

# A-REI Quinoa Pasta 3

Alignments to Content Standards: A-REI.C.6

## Task

Jerry was recently diagnosed with celiac disease. This means that he cannot eat any food containing gluten, in particular, he cannot eat pasta made from wheat. His mom has found a gluten free pasta that he likes a lot. It is called “Ancient Harvest Quinoa Pasta”. How much of the pasta is actually quinoa?



## IM Commentary

This task is an example of a mathematical modeling problem (SMP 4) and it also illustrates SMP 1 (Making sense of a problem). Students are only told that there are two

ingredients in the pasta and they have a picture of the box. It might even be better to just show the picture of the box, or to bring in the box and ask the students to pose the question themselves. The brand of pasta is quite commonly available at supermarkets or health food stores such as Whole Foods and even at Amazon.com. The box has the nutritional label and a reference to the website where the students can find other information about the ingredients

This task is a variant of 8.EE Quinoa Pasta 1 and A-REI.6 Quinoa Pasta 2. In the first task, all the relevant information is given as part of the task statement and the students are explicitly asked to set up a system of equations.

It is worth spending some time discussing reasonable levels of numerical precision. While the percentage of quinoa which is protein is given to three digits of accuracy, other values in the problem (e.g., the number of grams of protein per serving) are given only to the nearest gram. So while the computations shown in the solution are carried out using 3 decimal places, the answer should only be reported as whole numbers.

This task could be used as a group activity where students cooperate to formulate a plan of how to solve the problem and to set up the equations required to solve the problem. Students may require guidance from the teacher to pursue different solution methods.

Edit this solution

## Solution

This is just one possible solution to the problem. Students might come up with a variety of solution methods that are equally valid.

After looking at the pasta box, one might think that the pasta contains mostly quinoa. A check of the ingredient list shows that it actually contains corn and quinoa. Corn is listed first, so this means that more than 50% of the pasta is corn. A “Frequently Asked Questions” list at the pasta company’s website (<http://www.quinoa.net/11301.html>) actually contains the question we are trying to answer, and the answer states that the percentage of quinoa and corn is “proprietary information”, which is a quite intriguing statement.

Since we only have two ingredients, it might be possible to set up a system of two liner

equations in two unknowns, to solve the problem. The nutritional label gives additional information, including that the serving size is 57 grams and that there are 4 grams of protein in one serving. If we let  $q$  be the amount of quinoa, in grams, in one serving of pasta and  $c$  be the amount of corn, in grams, in one serving of pasta we have

$$q + c = 57.$$

We already know that there are 4 grams of protein in one serving of the blend, so if we can find out what the protein content of quinoa and corn is, then we can set up a second equation. There are different ways to estimate the protein content of the two ingredients. A search of the pasta company's website reveals a page with nutritional values of different foods (<http://www.quinoa.net/199.html>). Different websites also give this information. Depending which numbers we use, we will get different answers. For the following solution we will use the information given on the website. This means we are making an important assumption: The protein content of the ingredients in the pasta is correctly reflected by the information on the webpage. The information on the website states in the table titled "Quinoa's Food Value" that quinoa contains 16.2% protein and corn contains 3.5% protein. This is enough information to set up our second equation:

$$0.162q + 0.035c = 4.$$

Therefore, we have the following system of equations:

$$\begin{aligned} q + c &= 57 \\ 0.162q + 0.035c &= 4. \end{aligned}$$

We can solve this system using the method of substitution or the method of elimination. Using the method of substitution, we solve the first equation for  $q$ :

$$q = 57 - c.$$

We substitute this for  $q$  in the second equation and solve for  $c$  :

$$\begin{aligned}
 0.162q + 0.035c &= 4 \\
 0.162(57 - c) + 0.035c &= 4 \\
 9.234 - 0.162c + 0.035c &= 4 \\
 -0.127c &= 4 - 9.234 \\
 -0.127c &= -5.234 \\
 c &= 41.213.
 \end{aligned}$$

So  $c = 41$  and  $q + c = 57$ , therefore we have  $q = 16$ . Out of the 57 grams of pasta in one serving, 41 grams are corn and 16 grams are quinoa. In other words, about 72% of the pasta blend is corn and 28% is quinoa.

Note: In our solution to the problem, we are making the assumption that the protein content of the corn and the quinoa used to make the pasta is the same as the protein content listed in the table on the website. This may or may not be the case. For example, wikipedia lists the protein content of quinoa as 14% and of corn as 3.22 %. Using these numbers, our solution would be different: 35 % quinoa, 65 % corn.

This task has many extensions. A more thorough information search on protein content of quinoa and corn would yield a range of numbers. We could use this range to find an upper and lower bound for the amount of quinoa and corn in the pasta. Furthermore, the nutritional label lists the protein content of the pasta as 4 grams. This number might be rounded. The actual content might be as high as 4.49 grams.



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