Primary PoW Packet
The Arm Wrestling Match

https://www.nctm.org/pows/

Welcome!

This packet contains a copy of the problem, the "answer check," sample solutions and some teaching suggestions. This is Library Problem 5039. The text of the problem is included below. A print-friendly version is available using the "Print" link from the blue-shaded box on the problem page.

Standards

In *The Arm Wrestling Match* students are asked to find out how many arm wrestling matches will take place if six boys each wrestle each other one time. If your state has adopted the Common Core State Standards, this alignment might be helpful:

Grade 1: Number & Operations in Base Ten

> Extend the counting sequence.

Grade 1: Measurement & Data

> Represent and interpret data.

Grade 2: Operations & Algebraic Thinking

> Represent and solve problems involving addition and subtraction.

Grade 2: Measurement & Data

> Represent and interpret data.

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.

The Problem

The Arm Wrestling Match

Brady, Conner, Tucker, Jeremy, Mark, and Dave are having an arm wrestling contest.

Each boy will wrestle all of the others once to see who will be the champion.

How many arm wrestling matches will take place?

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.

There will be 15 matches.

If your answer does **not** match ours, did you
- remember that each boy arm wrestled one of the others only once?
- draw a picture or make a chart?
- talk in your group?

If your answer **does** match ours, did you
- explain?
- describe your picture or your chart?
- help anyone in your group?

Method 1: Make a Table

We noticed:

> Brady, Conner, Tucker, Jeremy, Mark, and Dave are the names of the boys.
> There are six names.
> Each boy wrestles the other boy.
> Each boy wrestles five boys.

We put this information in a table:

Boy's name	The boys he'll arm wrestle
Brady	Conner, Tucker, Jeremy, Mark, Dave
Conner	Brady, Tucker, Jeremy, Mark, Dave
Tucker	Brady, Conner, Jeremy, Mark, Dave
Jeremy	Brady, Conner, Tucker, Mark, Dave
Mark	Brady, Conner, Tucker, Jeremy, Dave
Dave	Brady, Conner, Tucker, Jeremy, Mark

But then we saw something – if each boy is to only arm wrestle each boy once then Brady arm wrestling Conner is the same as Conner arm wrestling Brady. We looked through our table and crossed out the duplicates:

Boy's name	The boys he'll arm wrestle
Brady	Conner, Tucker, Jeremy, Mark, Dave
Conner	~~Brady~~, Tucker, Jeremy, Mark, Dave
Tucker	~~Brady~~, ~~Conner~~, Jeremy, Mark, Dave
Jeremy	~~Brady~~, ~~Conner~~, ~~Tucker~~, Mark, Dave
Mark	~~Brady~~, ~~Conner~~, ~~Tucker~~, ~~Jeremy~~, Dave
Dave	~~Brady~~, ~~Conner~~, ~~Tucker~~, ~~Jeremy~~, ~~Mark~~

Now we counted the names listed in the second column that were not crossed out:

> 1, 2, 3, 4, 5
> 6, 7, 8, 9
> 10, 11, 12
> 13, 14
> 15

There will be 15 matches.
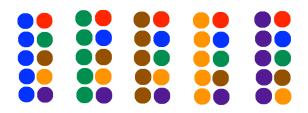
Method 2: Use Manipulatives

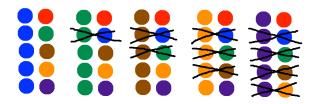We used counters to think about the contest. We picked out one color to stand for each boy:

The problem said that each boy will wrestle each of the other boys one time. If Brady is the red counter, we matched the red counter one time to each of the other counters:

Brady would have 5 arm wrestling matches. We did the same thing thinking of the blue counter as Conner, the green counter as Tucker, the brown counter as Jeremy, the orange counter as Mark and the purple counter as Dave.
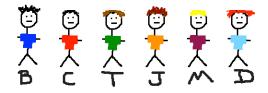
As we looked at our counters we could see that a blue and a green would be the same as a green and a blue. We needed to remove the duplicates. This is what we had left:
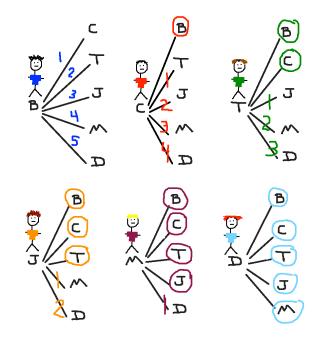
When we counted we decided there will be 15 arm wrestling matches.

Method 3: Draw a Picture

We drew a picture of the 6 boys in the story.

Then we thought about each boy arm wrestling each of his friends. But then one person in our group noticed that in the first picture we had B(Brady) arm wrestling with C(Conner) but in the second picture we had C(Conner) arm wrestling with B(Brady). We can't have them wrestle each other more than once. So as we circled the person if it was a duplicate and we only counted the new matches.

We added 5 + 4 + 3 + 2 + 1 and got 9 + 5 + 1 and then we got 15. There will be 15 matches.

This problem has not yet been discussed during any of our online courses but today (June 1, 2012) we received email, pointing out an issue with the Answer Check that we originally published for this problem. We appreciate that Mr. Rumerman and his students took time to not only point out an incorrect answer but more importantly include their explanation for their answer. After reflection, both the Answer Check online and this Teacher Packet have been revised. And the Math Forum sends a big "thank you" to Mr. Rumerman and his students. Here is correspondence

from Mr. Michael Rumerman's 3rd grade math class at Jones Lane Elementary School in Gaithersburg, Maryland

Your offical guide to multiple paths to the solution all came up with 30 arm wrestling matches.

My 3rd graders today cooperatively worked on this problem, and half of them realized that the answer is 15.

For example if each boy arm wrestles only once (based on your table) if Brady arm wrestles Conner, Tucker, Jeremy, Mark, Dave then when Conner goes, he can only arm wrestle 4, because he's already arm wrestled Brady.

With each round of arm wrestling matches (and due to the stipulation that each boy only arm wrestles the others only once), each round will have fewer and fewer matches to prevent double matches.

The answer is 15, not 30.

Once I responded to Michael and his students asking for permission to include his name and quote the comments, he responded and attached student work, saying:

Also, I am attaching a sample of one groups work to show their problem solving strategy of making a table or list to find their answer (You will see I modified the problem to only the change in names of the boys from the original problem to boys in my class).

If you try it with your students and have a short story to tell about

- how you prepared/planned to present the problem to your students
- what happened when you used it with students
- what classroom environment did you use? individual, pairs, groups, whole class?
- something you noticed about your students' approaches to the problem
- something you wondered about your students' understandings or misunderstandings

We hope this information is useful in helping you make the most of the Primary Problems of the Week in the Library. Please let me know if you have ideas for making them more useful.

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