Problem of the Week Teacher Packet

Anthony's Famous Butter Rolls

This year Anthony's family is hosting the big Thanksgiving dinner. That means his grandmother, aunts, uncles, and cousins will all be coming to his house. There will be 12 adults and 15 children, so they're going to need a lot of food!

Anthony is in charge of making the rolls. His mom wants him to make enough so that there will be 3 rolls for every 2 adults and 4 rolls for every 3 children. She also told him to bake one extra roll for each person to make a turkey sandwich the next day.

She advised him not to make partial recipes because recipes with yeast often turn out better if you follow the directions exactly. With all the leftovers that could spoil, refrigerator space will be precious, so Anthony doesn't want to save any dough to bake later – he wants to bake it all at once.

His recipe makes 2 dozen rolls. How many rolls will he make if he follows all of his mother's suggestions? Explain how you arrived at your answer.

Extra: *Anthony's Famous Butter Rolls Recipe*

5 ½ cups all-purpose flour	1 ½ cups milk
3 tablespoons white sugar	½ cup water
2 teaspoons salt	¾ cup butter
1 ½ teaspoons active dry yeast	Makes 2 dozen rolls

How much of each ingredient will he need?

Answer Check

After students submit their solution, they can choose to "check" their work by looking at the answer that we provide. Along with the answer itself (which never explains how to actually get the answer) we provide hints and tips for those whose answer doesn't agree with ours, as well as for those whose answer does. You might use these as prompts in the classroom to help students who are stuck and also to encourage those who are correct to improve their explanation.

Anthony will make 72 butter rolls for Thanksgiving.

If your answer **doesn't** match ours,

- did you remember that 1 dozen equals 12?
- did you draw a picture?
- did you act it out in your group?
- did you remember that Anthony's mother wants him to bake one extra roll for each person?
- did you remember that Anthony is advised not to make partial recipes?

If any of those ideas help you, you might revise your answer, and then leave a comment that tells us what you did. If you're still stuck, leave a comment that tells us where you think you need help.

If your answer **does** match ours,

- did you try the Extra?
- are you confident that you could solve another problem like this successfully?
- is your explanation clear and complete?
- did you make any mistakes along the way? If so, how did you find them?
- what hints would you give another student trying to solve this problem?

Revise your work if you have any ideas to add. Otherwise leave us a comment that tells us how you think you did—you might answer one or more of the questions above.

Our Solutions

Method 1: Plan and Reflect

We read the problem and listed our noticings:

> Anthony's family is hosting a big dinner.
> 12 adults and 15 children will be at the dinner.
> Anthony is in charge of making rolls using these "rules"
>> 3 rolls for every 2 adults
>> 4 rolls for every 3 children
>> 1 roll extra for each
>> Full recipes only – no partial recipes
>> A full recipe makes 2 dozen rolls
> Adults and children eat a different amount
> Everyone gets at least one roll for the next day's sandwich.

We made a plan to start by:

- calculating how many sets of "3 rolls" and how many sets of "4 rolls" would be since we know the number of children and adults.
- figuring out how many extra "1 rolls" would be needed.

To find out how many rolls Anthony should make for the adults we divided the 12 adults by 2 which equals 6, and then we multiplied it by the 3 rolls which equals 18. To find out how many rolls Anthony should make for the children, we divided the 15 children by 3 which equals 5, then we multiplied it by the 4 rolls which equals 20. We added 18 rolls to 20 rolls and got 38 rolls.

We stopped for a moment to think about if that seemed reasonable and it did. So, we continued with our plan.

Because his mom told him to bake one extra roll for each person, we added the 12 adults and the 15 children giving a total of 27 people. Because each person will need one extra roll, the total number of extra rolls is 27 x 1 = 27 extra rolls. Now we had the 38 rolls plus 27 extra rolls for a total of 65 rolls altogether.

We stopped again to think about what we had noticed and what we had calculated so far. We still had one more thing to consider and that was the idea of making full recipes.

