

Four 4s

Setting up a productive class culture of multidimensional mathematics and equitable group work

#4

Introduction

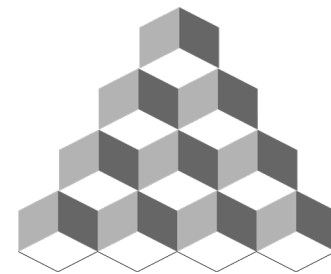
This activity has been a favorite of teachers and students. It is a nice opening activity that provides students the opportunity to appreciate different ways of achieving the same answer through the writing of equivalent expressions. During this activity students can practice orders of operation and work together to find different expressions that result in the same numerical answer. Mistakes are valued and creative ways of making an answer are celebrated. It is also a really nice activity for helping students be comfortable coming to the board - in a safe, low risk way.

Connection to CCSS

MP 3
MP 7
MP 8

Agenda

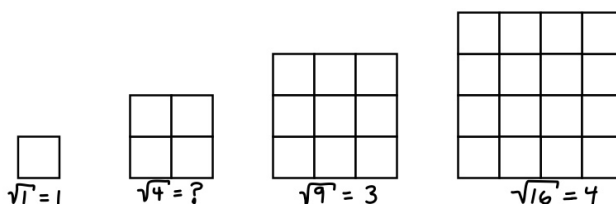
Activity	Time	Description/Prompt	Materials
Launch	5 min	Introduce students to the four 4's problem. Write the numbers on the board from 1 to 20 and have students record these in their journal. If students are familiar with four 4's you can replace it with another activity like three 2's and two 3's or 1-4-9-2. In these activities students try to use these numbers to make 1 through 20 and beyond.	<ul style="list-style-type: none"> Whiteboard Maths journal Pen/pencil
Explore	10+ min	Explore individually or with their group members to find the numbers 1-20. Invite students to come to the board and record any solutions they have. Exploration can go on over days and students can continue to share answers in an area for public display.	<ul style="list-style-type: none"> Whiteboard Maths journal Pen/pencil
Discuss	5 min	Introduce the idea of factorial to the class if/when appropriate.	<ul style="list-style-type: none"> Whiteboard/ Document Camera Different colored markers



To the Teacher

Four 4s is one of our favorite activities. We find that it encourages all students to participate in different ways and allows them to get comfortable sharing their work and helping each other. It's a great way to start the year because it is an opportunity to model what to do with mistakes when we see them, how mistakes are good to share and how there are no bad consequences for making them. It also encourages students to look for more than one way to solve a problem.

When we did this with our students and asked what operations they knew, they initially came up with four operations: adding, subtracting, multiplying, and dividing. Then we added square root but because this was not familiar to all students. We reminded students what square root was by drawing the following pattern on the board:



Another message this activity communicates is that some problems take time and it's okay if we don't complete an activity. We can work on an activity and go back to it over time. When we go back to it we can be more creative and find other expressions. Four 4's pushes students to go beyond the practice of just finding an answer and has them working to find many different ways to achieve and answer.

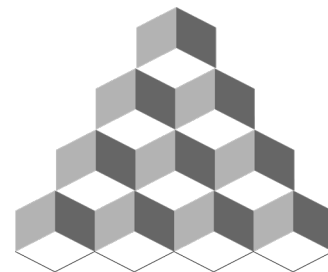
Launch

Start the activity by writing the numbers 1 to 20 on the board with plenty of space in between them. Ask students to record these numbers in their journal as well.

1.	6.	11.	16.
2.	7.	12.	17.
3.	8.	13.	18.
4.	9.	14.	19.
5.	10.	15.	20.

Tell students in this activity they are trying to find every number from 1 to 20 using only four 4's - all four of them have to be used each time - and any operations. Ask them to think of operations and make a list on the board of what they come up with.

Let students know you want them to include as many strategies as they can think of for each number and to write this in their journals and on the board. Tell them that if they come up with something for a number that already has a strategy you want them to use a different color and write their strategy on the board too. Remind them that there are many ways to approach these problems and that is one of the things you want them to experience when working on this activity.



Let them know that while the finding of individual strategies is not a very groupworthy task, and students often like to work alone in thinking about them, you have them sitting in groups so they can discuss their ideas and strategies.

Explore

While students are exploring encourage them to put their strategies on the board whenever they think of one. Remind them they can put up as many solutions as they can think of for each number.

If you notice a student puts up an expression with a mistake do not identify it as incorrect, wait, as students will often see it for themselves and correct it as more solutions are shared.

Make space for students to explore the activity at their own pace. This is a useful activity to come back to over a few days so there is no need to rush them along. When you come back to the activity have students work on the numbers that they have not yet found solutions for.

Discuss

Students will likely find all of the numbers except 11, 13 and 19. At that point, you can share with students the meaning of the factorial operation. We recommend introducing it by just writing the equivalent expressions for 1 through 4 factorial on the board. Let students read it and work to understand the patterns in what you have written. It is important to do this so students become used to reading for understanding, noticing patterns and repeated steps in reasoning. If students do need to discuss how factorial works they can do that in their groups. Students will put factorial to good use, as they will see that it allows them to find the missing numbers and new ways to make numbers they have already found.

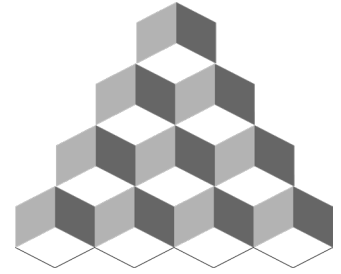
Factorial	
1!	= 1 = 1
2!	= 2 × 1 = 2
3!	= 3 × 2 × 1 = 6
4!	= 4 × 3 × 2 × 1 = 24

Extend

- Can you continue using Four 4's to find numbers greater than 20?
- Make a number challenge of your own that is similar to Four 4's
- Can you use Four 4's to make negative numbers?
- How many numbers can you make with Five 5's?

Look-Fors

- •What numbers are students finding? What solutions are students coming up with? Are they finding more than one solution? If they are finding different solutions for one number invite the students to put those different solutions up on the board. Are students using different operations? Is there an operation they aren't using? Do students understand that they can use parenthesis? Watch to see if any students use new operations that the class didn't think of. If a student is using exponents or factorials they could share those with the class. Many students get excited about this problem and will enjoy thinking of other solutions on their own. It is also a great task for students to pull out if they have finished another task. Keep it up in the classroom so that as a class you can develop your solutions over time.



- Which students are putting solutions up on the board? Look for the solutions students are finding for each number. Encourage students to put their solutions up on the board. If there are students who haven't been up to the board during the week try to pay attention to the solutions they are finding. This is a great way for students to put their work up for the first time. Notice if students are putting up solutions that don't work. Are other students noticing? If a student notices something doesn't work have them adjust the solution in a different color. You can pull together the class at some point and have conversations about these different solutions and why some do or do not work.
- How are students communicating solutions? Invite students to share their thinking and their findings with their group when they have had some time to think individually. Something one student says may inspire another student with a new idea. This may also spark some conversations about order of operations and how moving numbers and operations around can change the solution.

Reflect

Ask students to respond to the reflection question in their Maths journals. What surprised you about this activity? What did you learn from this activity?