How do we solve problems with large integers?

We have used the number line to help us with integer addition. The number line helps us build number sense.

**Example 1**

Use the number line to solve $-10 + 7$.

$-10 + 7$

When we look at this problem on the number line, we see clearly which direction we need to move. We move $10$ in a negative direction and then $7$ in a positive direction.

The answer is $-3$.

We can work these problems without much difficulty because small numbers are easy to look at on a number line.
What about a problem that uses big numbers like this one?

\[-156 + 64\]

It is not easy to make a number line that is big enough for a problem like this. And even if it were easy to locate \(-156\) on a number line, it would take a long time to count to the right 64 places. But we can use the number sense we have learned to help us think about the problem and the direction we need to move. We can use a modified number line.

A modified number line is a blank number line with zero in the middle.

![Modified Number Line Diagram]

**Example 2**

Estimate the location of \(-156\) on a modified number line.

To estimate the location of \(-156\) on the number line, move in a negative direction from zero.

Before we work the problem, we need to think about the two numbers. We estimated about where \(-156\) is located on this number line. The next step is to determine which way to move on the number line to add the 64. We are adding a positive number, so we move to the right.

Now we need to determine how far to move to the right.

Will 64 take us all the way back to zero? No, we would have to add a positive 156 to get back to zero. That means the answer falls somewhere on the negative side.
Now we use our number sense to get a good idea of what the answer will be. When we look at $-156$ on a simple number line, we know that if we move 56 to the right, we get to $-100$. Our answer will be a little farther to the right than $-100$ because we have to go 64 to the right, which is more than 56. The answer is probably somewhere in the $-90$s.

**Example 3**

*Use a modified number line to show $-156 + 64$.*

$-156 + 64$

Go right 56.

At this point, we can keep using our number sense to figure out the answer. When we break 64 apart so that one of the parts is 56, we get $64 = 56 + 8$.

That means we count to the right 8 more. Now let’s think about the answer to this problem:

$-100 + 8$

When we count 8 to the right, we get $-92$. That’s our answer.

Go to the right 8 more.
Does this answer make sense? We know the answer will be:

- on the negative side of the number line from our first estimate.
- a little bit more than −100.

The number −92 fits this description.

Another way to work the problem or check our answer is to use a calculator. Let’s use our number sense to solve the next problem.

**Example 4**

**Solve −78 − 110 using a modified number line.**

- First, we place −78 on the number line where we think it might go. We are just estimating so it doesn’t need to be exactly placed.
- We are subtracting. The rule for subtracting is when we subtract, we add the opposite.
- Next, we rewrite the subtraction problem as an addition problem.

\[-78 + (-110)\]

- Then, we ask ourselves which direction we are moving. Because we are adding a negative, we are moving left. Our answer is going to be negative.
- Next, we break the number into parts that are easier to work with. We break −110 into −100 and −10. It’s easy to move 100 in the negative direction.

We go left 100.

- Last, we move 10 more spaces to the left, which gives us −188.

**Answer:** −188
Lesson 13

We can use a calculator to figure out the answer or check the answer we got using the number line.

Enter ➔ 7 8
Press ➔ +
Press ➔ 1 1 0
Press ➔
We should see –188 on our screen.

Sometimes the numbers we work with are not this easy. We must depend on good number sense and estimate the answer. Then we have to use a calculator.

Three tools help us work these problems:

1. A simple number line on paper or in our head.
2. Number sense (ask, about where is the answer going to be?).
3. A calculator to work the problem or check our mental math.

**How do extended facts help us with large integers?**

When we first learned to add and subtract whole numbers, we found that we could extend our knowledge about basic facts and solve similar problems with larger numbers. We called these extended facts.

For instance, because we know that 5 + 4 = 9, we can easily extend this knowledge to 50 + 40 = 90 or 500 + 400 = 900.

We can demonstrate this with subtraction as well. If we know that 15 – 7 = 8, we can use that knowledge to see that 150 – 70 = 80 and 1,500 – 700 = 800.
Extended facts help us understand larger integers as well. Let’s look at an example.

**Example 1**

**Solve** \(-500 - 400\).

This might seem like a difficult problem at first, but we can rely on our knowledge of simpler facts to help us. We can think of this problem:

\[-5 - 4\]

We use the “add the opposite” rule and rewrite the problem.

\[-5 + -4\]

Then we think about direction on the number line. We start at 0 and move back 5. Then we move back 4.

The answer is \(-9\).

It’s too hard to draw \(-500\) and \(-400\) on a number line, so we use our simpler problem and number line to help us solve it.

- Start by thinking about the “add the opposite” rule.
- The equation \(-500 - 400\) may be rewritten as \(-500 + -400\).
- Think of the basic fact \(-5 + -4 = -9\).
- Apply this knowledge to the extended fact.

\[-500 + -400 = -900\]

Again, we see the importance of having good number sense about the numbers we are working with, whether they are whole numbers, fractions, decimal numbers, or positive and negative integers.
Lesson 13

Activity 1

Write > or < to show the bigger number.

1. \(-175 \underline{\quad} -317\)
2. \(259 \underline{\quad} -372\)
3. \(-112 \underline{\quad} -1\)
4. \(95 \underline{\quad} -137\)
5. \(-275 \underline{\quad} -285\)
6. \(0 \underline{\quad} 395\)

Activity 2

Draw a simple number line on a sheet of paper. Then estimate the location of each number and place them on the number line. Use the letter and the number to label your answer on the number line.

Model  
\[ m = -120 \]

\[ \begin{array}{c}
\text{Model} \\
\text{m = -120} \\
\text{m} \\
\hline
-120 \quad 0
\end{array} \]

1. \(A = -75\)  
2. \(B = 120\)
3. \(C = 85\)  
4. \(D = -150\)

Activity 3

Solve these “big” number problems by using good number sense and a calculator. Sketch a simple number line on a sheet of paper to help you.

1. \(-297 + 101\)  
2. \(537 - 600\)
3. \(-411 - 384\)  
4. \(-600 - 400\)
5. \(700 - 900\)  
6. \(100 - -200\)

Activity 4 • Distributed Practice

Solve.

1. Convert \(\frac{15}{100}\) to a percent.
2. Convert 0.08 to a fraction.
3. What common fraction is equal to 75%?
4. \(\frac{3}{4} \cdot \frac{5}{8}\)
5. \(177.07 - 168.19\)
6. \(\frac{27}{9} \div \frac{1}{9}\)
7. \(2.5 + 1.9 + 4.7 + 6.8\)
8. \(11.1 \cdot 0.8\)