Anthony's recipe makes 2 dozen rolls and since 1 dozen is 12, 2 dozen equals 24 rolls. His mom told him not to make partial recipes. He needs to make at least 65 rolls. We looked for a number that was a multiple of 24 that was no less then 65. The lowest multiple was 24 x 3 = 72. Therefore, if he follows all of his mom's suggestions he will make 72 rolls.

Extra: We know that 72 rolls is 3 recipes. To find how much of each ingredients that Anthony will need, all we have to do is add three of them together. This is what we did and what we got:

| ingredient	1 recipe	3 recipes
flour	5 ½ cups	16 ½ cups
sugar	3 tablespoons	9 tablespoons
salt	2 teaspoons	6 teaspoons
yeast	1 ½ teaspoons	4 ½ teaspoons

|		
milk	1 ½ cups	4 ½ cups
water	½ cup	1 ½ cups
butter	¾ cup	2 ¼ cups

Method 2: Draw a Picture

I read the story and noticed that it says that Anthony needs to make 3 rolls for every 2 adults and 4 rolls for every 3 children. I decided to draw this picture to keep track of that information.
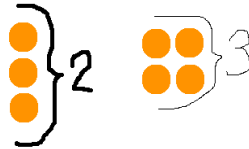
The other information about adults and children in the problem was that there will be 12 adults and 15 children at the big dinner. I thought about how I could use this information combined with my first picture. The "2" represents the adults and since there will be 12 adults, I need 6 of those pictures. If I think the same way about the children I need 5 of those pictures. Now I had this:
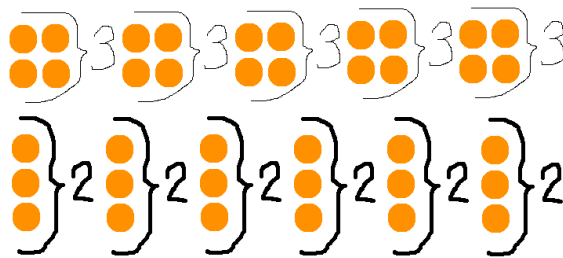
I remembered one more detail. He had to make one extra roll per person. I added those rolls to my picture:
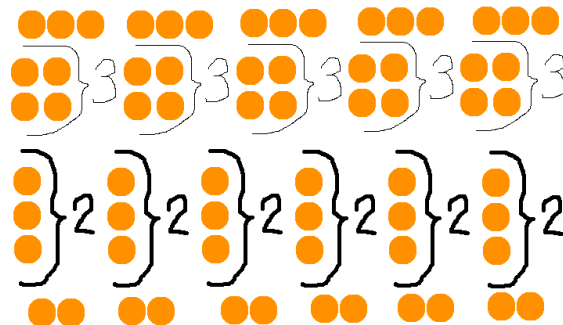
I counted all of the rolls:

5 groups of 7 made 35
6 groups of 5 made 30

Together that was 65 rolls but because Anthony needed to follow all of his mother's suggestions, he also had to make full recipes. If one recipe makes 2 dozen or 24 rolls than he has to make 24 or 48 or 72 or more. If he only made 48 rolls that wouldn't be enough. Anthony should make 72 rolls.

Method 3: Make a Table

First I read the problem and found out that there were 15 children and 12 adults. I also found out that Anthony's mother told him to make 3 rolls for every 2 adults and 4 rolls for every 3 children. The number of adults, children and rolls is shown below.

