29.1 Number Line Movement - Worksheet 1

1. Draw a movement diagram to represent $2 + 4$ and compute the result.

Make sure that you are facing the correct direction!

2. Draw a movement diagram to represent $3 - 7$ and compute the result.

3. Draw a movement diagram to represent $-4 + 5$ and compute the result.

4. Draw a movement diagram to represent $-3 - 2$ and compute the result.

29.2 Number Line Movement - Worksheet 2

1 Draw a movement diagram to represent $4 + (-3)$ and compute the result.

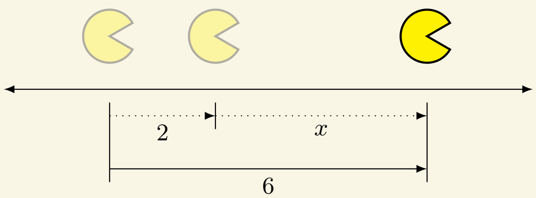
2 Draw a movement diagram to represent $2 - (-4)$ and compute the result.

3 Draw a movement diagram to represent $-1 + (-3)$ and compute the result.

4 Draw a movement diagram to represent $-4 - (-7)$ and compute the result.

29.3 Number Line Movement - Worksheet 3

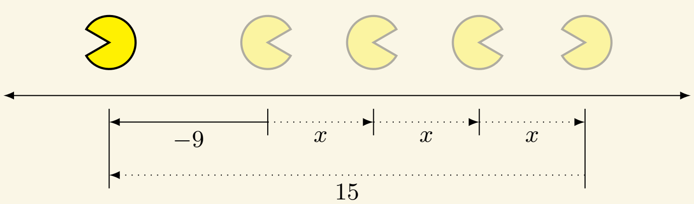
1 We have seen that the visualizations that we've created give us another way to look at solving equations. For example, we can use our movement diagram to visualize the equation $2 + x = 6$:



Convert the algebraic equation $2 + x = 6$ into a question about the diagram above. Be sure that your words include enough information that the diagram can be reconstructed by analyzing the words.

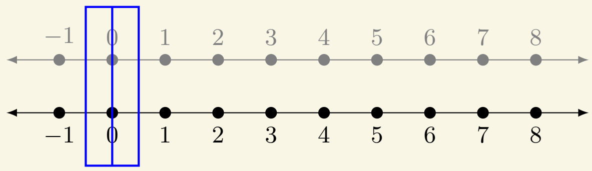
You don't need an example. Think about how you might explain this diagram to a middle school student.

2 Convert the diagram into an algebraic equation, then solve it.

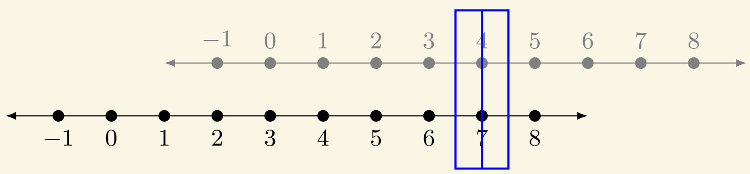


29.4 Number Line Movement - Worksheet 4

1 We can replace the idea of movement with stacked number lines and a slider.



You can think of this as two rulers. To represent $a + b$, slide the top ruler over by a spaces, then move the slider to the position b on the upper ruler. The value on the bottom ruler marked by the slider gives the result. Here is what $3 + 4$ would look like.



- Step 1: Slide the top ruler 3 spaces to the right. Notice that gray 0 lines up with the black 3.
- Step 2: Move the blue slider over the top of the gray 4.
- Step 3: Read the final answer from the bottom line.

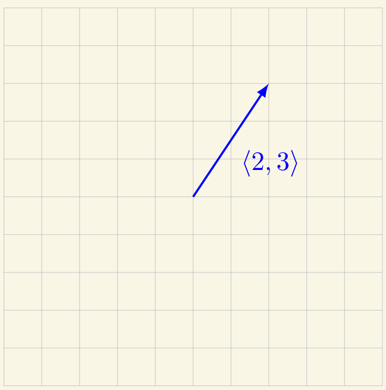
Draw a stacked number line diagram to calculate $3 + (-2)$.

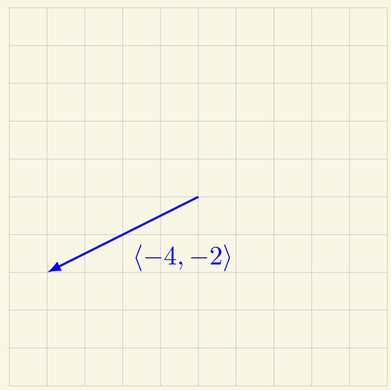
Although this may seem like an artificial construction, this idea basically mimics the way that calculations were done with slide rules. Unfortunately, there is one piece missing, which is the application of logarithms. And logarithms go beyond the scope of this course. But one of the core features of logarithms is that it converts multiplication into addition. And that is the trick that makes slide rules work.

Slide rules have been replaced by calculators, but it's of historical interest that slide rules were the calculators of their day, which spanned from the early 1600s through the mid-1900s. Slide rules were phased out during the 1970s when pocket calculators started to become cheap enough for the average person to be able to purchase one.

29.5 Number Line Movement - Worksheet 5

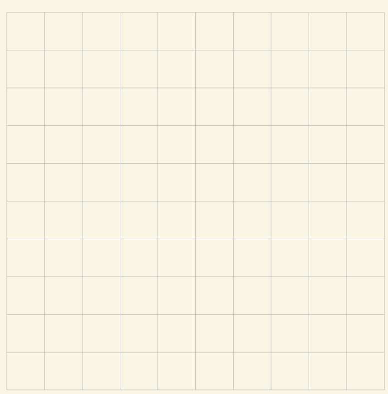
1 We've considered arithmetic as movement on the number line. But it turns out that we can do the same thing on the coordinate plane. But rather than using a single number, we use a pair of numbers to indicate motion in the horizontal and vertical directions. Here are a couple different vectors.





Notice the use of pointed brackets instead of round brackets. This is how we distinguish points from vectors.

In the same way that addition with a movement diagram was simply doing one movement followed by another one, addition of vectors can be thought of as doing one movement followed by another one. With this concept in mind, sketch a picture of $\langle 2, 3 \rangle + \langle -4, -2 \rangle$ on the grid and then compute the result.



Remember that the result is the final result of all the movement. What would the arrow look like if you simply went to the final position directly?

2 Based on the ideas in this section, what do you think $-\langle 1, 5 \rangle$ means? How would you justify or explain your idea?

Hint: What is the relationship between 3 and -3?