In the dictionary, the word “add” means to combine (a column of figures, for example) to form a sum or to join or unite so as to increase in size, quantity, quality, or scope.

The symbol for adding, or ________________, in math is “+”. Other words or phrases that imply addition in math are:

- **Sum**
  - sum of 5 and 8
  - 5 \( + \) 8
- **Plus**
  - 5 plus 8
  - 5 \( + \) 8
- **Added to**
  - 5 added to 8
  - 8 \( + \) 5
- **More than**
  - 5 more than 8
  - 8 \( + \) 5
- **Increased by**
  - 8 increased by 5
  - 8 \( + \) 5
- **Total**
  - total of 8 and 5
  - 8 \( + \) 5

For example, find 123 + 88. In this expression, 123 and 88 are called **addends**. The result of their addition is called the ________________.

To add whole numbers, we add digits in corresponding place values together. When the numbers are large, it is much easier to write the numbers vertically, lining up place values.

\[
123 + 88 = \begin{array}{c}
123 \\
+ 88 \\
\end{array}
\]

**Note**: When the sum of corresponding digits is greater than 9, we must “carry” to the next place value.

**Example 1**: Add: 12,345 + 1267

Before talking about the properties of addition, we need to introduce the concept of **variables**. A variable is a symbol (generally a letter of the alphabet) that is used to represent an unknown number or any one of several numbers.

**Properties of Addition**

**Identity Property of Addition** (or **Addition Property of 0**): For any whole numbers \( a \) and \( b \), \( a + 0 = a \), the sum of 0 and any number is that same number.

In other words, adding 0 does not change value!

\[
0 + 8 = 8 + 0 = 8
\]
**Commutative Property:** changing the order of addition does not change the sum.

For any whole numbers \(a\) and \(b\), \(a + b = b + a\)

\[2 + 9 = 9 + 2 = 11\]

**Associative Property:** changing the grouping of addition does not change the sum.

For any whole numbers \(a, b, \text{ and } c\), \((a + b) + c = a + (b + c)\)

\[2 + (9 + 4) = 15 \quad \text{AND} \quad (2 + 9) + 4 = 15\]

Look at Hawkes slide 10.

**Perimeter**

The *perimeter* of a flat surface object is the *distance around* it. Consider the following *polygons* (flat figure formed by connected line segments):

- **Square**
- **Rectangle**
- **Triangle**

To find the perimeter of a polygon, we just add the length of all sides together! Don’t forget to use units, if given. Units for perimeter are one dimensional (feet, inches, centimeters, etc.).

*Example 2:* Find the perimeter of the triangle:

\[
\begin{array}{c}
\text{12 in} \\
16 \text{ in}
\end{array}
\]

https://www.youtube.com/watch?v=OTVHku3ssus&list=PL9dj44OpeMZeo_qNgDr_lqgRlvdvChKePq7&index=3

In the dictionary, the word “subtract” means to take away; deduct.

The symbol for subtracting, or __________________, in math is “-”. Other words or phrases that imply subtraction in math are:

- Difference of
- Minus
- Subtracted from
- Less than
- Decreased by
- Less

<table>
<thead>
<tr>
<th>Difference of</th>
<th>difference of 8 and 5</th>
<th>8-5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minus</td>
<td>8 minus 5</td>
<td>8-5</td>
</tr>
<tr>
<td>Subtracted from</td>
<td>5 subtracted from 8</td>
<td>8-5</td>
</tr>
<tr>
<td>Less than</td>
<td>5 less than 8</td>
<td>8-5</td>
</tr>
<tr>
<td>Decreased by</td>
<td>8 decreased by 5</td>
<td>8-5</td>
</tr>
<tr>
<td>Less</td>
<td>8, less 5</td>
<td>8-5</td>
</tr>
</tbody>
</table>
For example, find 10 - 7. The result of the subtraction is called the ________________. For example, 10 – 7 = 3 so 3 is the difference between 10 and 7.

Subtraction is actually defined in terms of addition (they are reverse operations of each other): 10 – 7 = 3 because 7 + 3 = 10. Thus, addition can be used to check subtraction!

**Properties of Subtraction**

- the difference of any number and 0 is that same number
- the difference of any number and itself is 0

To subtract whole numbers, we subtract digits in corresponding place values. When the numbers are large, it is much easier to write the numbers vertically, lining up place values.

\[
\begin{array}{c}
123 \\
- 88 \\
\hline
35
\end{array}
\]

*Note:* When a digit in the second number is larger than the corresponding digit in the first number, we must “borrow” from the next place value.

**Example 3:** Subtract: 12,345 – 1267. Check by adding.

**Estimating sums and differences with whole numbers.**

One use for rounding numbers is to estimate an answer. In this manner major errors can be spotted at a glance. In some situations an estimated answer may be sufficient. For example, a shopper may simply estimate the cost of purchases to be sure he or she has enough cash to cover the cost.

**To Estimate:** 1. Round each answer to the place of the leftmost digit.
   2. Perform the indicate operations with these numbers.

Example 4. Estimate the sum: then find the sum.

\[
\begin{array}{cc}
73 & 70 \\
835 & 800 \\
368 & 400 \\
\hline
1270
\end{array}
\]
Example 5. This also works with subtraction.

\[
\begin{array}{cccc}
4156 & 4000 \\
-883 & -900 \\
\end{array}
\]