Adults	Rolls	Children	Rolls
2	3	3	4
2	3	3	4

```
2      3      3      4
2      3      3      4
2      3      3      4
2      3
----   ----   ----   ----
12     18     15     20          totals for Thanksgiving
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There needs to be 1 extra roll for each person to make sandwiches. So you need 15 + 17 = 27 extra rolls. For the total number of rolls you need:

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    18 - rolls for adults for Thanksgiving
    20 - rolls for children for Thanksgiving
 + 27 - rolls for next day sandwiches
 -------
    65 - total rolls needed.
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However, his mother told him not to make partial recipes. Since the recipe makes 2 dozen or 24 rolls I just have to add 24s until I go over 65.

        24 + 24 = 48. 48 + 24 = 72. So he will need to make 72 rolls.

Method 4: Algebra (not expected of elementary students but older students might want to try their hands at this method)

I read the problem and noticed:
- 12 adults will need rolls
- 15 children will need rolls
- every 2 adults eats 3 rolls
- every 3 children eats 4 rolls
- 1 extra roll per person is needed
- recipe makes 2 dozen
- full recipes only, no partial recipes

If I let x = 1 roll, I can write:
        Adults need 12/2(3x) + 12x = 18x + 12x = 30x or 30 rolls
        Children need 15/3(4x) + 15x = 20x + 15x = 35x or 35 rolls

So I know that Anthony needs to make 65 rolls. Since the recipe makes 2 dozen or 24 rolls I still need to figure out how many recipes he should make and how many rolls that would be since he plans to make full recipes. Two recipes would be 48 rolls and that's not enough. Three recipes would be 72 rolls and since that's more than 65 rolls, that's it! Anthony should make 72 rolls if he follows all of his mother's suggestions.

Standards

If your state has adopted the Common Core State Standards, you might find the following alignments helpful.

Grade 3: Operations and Algebraic Thinking

    Solve problems involving the four operations, and identify and explain patterns in arithmetic.

Grade 4: Operations and Algebraic Thinking

    Use the four operations with whole numbers to solve problems.

Grade 5: Operations and Algebraic Thinking

    Write and interpret numerical expressions.

Mathematical Practices

1. Make sense of problems and persevere in solving them.
2. Reason abstractly and quantitatively
3. Construct viable arguments and critique the reasoning of others.
4. Model with mathematics

Additional alignment information can be found through the Write Math with the Math Forum service, where teachers can browse by CCSS, NCTM, and individual state standards to find related problems.

Teaching Suggestions

When this problem was first offered, there were a variety of strategies used. A major part of getting this problem correct was determining the exact number of rolls that Anthony was supposed to make for the adults and then the kids. One way to solve this problem was to count the groupings; another was to use tables - a good way of keeping track of how many rolls each group was supposed to get. A few students used ratios or proportions.

Quite a few students forgot to add the extra roll for each person. However, the hardest part of this problem seemed to be remembering the idea that Anthony had to make full batches of rolls in dozens. Many students figured out the actual number of rolls needed was 65 but did not know how to conclude from there that he would have to make 72 rolls.

Although not described as a method in the Our Solutions section, students might benefit from acting it out. Counters could be used to represent the rolls. If students do a good job of noticing and wondering in their groups and use a manipulative to think about the mother's suggestions they might hold on to all of the details mentioned in the problem.

Resist the urge to give direct instructions on a specific approach. Locate the Noticing and Wondering activity in our Understanding the Problem strategy. You'll find everything you need from the Problem Solving Activities link in the left menu bar.

The questions in the Answer Check, above, might serve as useful prompts to help students make progress. Encourage students to use a strategy that works for them. You can see from the various methods that we have thought to use for this problem, there are several ways to approach this problem. And keep in mind that we may not have thought of them all!

If you would like a calendar of the Current Problems, consider bookmarking this page:

http://mathforum.org/pow/calendar.html

Sample Student Solutions – Focus on *Interpretation*

