[ 300 \ 000 \ 000 + 50 \ 000 \ 000 + 8 \ 000 \ 000 + 200 \ 000 + 30 \ 000 + 500 + 0.001 + 0.000 \ 4 \]

**Example 3**
The population of Canada is approximately thirty-three million, four hundred twenty-eight thousand nine hundred. Write the population of Canada in standard form and expanded form.

Break down the parts to write standard form first:

- thirty-three million: 33 million
- four hundred twenty-eight thousand: 428 thousand
- nine hundred: 900

Standard form:

\[ 33 \ 428 \ 900 \]

Expanded form:

\[ 30 \ 000 \ 000 + 3 \ 000 \ 000 + 400 \ 000 + 20 \ 000 + 8 \ 000 + 900 \]

You can also use place value to quickly subtract values.
Example 4
What is 10 000 less than 315 248 679?

Identify the number in the ten thousands place: 315 248 679

Ask yourself, “What is one less than this number?” 3

Now change that number to 3 and keep the rest of the number:

315 238 679

Place value can also be used to solve problems. Use the following Exploration to find ways to write small and large numbers.

Exploration 1: Making Numbers

Materials: Unit 1, Lesson 1, Exploration 1 page in your Workbook, 8 Index Cards, Marker, Pencil

1. Write the following digits and the decimal on one index card each. Be sure to use your marker and make the numbers very large.

2. What is the largest number that you can make using these cards if you must have three digits after the decimal?

3. Write your large number in standard form.

4. Write your large number in expanded form.
5. Write your large number in words.

6. What is the smallest number that you can make using these cards if you must have only three digits after the decimal?

7. Write your small number in standard form.

8. Write your small number in expanded form.

9. Write your small number in words.

10. What is the largest number you can make if you can place the decimal anywhere you want? Write the number in standard form and in words.

11. What is the smallest number you can make if you can place the decimal anywhere you want? Write the number in standard form and in words.

Let's Practice

- Turn in your Workbook to Unit 1, Lesson 1 and complete 1 to 18.
Numbers in Real Life
There are large numbers in many areas of science and in the media, such as:

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canada's retail trade for 2007</td>
<td>$412 000 000 000</td>
</tr>
<tr>
<td>Distance to the moon</td>
<td>384 403 km</td>
</tr>
<tr>
<td>Video game related sales for November 2006</td>
<td>$1 700 000 000</td>
</tr>
<tr>
<td>Average weight of an Asian elephant</td>
<td>5 500 kg</td>
</tr>
</tbody>
</table>
You can also find very small numbers, such as:

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average length of a carpenter ant</td>
<td>13 mm</td>
</tr>
<tr>
<td>Thickness of a penny</td>
<td>1.45 mm</td>
</tr>
<tr>
<td>Wavelength of green light</td>
<td>0.000 000 51 m</td>
</tr>
</tbody>
</table>

**Let’s Explore**

**Exploration 2: Searching for Numbers**

**Materials:** Unit 1, Lesson 1, Exploration 2 page in your Workbook, Newspapers, Internet, Magazines, Science Textbooks, Pencil

1. Find five numbers in one of your resources that are greater than one million.
2. Record the source, what the number describes, and then write the number in standard form and expanded form in the table.
3. Find five decimal numbers that are smaller than one.
4. Record the source, what the number describes, and then write the number in standard form and expanded form in the table.
5. Reflect: What resources might you use to find large numbers?
6. Reflect: What resources might you use to find small numbers?
• Turn in your Workbook to Unit 1, Lesson 1 and complete 19 to 22.