



Problem of the Week Teacher Packet

Charlie's Gumballs

Charlie has a giant bag of gumballs and wants to share them with his friends.

He gives half of what he has to his buddy, Jaysen. He gives half of what's left after that to Marinda. Then he gives half of what's left now to Zack. His mom makes him give 5 gumballs to his sister. Now he has 10 gumballs left.

How many gumballs did Charlie have to begin with?



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.

Charlie started with 120 gumballs.

If your answer does not match our answer, did you

- work backwards?
- try a number and see how it might work?
- talk in your group?

If your answer does match ours,

- explain?
- write a number sentence?
- help anyone in your group?

Our Solutions

Method 1: Work Backwards

I worked backwards. I started with Charlie's gumballs at the end and added his sister's:

$$10 + 5 = 15$$

I knew that Zack had that many and I added them:

$$15 + 15 = 30$$

I knew that Marinda had that many and I added them:

$$30 + 30 = 60$$

I knew that Jaysen had that many and I added them:

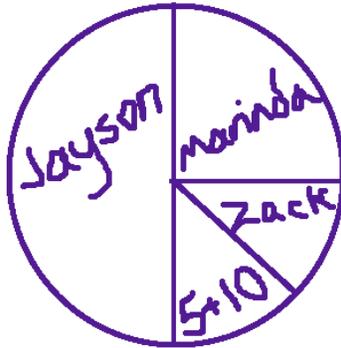
$$60 + 60 = 120$$

So Charlie had 120 gumballs.

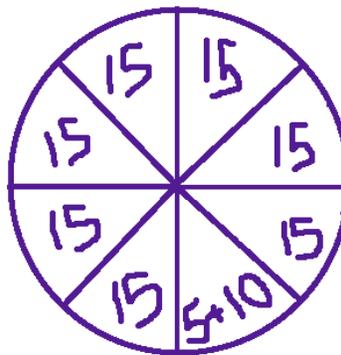
Method 2: Draw a Picture

We read the story and then decided that we'd draw a picture. We drew a circle to show all of the gumballs and we cut it in half to show how much Jaysen got. We cut the part that was left in half to show the part Marinda got. We cut the part that was left in half to show the part Zack got. We put $5 + 10$ in the last part to show Charlie's sister's 5 gumballs and Charlie's gumballs.

Our picture looked like this:



We saw that Zack's part of the circle was the same size as the $5 + 10$ and so we decided Zack got 15 gumballs. We divided Marinda's part in two and saw that she got 15 and 15. We divided Jaysen's part in two and then again in two and saw that he got 15 and 15 and 15 and 15.



We added up all the numbers and knew that Charlie had 120 gumballs in the bag.

Method 3: Guess and Check

After we read the story we talked about how many gumballs might be in that bag in the picture. It looked like a lot. We guessed 100. Now we checked:

Half of 100 is 50

Half of 50 is 25

Half of 25 – we can't do that or we'd have to cut a gumball in half but it's about 12 or 13. That's not quite enough to have 5 for his sister and 10 for Charlie. We're going to pick a little bigger number.

Our next guess is 116.

Half of 116 is 58

Half of 58 is 26

Half of 26 is 13 – we're close! We just need 2 more gumballs for Zack and 2 more gumballs to make 15 for Charlie and his sister.

Our third guess is 120.

Half of 120 is 60

Half of 60 is 30

Half of 30 is 15

And then we have 15 left!

To double check we have:

$$5 + 10 + 15 + 30 + 60 = 120$$

Charlie had 120 gumballs at the start.

Method 4: Write Number Sentences

We can write this number sentence about the gumballs that Charlie gave his friends and his sister:

$$\text{gumballs} = 1/2 \text{ gumballs} + 1/2 \text{ of } 1/2 \text{ gumballs} + 1/2 \text{ of } 1/2 \text{ of } 1/2 \text{ gumballs} + 5 + 10$$

We know that 1/2 of 1/2 of something is 1/4 and we know that 1/2 of 1/2 of 1/2 of something is 1/8. We can write our number sentence like this:

$$\text{gumballs} = 1/2 \text{ gumballs} + 1/4 \text{ gumballs} + 1/8 \text{ gumballs} + 5 + 10$$

When we add 1/2 and 1/4 and 1/8 we get 7/8 and so we can write:

$$\text{gumballs} = 7/8 \text{ gumballs} + 15$$

We know that 15 is 1/8 of gumballs because that's how many we would add to 7/8 gumballs to get all of them. So,

$$15 + 15 + 15 + 15 + 15 + 15 + 15 + 15 = \text{all of the gumballs}$$

$$30 + 30 + 30 + 30$$

$$60 + 60$$

$$120$$

Charlie had 120 gumballs!

