

BEANSTICK ALGEBRA

Performance Standard 8D.E

Create and solve linear equations with variables using manipulatives accordingly:

- *Mathematical knowledge:* Use manipulatives (beansticks) to create all the possible equations correctly when given values for the variables.
- *Strategic knowledge:* Use one of a variety of appropriate methods to create and solve linear equations with “x,” “y,” and “z” variables.
- *Explanation:* Explain completely and clearly what was done and why it was done.

Procedures

1. ***In order to use algebraic concepts and procedures to represent and solve problems (8D)***, students should experience sufficient learning opportunities to develop the following:
 - Create and solve linear equations involving whole numbers using a variety of methods (e.g., guess and check, beanstick counters).Note: This assessment is based on prior use of beanstick counters to create equations with variables.
2. Provide each student with a copy of the “Beanstick Algebra” recording sheet and the rubric. Have students review and discuss the task to be completed and how the rubric will be used to evaluate it.
3. Provide each student with a bag of beanstick counters. Show the students the transparency of the counters with the question and ask “If $x=7$, $y=9$, and $z=4$, how many different ways can you make 43 using only addition?” The student should make displays of beanstick counters that when added have a sum of 43. The student should then sketch each display on his/her paper and write an equation to match the display, using x , y , and z as variables. Answers:

four sticks with 9 beans and one stick with 7 beans	$4y+x=43$
nine sticks with 4 beans and one stick with 7	$9z+x=43$
five sticks with 7 beans and two sticks with 4	$5x+2z=43$
three sticks with 9 beans and four sticks with 4 beans	$3y+4z=43$
two sticks with 7 beans, one stick with 9 beans, and one stick with 4 beans	$2x+y+5z=43$
three sticks with 7 beans, two sticks with 9 beans, and one stick with 4 beans	$3x+2y+z=43$

4. After the students have found all the combinations, have each student take another sheet of paper and write about the strategy she/he used to find the combinations. (One strategy might be listing multiples of 7, 9, and 4 and adding them together. $9 \times 4 = 36$ and $4 \times 9 = 36$ and $36 + 7 = 43$. Using the multiple of 4 and 9 produced two different equations, $9z+x$ and $4y+x$.)
5. For the second part of the assessment, ask each student to find another number that could be made using these beanstick counters and explaining the strategy used to find this number. For example: $x+y+z=20$. If we triple the sum (knowing $3x+3y+3z=60$) and add 1, could we find combinations to make 61? Yes, we can. Once again using the strategy of listing multiples and combining them works well. Please keep in mind this is not the only strategy.

Multiples:	7,14,21,28,35,42,29,56 9,18,27,36,45,54 4,8,12,16,20,24,28,32,36,40,44,48,52,56,58,60
Combinations	$52+9=13z+y$ $7+54=x+6y$ $35+18+8=5x+2y+2z$ $49+12=7x+3z$ (These are not all the combinations but a few to use as an example.)

6. Evaluate each student’s work using the rubric and the guide on the rubric to determine the performance level. (Students should find all the combinations and be able to explain how they know they have found all the combinations. They should also be able to tell how to find another number that could be made using combinations of these numbers.)

Examples of Student Work follow

Time Requirements

- One class period

Resources

- Beansticks need to be run off on different colors of cardstock (all the sticks with 7 beans on one color, the 9 beans on another color, and the 4 beans on a third color), laminated and cut out. (One need not cut them precisely but could use a paper cutter and cut them in rectangles with one stick per rectangle. This saves time.) Once the beansticks are cut out, 10 of each color should be placed in a snack-sized zip-seal bag.
- An overhead transparency of the task sheet
- Copies of the "Beanstick Algebra" task sheet
- Mathematics Rubric

If...

