27.1 Negatives on the Number Line - Worksheet 1

1 Calculate $-3 + 5$ using a number line. Draw all the points and count out the steps.

2 Calculate $3 - 8$ using a number line. Draw all the points and count out the steps.

3 Calculate $-3 - 4$ using a number line. Draw all the points and count out the steps.

4 Without performing the calculation, explain why $387 - 749$ will result in a negative number.

5 Without performing the calculation, explain why $-178 - 455$ will result in a negative number.

27.2 Negatives on the Number Line - Worksheet 2

1 Calculate $19 - 45$ using a number line.

2 Calculate $-28 - 46$ using a number line.

3 Calculate $-15 + 73$ using a number line.

4 Practice your mental arithmetic by performing the following calculations without drawing a number line (though you may certainly visualize one).

$33 - 57 =$ $\qquad$ $-38 + 19 =$ $\qquad$ $-32 - 29 =$

$-42 + 70 =$ $\qquad$ $-43 + 37 =$ $\qquad$ $72 - 34 =$

$38 - 14 =$ $\qquad$ $-52 + 31 =$ $\qquad$ $-22 + 49 =$

$-18 - 35 =$ $\qquad$ $28 - 63 =$ $\qquad$ $-24 + 15 =$

27.3 Negatives on the Number Line - Worksheet 3

1 Calculate $159 - 217$ using a number line.

2 Calculate $-228 - 146$ using a number line.

3 Calculate $-215 + 273$ using a number line.

4 Practice your mental arithmetic by performing the following calculations without drawing a number line (though you may certainly visualize one).

These are difficult mental calculations! Aim for being accurate, not fast.

$-211 - 157 =$ $-118 + 205 =$ $-312 + 129 =$

$-138 - 124 =$ $-152 + 361 =$ $-212 + 188 =$

$-242 + 170 =$ $-143 + 137 =$ $238 - 314 =$

27.4   Negatives on the Number Line - Worksheet 4

1 Calculate $-53 + 27$ using a number line.

2   Earlier in the section, there was a warning about adding and subtracting in columns when working with negative numbers. We are going to explore the challenges that arise in this setting in order to more fully understand the challenges that arise from working in columns.

   Below a possible first step (ones column) of the calculation $-53 + 27$ when performed using columns:

$$
\begin{array}{r} \overset{1}{-53} \\ +27 \\ \hline 0 \end{array}
\qquad
\begin{array}{l} 3 + 7 = 10 \\ \text{Carry the one} \end{array}
$$

Identify the error that has already taken place in this calculation.

This can be difficult. If you do not get an answer in a few minutes, just go on to the next problem.

3   There is a "rule" that can be used for doing this calculation in columns. To calculate $-a + b$ (where a and b are positive numbers).

- Step 1: Identify the larger number.

- Step 2: Perform the calculation "larger minus smaller."

- Step 3: Give your result the same sign as the larger number in the original problem.

Apply this "rule" to the calculation $-53 + 27$. Explain how this "rule" is a more complicated expression of the number line calculation.

27.5 Negatives on the Number Line - Worksheet 5

1

In the previous worksheet, we saw that calculations in columns can be problematic and lead to errors. The "rule" that was provided is the common way that this is taught. But this is not the only way to think about doing this calculation in columns. We're going to explore this in a different way.

Rather than working with digits, we will work with values. We will look at the calculation $-53 + 27$ again, but rewriting the calculations using expanded form. From here, it is much easier to perform the calculation while avoiding errors.

$$
\begin{array}{r} -53 \\ +27 \\ \hline \end{array}
\quad \rightarrow \quad
\begin{array}{rr} -50 & -3 \\ +20 & +7 \\ \hline \end{array}
\quad \rightarrow \quad
\begin{array}{rr} -50 & -3 \\ +20 & +7 \\ \hline -30 & +4 \end{array} \quad = -26
$$

Notice that this presentation does not conform to any of the best practices of presentation. This should really be considered as scratch work.

Using the expanded form version of writing the calculation, calculation $42 - 76$.

2

What this is showing is that the calculation can be performed if we focus on individual place values. Upon a deeper investigation, this would also reveal that the real issue comes down to the steps of "carrying the one" or "borrowing." The digit manipulations that one might normally do are incompatible with the algorithms for addition or subtraction in columns. Here are two of the most reasonable attempts at performing this calculation using the traditional algorithms.

$$
\begin{array}{r} \overset{1}{-5}3 \\ +27 \\ \hline -20 \end{array}
\qquad
\begin{array}{l} 3 + 7 = 10 \\ \text{Carry the one} \\[4pt] 1 - 5 + 2 = -2 \end{array}
\qquad\qquad
\begin{array}{r} -53 \\ +27 \\ \hline -34 \end{array}
\qquad
\begin{array}{l} -3 + 7 = 4 \\[4pt] -5 + 2 = -3 \end{array}
$$

As best as you can, try to explain the conceptual errors of each attempt.

This is a very tricky problem! It's not obvious to a lot of people what is going wrong here. Try using the previous problem to help your thinking.