In the solutions below, I've provided scores the students would have received in the **Interpretation** category of our scoring rubric. My comments focus on areas in which they seem to need the most improvement.

Novice	Apprentice	Practitioner	Expert
Understands few of the criteria listed in the Practitioner column.	Understands most but not all of the criteria listed in the Practitioner column.	Understands that - the goal is to find how many rolls should be made. - there will be 12 adults and 15 children at dinner. - Anthony's mom asks him to make 3 rolls per 2 adults and 4 rolls per 3 children plus 1 extra roll per person and full recipes (no partial recipes). - the recipe makes 2 dozen rolls. - a dozen equals 12 rolls.	Is at least a Practitioner in Strategy and comes up with the correct solution for the Extra.

Jarrod, age 10, Novice

I got extacly 97 rolls of bread.

well at first i did 12 *3 and got thirty-six.then i did 15*4 and i got sixty and his mom told him to make a extra roll. so i got 97

I notice that Jarrod multiplied the number of adults (12) by the number of rolls (3). I wonder if he realized that the problem said that there should be 3 rolls for "every 2 adults." That makes a difference! I might suggest that Jarrod draw a picture or use a manipulative to act out what might be happening in the problem.

Ryan, age 12, Novice

To do the adults I put them in to groups of 2 and I could make 6 of them and for every group there is 3 rolls so you do 3times 6 and get 18 then you do the kids.
 to do the kids you put the kids in groups of 3 and 4 rolls per group then you do 3 times 4 and then you get 12.

you add 12 and 18 and get 3

I notice that Ryan has made use of two of the five ideas listed under Practitioner. I would encourage him to return to the story of the problem and see if he could take the next step. He's actually close to being an Apprentice in Interpretation and I scored him Novice only because he's made use of the two hints that are the most straightforward.

Nick, age 11, Apprentice

If Anthony folloes all of his mother's directions he will make 89 rolls.

To solve this problem,I first wrote down that there were 12 adults and 15 kids.Since he had to make 3 rolls for every 2 adults and 4 rolls for every 3 kids, plus he had to make one extra for everybody, I did the math and found out that there were 18 rolls for adults there were 20 rolls for kids, and there were 27 extra rolls.Then I did the math and found out that there were 24 rolls in the recipe.Finally, I added 27,24,20,and 18 and I got 89.

I notice that Nick used the information about the number of rolls for each adult and child. He also used the idea that each person should have a roll for the next day. I wonder why he added 24 (the number of rolls a recipe makes) to his other numbers.

Brainiacs (team), age 10, Apprentice

He will need 3dozans for their to be enough for everyone.

Well, first I drew a picture of 12 little dots to represent the adults and 15 little stars to represent the children.For every 2 adults we put 3 rolls and it turned into = 18.For every 3 children we put 4 rolls it turned into 20 rolls.Then we added 20+18=38 then we had to add 15+12=27 (that was for the turkey sandwiches the next day)then we added the 27 to the 38 and got 65 then we divided 65 by 27 and got 3 remander 11 and since there was a remander we said 4.

I notice that this team of students drew a picture to think about the problem and I would point out to them that this is a very good strategy for this problem.

I wonder why they chose to divide by 27. I might ask them how many rolls a full recipe makes so that they think about that last clue of the problem that needs to be considered.

Mr. Thompson's class (team), age 9, Apprentice

For adults Anthony would need 18 rolls and children need 20 rolls. 18+20=38 + the extra 27 for everyone to make a turkey sandwich =65 rolls.But Anthony would need 6 recipies so he would make 72 rolls because 6 dozen would make 72.(He would have 7 extra because 7+6 is 1 dozen.)

adult:	2 2 2 2 2 2		children:	3 3 3 3 3
rolls:	3 3 3 3 3 3		rolls:	4 4 4 4 4
	6 6 6			8 8 4
	12			16
	+ 6			+ 4
	____			____
	18			20

20+18=38 rolls. Add 27 for turkey sandwiches.   38+27=65 total

Mr. Thompson's class has a great start. I love their display of numbers showing how they thought about the two groups of people and the number of rolls they each would eat.

I would suggest that they check the problem one more time to see if there is one more suggestion Anthony's mom asked him to consider!

Problem 2767

Sammy, age 11, Practitioner

Anthony is going to have to make 6 dozen rolls and he will have 7 rolls left over.

