

# The Whole Problem-Solving Process: Traversing the Chasms Between Thinking, Talking, Writing, and Typing Mathematics

	<b>Oral</b>	<b>Written</b>
Communicating to organize your thoughts and explore	<ul style="list-style-type: none"> <li>Working on problems in small groups</li> <li>Group brainstorming</li> <li>Reaching shared understanding of a situation</li> </ul>	<ul style="list-style-type: none"> <li>Writing noticings and wonderings about a problem scenario</li> <li>Highlighting or circling key words</li> <li>Carrying out calculations</li> <li>Making a table</li> <li>Testing values</li> </ul>
Communicating to ask questions	<ul style="list-style-type: none"> <li>Asking peers what they did</li> <li>Asking a teacher for help (beyond saying "I don't get it.")</li> <li>Asking a peer for help</li> <li>Asking for clarification</li> </ul>	<ul style="list-style-type: none"> <li>Writing questions in the margin</li> <li>Writing a list of wonderings</li> <li>Writing a note to a peer</li> <li>Writing a note to the teacher</li> </ul>
Communicating to tell your point of view	<ul style="list-style-type: none"> <li>Stating a position on a question</li> <li>Making oral predictions</li> <li>Telling the group about something you noticed</li> <li>Telling if you think the problem is hard or easy</li> <li>Explaining how you interpreted the problem</li> <li>Suggesting a strategy or approach to the group</li> <li>Explaining your assumption</li> </ul>	<ul style="list-style-type: none"> <li>Writing an answer to a poll or opinion question</li> <li>Writing the answer to a prediction</li> <li>Writing down something you noticed about the problem</li> <li>Writing about whether a problem seems hard or easy to you</li> <li>Writing about your interpretation of a problem</li> <li>Writing about how you plan to approach a problem</li> <li>Writing about assumptions you made</li> </ul>
Communicating to tell what happened	<ul style="list-style-type: none"> <li>Telling the teacher about your "aha!" moment</li> <li>Explaining to a peer what steps you did to get the answer</li> <li>Explaining to the class what steps you did to get the answer</li> </ul>	<ul style="list-style-type: none"> <li>Writing about your "aha!" moment</li> <li>Writing down the steps you did</li> <li>Writing a guide to show someone else the steps to take</li> </ul>
Communicating to explain	<ul style="list-style-type: none"> <li>Telling a peer how you thought about the problem</li> <li>Showing a peer how you solved the problem and telling how you knew</li> <li>Telling the class or the teacher what steps you did and how you thought to do them</li> </ul>	<ul style="list-style-type: none"> <li>Writing a personal account of how you thought to solve the problem</li> <li>Writing about how your steps connected to your understanding</li> <li>Writing a guide to help someone who is stuck think through the problem</li> </ul>
Communicating to justify	<ul style="list-style-type: none"> <li>Telling why you are confident in your answer</li> <li>Debating with another student about which answer is correct</li> <li>Giving a counterexample to someone else's argument</li> <li>Explaining why there can only be one answer to the problem (or why there are definitely multiple answers)</li> <li>Using definitions to show that your reasoning is right</li> <li>Proving that your answer must follow from the definitions/assumptions</li> </ul>	<ul style="list-style-type: none"> <li>Writing about how confident you are</li> <li>Writing an argument for why you are correct</li> <li>Writing a counterexample to disprove an argument</li> <li>Writing an explanation of why there can only be one answer to a problem (or why there are definitely multiple answers)</li> <li>Using definitions to write a justification of your answer</li> <li>Writing a two-column proof</li> <li>Writing a paragraph proof</li> <li>Writing an article for a mathematical journal</li> </ul>

**Chart from Chapter 2, "Communication and Community",  
Max Ray-Riek, *Powerful Problem Solving***

## Student Solutions to Wooden Legs

### Lauren

Answer:

There are only 3 ways she can use all 31 legs.

Explanation:

I know this because I used blocks and these are all of the solutions I got: 9 stools and 1 table, 5 stools and 4 tables, and lastly 1 stool and 7 tables.

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### Wyatt

Answer:

1. 7 tables and 1 stool 2. 9 stools and 1 table 3. 4 tables 5 stools

Explanation:

guess and check but only the numbers before 10 or it will be 40 and 30.

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### Michaela

Answer:

in the and my group found three answer: the first answer was 7 table and 1 stool the second we answered 9 stools and 1 table and third one was 4 tables and 5 stools.

Explanation:

$$7 \cdot 4 = 28 \text{ and } 1 \cdot 3 = 3 \quad 28 + 3 = 31$$

$$4 \cdot 4 = 16 \text{ and } 3 \cdot 5 = 15 \quad 16 + 15 = 31$$

$$9 \cdot 3 = 27 \text{ and } 4 \cdot 1 = 4 \quad 27 + 4 = 31$$

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### Shalina

Answer:

She can make 1 of the 3-legged stools and 7 of the 4-legged table, 5 3-legged and 4 4-legged, and 9 3-legged and 1 4-legged.

