Backwards Reasoning

February 11, 2018

1. Jane picked a number. She multiplied it by 2 and added 1. She got 15 as a result.

   (a) We can draw a picture to show the operations that Jane applied. In the last circle, write the number 15.

   (b) Now, to find Jane's number, we reverse the operations. In each circle, write the number that results from applying the operation.

   (c) What was Jane's number?

2. Tim took his age, added 1 and multiplied by 2. She got 16.

   (a) Again, we can draw a picture to show the operations that Tim applied. In the last circle, write the number 16.

   (b) Now draw the same picture with the reverse operations.

   (c) How old is Tim?

3. In both problems above, (problems 1 and 2) the starting number is the same and the operations are the same but we get different answers. We get 15 for #1 and 16 for #2. Why is this the case? How are the two problems different?

4. On Valentine's Day, Courtney wants to give candy to her whole family. She gives a third of the candy to her sister. Then she gives a third of the candy that she has left to her Mom. Then she gives a third of the rest of the candy that she has left to her Dad. After that, 3 pieces of candy are left! How many pieces of candy did Courtney buy for Valentine's Day?

5. The mother of twins, Hathaway and Hayden, left some strawberries for them on the table. She asked them to divide the berries equally. First, Hathaway took a third. Later, Hayden took a third of what was left. Finally, they had to decide how to split the rest of the strawberries. There were 6 strawberries left. 3 strawberries for each of them. How many strawberries did the mother leave for them at the beginning?

6. A flock of birds likes to fly from lake to lake all day. They stop at Lake Sadie first. When the flock leaves, a third of the flock stays behind. Then they stop at Lake Hallie. When the flock leaves Lake Hallie, a third of the birds stays behind again. They stop at two more lakes where a third of the flock leaves each time before they arrive at Lake Kallie. 3 birds arrive at Lake Kallie. How many birds did the flock start with?

7. Chynna is trying to get to her grandma's house. However, in order to get to her grandma's house she has to pay the trolls that live under the bridges a toll. Luckily, everytime she crosses a bridge her money doubles. She must pay the troll 12 coins first, before she crosses a bridge. Chynna is going to make it! She has just enough money to get from her house to her grandma's house. This means when she arrives at her grandm'as house she will have zero coins left. If her grandma's house is three bridges away, how many coins does Chynna start with. Hint: it will help you to draw a picture!

8. Barry, Larry, and Mary have a total of 60 books together. Larry has one more book than Barry, and Mary has one more book than Larry.

- How many books do they each own?

- Is this a backwards reasoning problem? If so, draw the operations and numbers in your own picture below.

9. Carrie has many apples on Sunday. On Monday, she gives half of her apples away but cuts another half of an apple. Sadly, there is a worm in the other half of her apple so she throws the other half away. She continues to give half of her apples away but cut another half of an apple and throw the other half away on Tuesday and again on Wednesday. Finally, on Thursday, she gives half of her apples away, cuts another half of an apple and throws the other half away and ends up with two whole apples (or 4 halves) at the end of the day. How many apples did she start with on Sunday.

10. Igor has an amazing number trick. He says he an take any number, apply arithmetic operations to it, and always get the number 7! He teachers his friend to do the trick. He says to:

- Double the number
    1. Add 5
    2. Add 12
    3. Subtract 3
    4. Divide by 2
    5. Subtract your original number

    Try Igor's trick on a number of your choice! Do you get 7? Can you explain what is going on? Why does Igor's trick work?

11. The mother of twins, Hathaway and Hayden, left some strawberries for them on the table. She asked them to divide the berries equally. First, Hathaway took a third. Later, Hayden took a third of what was left. Finally, they had to decide how to split the rest of the strawberries. There were 6 strawberries left. 3 strawberries for each of them. How many strawberries did the mother leave for them at the beginning?

Challenge Problems:

1. Solve the equation by putting a "+" or a "-" in between the numbers. There are many correct answers.

   (a) $5 \quad 4 \quad 3 \quad 2 \quad 1 = 3$

   (b) $5 \quad 4 \quad 3 \quad 2 \quad 1 = 5$

2. Solve the next equation only inserting a "+" in between the numbers. Remember if you leave a space blank, the two numbers around the blank space become one number! For example, if you have "1 2", and you do not put a + in between them. You will have 12.

   (a) $1 \quad 2 \quad 3 \quad 4 \quad 5 \quad 6 \quad 7 = 100$