

Chef Story for Positive & Negative Numbers



In a far-off place, there was once a team of amazing chefs who cooked up the most marvelous food ever imagined.

They prepared their meals over a huge cauldron, and their work was very delicate and complex. During the cooking process, they frequently had to change the temperature of the cauldron in order to bring out the flavors and cook the food to perfection.

They adjusted the temperature of the cooking either by adding special hot cubes or cold cubes to the cauldron or by removing some of the hot or cold cubes that were already in the cauldron.

The cold cubes were similar to ice cubes except they didn't melt, and the hot cubes were similar to charcoal briquettes, except they didn't lose their heat.

If the number of cold cubes in the cauldron was the same as the number of hot cubes, the temperature of the cauldron was 0 degrees on their temperature scale.



For each hot cube that was put into the cauldron, the temperature went up one degree; for each hot cube removed, the temperature went down one degree. Similarly, each cold cube put in lowered the temperature one degree and each cold cube removed raised it one degree.

The chefs used positive and negative numbers to keep track of the changes they were making to the temperature.

Suppose 4 hot cubes and 10 cold cubes were dumped into the cauldron.

1. How would the temperature in the cauldron change?
2. How do you think they might record this change in their recipe?
3. What if they wanted to use two-color counters to represent this pictorially?

Similarly, assume they started again with a temperature of 0 degrees and added 3 hot cubes and then removed 2 cold cubes,

4. How would the temperature in the cauldron change?
5. How do you think they might record this change in their recipe?
6. What if they wanted to use two-color counters to represent this pictorially?

Suppose they wrote $-5 - +6$ and started with a temperature of 0 degrees.

7. What cubes would they be adding or removing from the cauldron?
8. How would the temperature in the cauldron change?
9. What if they wanted to use two-color counters to represent this pictorially?

After a while, the chefs realized that it was rather tedious to put cubes in the cauldron one at a time. So, for large jumps in temperature, they decided to put in or take out bunches of cubes.

For instance, if the chefs wanted to raise the temperature 100 degrees, then they might toss five bunches of 20 hot cubes each into the cauldron instead of 100 cubes one at a time. This saved a lot of time because they could have assistant chefs do the bunching.

10. When the chefs used bunches of cubes to change the temperature, what sign do you suppose they used to record their activity?
11. How would they record tossing five bunches of 20 hot cubes each into the cauldron? How could this be represented with the two-color counters?
12. What would $+3 * -6$ represent in terms of the cubes? How could this be represented with the two-color counters?
13. What would $-3 * +6$ represent in terms of the cubes? How could this be represented with the two-color counters?

Figure out how the temperature would change overall in each of the following situations, write an equation to describe the action and the overall result, and represent the action with two-color counters. Assume the chefs start each time with a temperature of 0 degrees.

- a. Two bunches of 4 cold cubes each were removed.
- b. Five bunches of 2 hot cubes each were removed
- c. Three bunches of 2 cold cubes each were added.

Describe the action involving hot or cold cubes that is represented by each of the following arithmetic expressions, state how the temperature would change, and represent the action with two-color counters.

- a. $2 * +5 + -3 * +4$
- b. $-2 + -3 * -5$