Explanation:

I first went  $1 \cdot 4 = 4$  then  $31 - 4 = 27$  which if divided by 3 becomes 9 so that would make it 1 4-legged and 9 3-legged. Then I did the same thing with 3 so i went  $1 \cdot 3 = 3$  then  $31 - 3 = 28$  which divided goes in evenly with  $4 = 7$  so 1 3-legged and 7 4-legged. Then it goes to the 2's and  $2 \cdot 3 = 6$  then  $31 - 6 = 25$  which does not go in evenly with 4 so it cant be one of the answers . Then I kept on going on untill I couldn't go on any more.

## Misha

Answer:

There are three combinations in order to use all 31 legs: 1 table and 9 stools; 4 tables and 5 stools; 7 tables and 1 stool.

Explanation:

1 table x4 legs =4 legs. 31 legs-4 legs=27 legs. 27 legs:3=9 stools.

2 tables x4 legs=8 legs. 31 legs-8 legs=23 legs. 23 can't be divided by 3.

3 tables x4 legs=12 legs. 31 legs-12 legs=19 legs. 19 can't be divided by 3.

4 table x4 legs =16 legs. 31 legs-16 legs=15 legs.15 legs:3=5 stools.

5 tables x4 legs=20 legs. 31 legs-20 legs = 11 legs. 11 can't be divided by 3.

6 tables x4 legs=24 legs. 31 legs-24 legs = 7 legs. 7 can't be divided by 3.

7 tables x4 legs =28 legs. 31 legs-28 legs=3 legs. 3 legs:3=1 stool.

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## Jake

Answer:

You can build seven table and one stool.

Explanation:

I just divide 4 into 31 and i got 7 remainder three seven times four = 28 and the remainder is for the one stool (3)

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## Conner

Answer:

One combination is 1 stool and 7 tables, another is 9 stools and 1 table, and the last one is 5 stools and 4 tables.

Explanation:

First I was trying to think of combinations in my head but then I thought of creating a list of numbers that equal 31. On the left side from top to bottom I did 0-15 and on the other side I did 31-16. Then I found that 3 was a multiple of 3 and 28 was a mutiple of 4 so that meant 1 stool and 7 tables. So that was my first combination. Then I found that 4 was a multiple of 4 and 27 was a multiple of 3 so that meant 9 stools and 1 table. My third combination was 15 legs and 16 legs which meant 5 stools and 4 tables.

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## Kelly

Answer:

Wendy can make 10 stools but she will have 1 leg left over.

Explanation:

The process I used was I first counted by 3 until I got to 30 but I had 1 left over so I wrote it down.

## Noah

Answer:

Wendy can make 1 table and 9 stools, she can make 7 tables and 1 stool and she can make 4 tables and 5 stools.

Explanation:

First, if Wendy uses 1 table that is 4 legs.  $31-4=27$  and 27 divided by 3 equals nine so 1 table and 9 stools uses all 31 legs. Second, Wendy uses 7 tables and 1 stool because 7 times 4 equals 28+3 for the 1 stool. Last, Wendy could do 4 tables and 5 stools because 4 times 4 equals 16 and 5 times 3 equals 15. 15 plus 16 equals 31.

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## Julia

Answer:

There are 3 possible ways to make furniture.

Explanation:

The first possible way to make 3-legged stools and 4-legged tables is to make 5 stools and 4 tables. My second way was 9 stools and 1 table. My last way was to 1 stool and 7 tables. I got my answers by using 3 strategies. My first strategy was to make a table. I took a ruler and made 3 columns. In the first column I wrote 3-legged stools. Then, in the second column I wrote 4-legged stools. In the last column wrote total legs. My second strategy was guess and check. This tied in with my table. I would think for a while and then write my guess down. Then, I did the math and totaled the legs. My last strategy was very unusual. I made a blank line and on the side wrote stools. I did the same with tables. Then, next to tables/stools I wrote equals blank legs (= \_\_\_ legs). I found these strategies very helpful.

$$\begin{array}{r} 5 \text{ stools} = 15 \text{ legs} \\ + 4 \text{ tables} = 16 \text{ legs} \\ \hline 9 \text{ furniture} = 31 \text{ legs} \end{array}$$

$$\begin{array}{r} 9 \text{ stools} = 27 \text{ legs} \\ + 1 \text{ table} = 4 \text{ legs} \\ \hline 10 \text{ furniture} = 31 \text{ legs} \end{array}$$

$$\begin{array}{r} 1 \text{ stool} = 3 \text{ legs} \\ + 7 \text{ tables} = 28 \text{ legs} \\ \hline 8 \text{ furniture} = 31 \text{ legs} \end{array}$$

$$\begin{array}{r} 3 \text{ stools} = 9 \text{ legs} \\ + 7 \text{ tables} = 28 \text{ legs} \\ \hline \text{furniture} \quad \text{legs} \end{array}$$