First I found out how many rolls the adults would need and that was 18, then i found out how many rolls the children would need and that was 20. Next i add all the rolls and that was 38, so then I had to fing out how many more rolls Anthony would need to make to give every one an extra roll to make a turkey sandwich.

All of the turkey sandwich's together were 27 so I new I would have to add the 27 to the 38 and that was 65. I new that 5x12 is 72 and that was close to 65 and i would have 6 rolls left over.

I notice that Sammy gives his answer in terms of dozens of rolls instead of individual rolls. That is an acceptable answer since 6 dozen rolls is the same as saying 72 rolls.

Both his Completeness score and Clarity score are at the Apprentice level. I would encourage him to reflect and revise to improve both of those scores.

Noa, age 10, Practitioner

Anthony will need to make 76 rolls. For the bonus question he will need to make his recipe 4 times.

I knew there were going to be 12 adults and 15 children. I knew each 3 children needed 4 rolls, and ever 2 adults needed 3 rolls. First I looked at the children I thought about how many rolls to make for the children. So I did:

15 divided by 3 = 5*4=20

So I knew the children needed 20 rolls. Then I looked at the adults. I needed to know how many rolls to make for the adults. Since every 2 adults needed 3 rolls I did:

2 divided by 2+6*3=18

So the adults need 18 rolls. Then I looked and saw that each person needed an extra roll for the next day. Then I needed to know how many people there were. I did:

18+20=38

I did that because there were 12 adults and 15 children. To find out how many rolls he needed to make altogether. He needs to add 38 to38 because there are 38 people. So I did:

38+38=76

So I knew Anthony needed to make 76 rolls.

Extra

He needs to make his recipe 4 times but since recipe makes 2 dozen rolls (24) he will have 96 rolls. He will have 24 extra rolls.

Noa has done a nice job formatting her explanation but I notice that she has used equations in a way that might lead one to think that "15 divided by 3" equals "20." This is a common misconception for students and I would take the opportunity to have her think about it.

I also notice that she has an inaccurate final answer because she confused the total number of people with the total number of rolls for the 2 groups. I decided to score her as Apprentice in Accuracy rather than bringing down her Interpretation score but I can see how it could be argued the other way.

Matthre, age 10, Practitioner

If Anthony follows all of his mom's suggestions then he will make seventy-two rolls.

The first thing I did was found out how many rolls Anthony needed to make for the adults. I did this by dividing the number of adults by two then multiplying that number by three. I then jotted the answer down on a sheet of paper. Then I figured out the number of rolls Anthony would have to make for the children. I did this by dividing the number of children by three and then multiplying that number by four. I then jotted the answer down on the same sheet of paper as before. The next thing I needed to figure out was the

Matthew has done a good job with his explanation but I would suggest that he work to improve his Clarity score.

I would suggest that he add a few paragraph breaks to help the reader.

number of extra rolls he needed to bake. I added the number of adults and the number of children together, and that was the number of extra rolls that Anthony needed to make. I then jotted that number down on the same sheet of paper that I jotted the other two numbers down. Next I added all the numbers on my separate sheet of paper together. The number I got was sixty-five. I knew that because the recipe made two dozen rolls that it could not make exactly sixty-five rolls. Instead, I used to closest number that is a multiple of twenty-four that is above sixty-five. The closest multiple of twenty-four that is above sixty-five is seventy-two. That is how I got my answer.

Scoring Rubric

A **problem-specific rubric** can be found linked from the problem to help in assessing student solutions. We consider each category separately when evaluating the students' work, thereby providing more focused information regarding the strengths and weaknesses in the work. A **generic student-friendly rubric** can be downloaded from the Teaching with PoWs link in the left menu (when you are logged in). We encourage you to share it with your students to help them understand our criteria for good problem solving and communication.

We hope these packets are useful in helping you make the most of Pre-Algebra Problems of the Week. Please let me know if you have ideas for making them more useful.

> —*Suzanne, @SuMACzanne*