Counting: Mathematics has its origins in the concept of counting. To understand and answer simple questions such as *How many?* Or *How much?*, One needs mathematics. Humans first had to understand the idea of “quantity”. For example one stick, one pebble or how many animals.

Numerals:

- A number is a quantity. (How many?, How much?)
- A numeral is a symbol used to represent a number.

Systems of Numeration:

A system of numeration consists of a set of numerals and a rule for combining them.

Four Types:

1. Additive system
2. Alphabetic system
3. Multiplication Systems
4. Place Value Systems

Additive Systems of Numeration:

In an additive system of numeration, each symbol represents a different number, and the value of a string of symbol of the sum of the values of each symbol.

1. **Egyptian System**
   The Egyptian system has symbols for the following values:

<table>
<thead>
<tr>
<th>Number</th>
<th>Picture</th>
<th>Symbol</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Stroke</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Heel bone</td>
<td></td>
</tr>
<tr>
<td>100</td>
<td>Coil of rope</td>
<td></td>
</tr>
<tr>
<td>1000</td>
<td>Lotus Flower</td>
<td></td>
</tr>
<tr>
<td>10,000</td>
<td>Pointing Finger</td>
<td></td>
</tr>
<tr>
<td>100,000</td>
<td>Tadpole</td>
<td></td>
</tr>
<tr>
<td>1,000,000</td>
<td>Astonished man</td>
<td></td>
</tr>
</tbody>
</table>

So there is a symbol for each power of 10:

$10^0, 10^1, 10^2, 10^3, 10^4, 10^5, 10^6$
What makes the number 10 so special?

The Egyptian system of numeration was an additive system. To write the number 342, three coils of rope, four heel bones and two lines would be written.

Example 1: Write the number 5242 in Egyptian numerals.

Example 2: Write the number 204 in Egyptian numerals.

2. Roman Systems

The Roman system uses the following symbols (numerals):

<table>
<thead>
<tr>
<th>Numeral</th>
<th>I</th>
<th>V</th>
<th>X</th>
<th>L</th>
<th>C</th>
<th>D</th>
<th>M</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value</td>
<td>1</td>
<td>5</td>
<td>10</td>
<td>50</td>
<td>100</td>
<td>500</td>
<td>1000</td>
</tr>
</tbody>
</table>

\[
\text{X} IV = 10 + (5-1) = 14 \quad \text{needs the subtraction}
\]

\[
\text{X} VI = 10 + 5 + 1 = 16
\]
The Roman system is an additive system with a few special subtraction rules:

\[
\begin{align*}
IV &= 5 - 1 = 4 \\
IX &= 10 - 1 = 9 \\
XL &= 50 - 10 = 40 \\
XC &= 100 - 10 = 90 \\
CD &= 500 - 100 = 400 \\
CM &= 1000 - 100 = 900
\end{align*}
\]

**Example 3:** What number is represented by MMCMXLVII, in Roman Numerals?

\[
1000 + 1000 + 900 + 40 + 5 + 1 + 1 = 2947
\]

**Example 4:** Express the number 3,849 in Roman numbers.

\[
3849 = 3000 + 800 + 40 + 9 = \text{MMMDCCLXIX}
\]

**Special Rule:** A horizontal bar over a set of numerals means to multiply the value by 1000.

\[
\begin{align*}
\overline{IV} &= 4(1000) = 4000 \\
\overline{CXI} &= (CXI = 100 + 10 + 1 + 1 = 112)(1000) = 112000
\end{align*}
\]

**Example 5:** What number is represented by \(\overline{CXI}\overline{DXCIII}？

\[
\begin{align*}
\overline{CXI} &= 100 + 10 + 1 + 1 = 112 \\
\overline{CXI} &= 112(1000) = 112000 \\
\overline{CXI}\overline{DXCIII} &= 112000 + 500 + 90 + 3 = 112593
\end{align*}
\]
Example 6: Write 7539 in Roman numerals.

\[ 7539 = 7000 + 500 + 30 + 9 \]
\[ = \text{VIIIDXXXIX} \]

Example 7: Write CCCXLVII as Hindu-Arabic numbers.

\[ 300 + 40 + 7 = 347 \]

Example 8: Write XIIIDCII in Hindu-Arabic.

\[ 12 (1000) + 500 + 90 + 2 = 12,592 \]