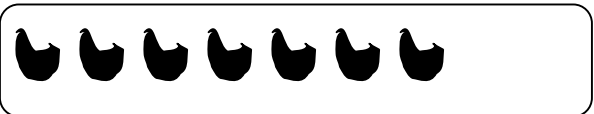
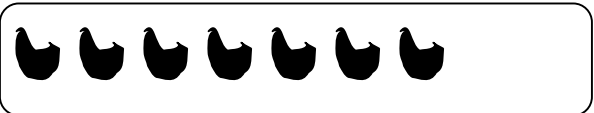
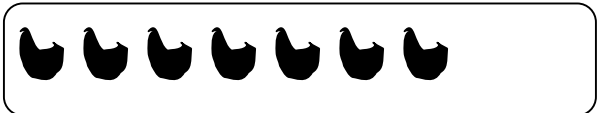
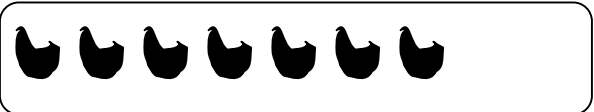
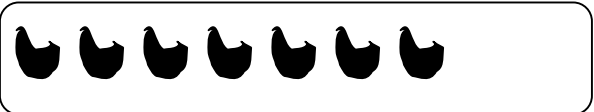
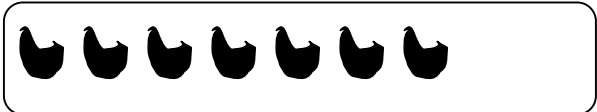
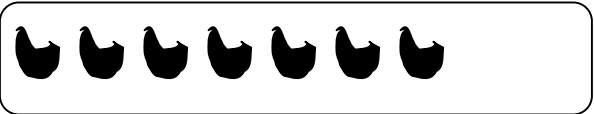
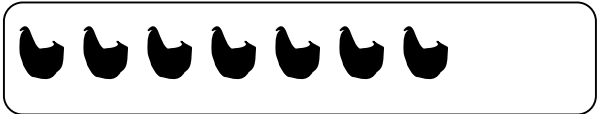
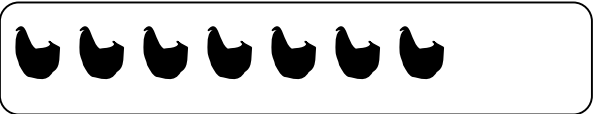
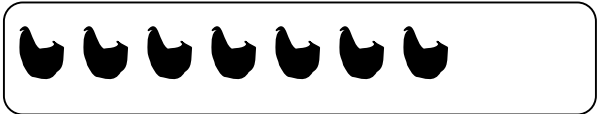
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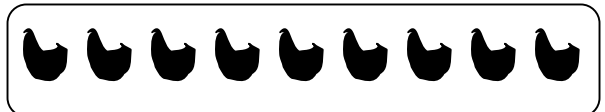
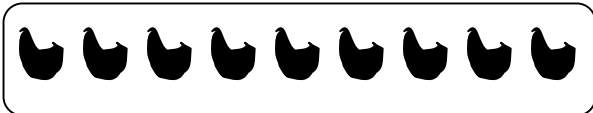
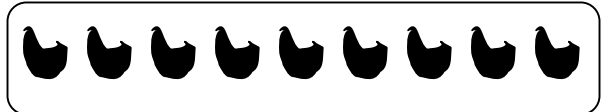
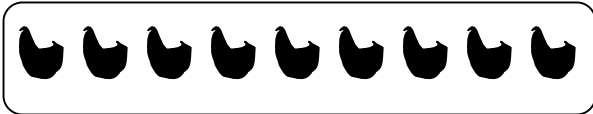
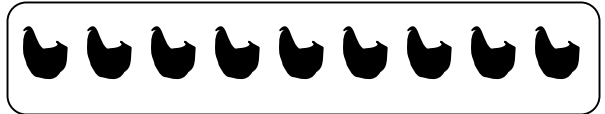
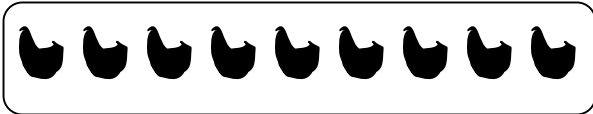
$$y = \boxed{\text{☺ ☺ ☺ ☺ ☺ ☺ ☺ ☺ ☺}} = 9$$

$$z = \boxed{\text{☺ ☺ ☺ ☺}} = 4$$

How many different ways can you make 43?