Method 5: Algebra (*certainly not expected for Primary students but if older students are assigned this problem they might solve it algebraically*)

Let x = the total number of gumballs that Charlie had in his bag.

$1/2x$ = the number of gumballs Charlie gave Jaysen

$1/2$ of $1/2$ or $1/4x$ = the number of gumballs Charlie gave Marinda

$1/2$ of $1/2$ of $1/2$ or $1/8x$ = the number of gumballs Charlie gave Zack

5 gumballs = the number of gumballs Charlie gave his sister

10 gumballs = the number of gumballs Charlie had for himself at the end of sharing

I can write this equation and solve for x :

$$x = \frac{1}{2}x + \frac{1}{4}x + \frac{1}{8}x + 5 + 10$$

$$x = \frac{4}{8}x + \frac{2}{8}x + \frac{1}{8}x + 15$$

$$x = \frac{7}{8}x + 15$$

$$\frac{8}{8}x = \frac{7}{8}x + 15$$

$$\frac{1}{8}x = 15$$

$$8\left(\frac{1}{8}x\right) = 8(15)$$

Standards

If your state has adopted the [Common Core State Standards](#), you might find the following alignments helpful.

Grade 2: Operations & Algebraic Thinking

Use addition and subtraction within 100 to solve one- and two-step word problems involving situations of adding to, taking from, putting together, taking apart, and comparing, with unknowns in all positions, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem

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.

Teaching Suggestions

This problem is one that was discussed during an online course offered to a group of primary level teachers from Montgomery County, Maryland. Here are some thoughts that were shared in the course about this particular problem:

Java's Thoughts

I worked on the PoW Charlie's Gumball with my second graders. I chose it because I wanted something where there would be a lot of opportunity for discourse. I wasn't sure how this would go since I have not worked on fractional parts with the students as yet.

To start the lesson I placed the problem in the center of a chart paper and divided the paper into fourths. Every group of 4 students worked together on the problem in the section that was divided off for them. I also placed another copy of the problem on the board that I used for my self. I introduced the problem to the students by reading it to them and then asking them what they noticed. I wrote their responses in the 1st section.

- "Charlie cuts the amount into $\frac{1}{2}$ each time."
- "He had some left over for himself."
- "Giant bag of gumballs can be split evenly."
- "We need to figure out how many he started with."

In the next section I had them tell me what they wondered. I recorded:

- "How many gumballs he gave to his friends?"
- "How many he started with?"
- "How big was the bag?"
- "How big are the gumballs?"

Next we talked about their noticings and wonderings and I told them they would need to find out how many gumballs he started with. As a group I had them discuss what strategies they would use to solve the problem and why. After the discussion they shared out that they would use subtraction, adding, guess and check (child explained method and I told her what strategy that was), counting off, tens and ones and working backwards. After we discussed the strategies the students were then given the task of solving the problem.

Many students right away said they already knew the answer. I handed out cubes that they could use and I saw students also using the hundreds chart on their desk. One child right away told his group that the answer had to be over one hundred because of the number of times Charlie gave away half.

As I walked around the room I saw students drawing a picture model to solve the problem, using the

cubes, chart and even their fingers. This problem took us the entire math block to complete and 2 students were able to successfully get the answer. They were also able to explain that to their groups and the whole class. I was impressed with my students' ability to work backwards and to do fractional parts. Even the students that were not able to come up with a solution were able to communicate a method in which to go about figuring out the problem.

My next step is to take this same problem again with a few minor tweaks and let my students play with it. I expect to find that more students would be successful the next time around.

We hope this information is useful in helping you make the most of this Primary Problems of the Week. If you have stories to tell about this or other problems, we'd love to hear from you.

<https://www.nctm.org/contact-us/>