## 25.1 Addition - Worksheet 1

1 Draw a base-10 blocks diagram to represent $38 + 15$ and compute the result.

2 Draw a base-10 blocks diagram to represent $195 + 219$ and compute the result.

3 Think about (do not draw) the diagram you would need to represent $48 + 37$ and compute the result from that mental picture. Did you find the visualization helpful or distracting? Explain what was helpful or distracting about the mental image for you.

The only correct answer to the “helpful or distracting” part of the question is an answer that is true to your own experience.

## 25.2 Addition - Worksheet 2

1 Calculate $36 + 59$ using a number line.

2 Calculate $227 + 389$ using a number line.

3 Think about (do not draw) the number line diagram you would need to calculate $23 + 38$ and compute the result from that mental picture. Do you prefer this visualization or the base-10 blocks visualization? Why?

4 Practice your mental arithmetic by performing the following calculations.

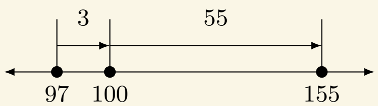
| | | |
|---|---|---|
| $44 + 21 =$ | $24 + 68 =$ | $46 + 19 =$ |
| $16 + 25 =$ | $79 + 26 =$ | $34 + 18 =$ |
| $323 + 258 =$ | $297 + 197 =$ | $186 + 315 =$ |

You might be surprised how much a little bit of practice can help to develop your skill and your confidence.

## 25.3 Addition - Worksheet 3

1 Here is a trick for mental arithmetic when one of the numbers is close to a multiple of 10 or 100. Figure out how far you are from that "nice" number and move that many steps first. Then the remaining movement is much easier to do. Here's a visualization of $97 + 58$:

We're actually using subtraction to facilitate addition.




$\boxed{97 + 58 = 155}$

Draw a number line diagram using the technique above to calculate $98 + 77$.

2 Draw a number line diagram using the technique above to calculate $49 + 36$.

3 Practice your mental arithmetic by performing the following calculations.

Remember that $a + b = b + a$.

| | | |
|---|---|---|
| $96 + 47 =$ | $97 + 88 =$ | $37 + 94 =$ |
| $49 + 76 =$ | $38 + 84 =$ | $34 + 18 =$ |
| $197 + 377 =$ | $298 + 428 =$ | $415 + 189 =$ |

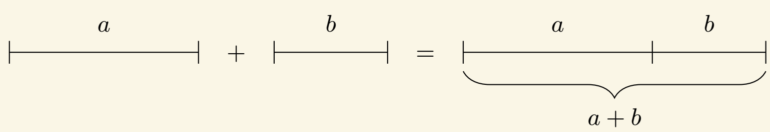
4 Which of the calculations did you find to be easier with this technique? Which were harder? What are the key differences that make one easier than the other?

## 25.4 Addition - Worksheet 4

**1** We are going to spend this time looking at numbers from the Greek perspective. This means that we're going to think of numbers as being sticks of specific lengths. With this in mind, addition of numbers is represented by finding the total length of two sticks put end-to-end.

One of the reasons that the Greeks liked this framework is because it allows us to work with abstract ideas about arithmetic rather than actually having to measure out physical lengths. We can simply replace the numbers with variables and the picture remains meaningful.

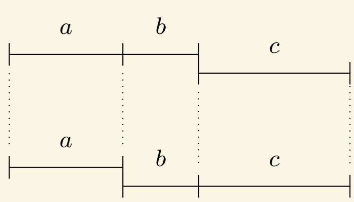
The units can be whatever you want them to be: inches, feet, centimeters, miles, . . .




Draw a diagram to represent the calculation $b+a$ and compare your diagram to the diagram of $a+b$. Explain why the two end results are the same length. Which property of addition is being demonstrated by this?

You may find it hard to put this into words. Try your best. It might help to think about what would go wrong if $a+b \neq b+a$.

**2** Using this framework, the meaning and validity of the associative property of addition is made much more apparent as well.

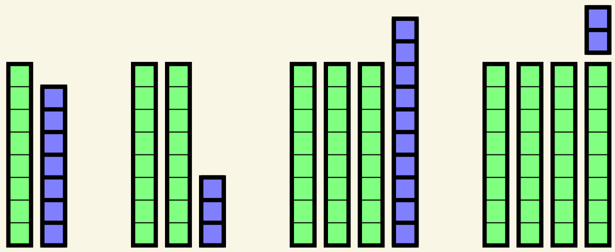



Determine which diagram represents $(a+b)+c$ and which one represents $a+(b+c)$. Explain how you reached your conclusion.

The purpose of this problem is to show you how the right diagram can help to communicate complex ideas in a simple manner.

## 25.5 Addition - Worksheet 5

**1** Recall that the base-8 number system is a system where we work in groups of 8 instead of groups of 10. The concept of addition carries over perfectly as long as the group sizes are respected.



$$17_8 \quad + \quad 23_8 \quad = \quad ??_8 \quad = \quad 42_8$$

Draw a base-8 blocks diagram to represent $25_8 + 34_8$ and compute the result.

**2** Draw a base-8 blocks diagram to represent $134_8 + 155_8$ and compute the result.

**3** Think about (but do not draw) the diagram you would need to represent $34_8 + 17_8$ and compute the result from that mental picture.