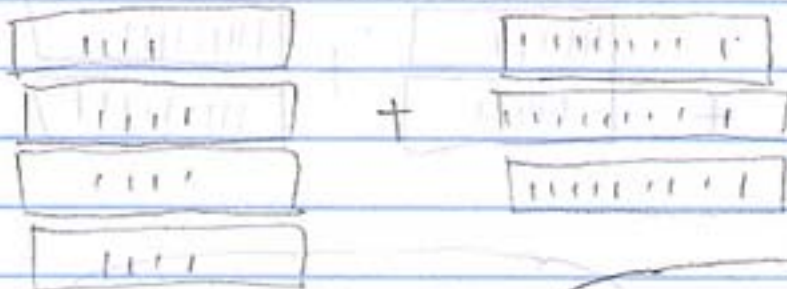
1.



(X) π = Green
 (Y) q = Pink
 (Z) H = Blue

$4y + x = 43$

2.



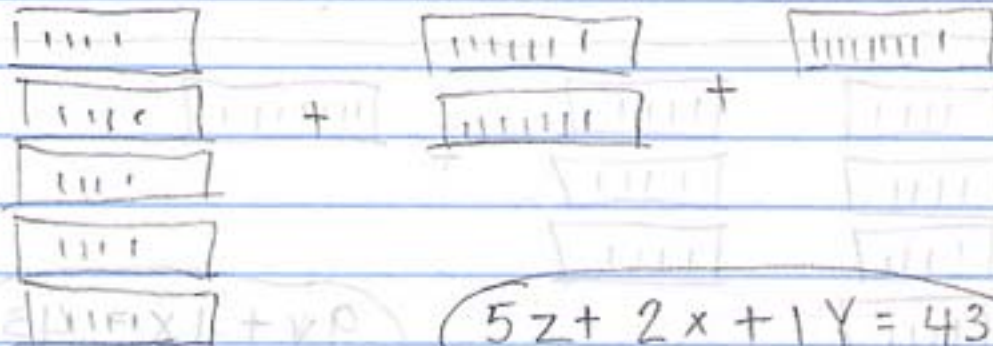
$4z + 3y = 43$

3.

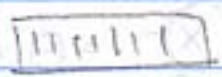
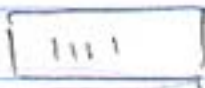

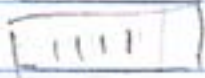
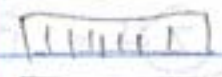
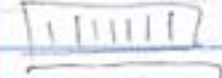
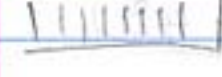


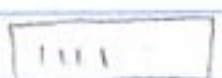



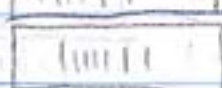
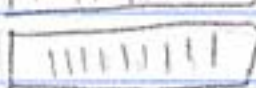
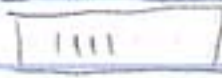
$3x + 2y + 1z = 43$

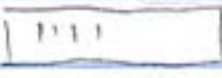

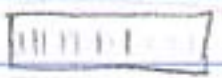
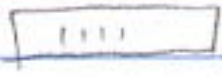
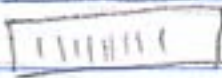
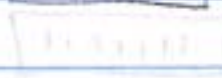
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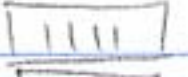


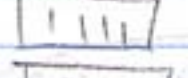
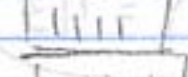

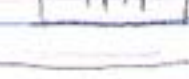


$5z + 2x + 1y = 43$

5.  + 
 + 


 $5x + 2z = 43$

6.  +  + 
 +  + 

 $3z + 2x + 2y = 43$

7.  +  + 
 +  + 
 $x + 2y + 2z = 43$

8.  + 
 +  + 



 $9y + 1x = 43$

Math
4-24-01

* I am definitely sure that I have found all the combinations, because I checked it over and over again. I also looked at my paper, and checked to see if I wrote the same one. I tried to use other ones, like more green or less green, and more pink or less pink, or more blue or less blue. I tried to do more, but I guess I done them all.

* I would find an another number besides 43 using these beamsticks, by using all these other combinations. These might be some numbers that work or something:

- 36,
- 39,
- 42,
- 45.