



# Math Fundamentals PoW

The Math Forum's Problems of the Week provide non-routine constructed response problems. The Math Fundamentals problems target concepts typically learned in grades 3-5. Memberships and mentoring options are available at the individual, class, school, and district levels.

## Marble Mayhem - posted March 17, 2008

Fred, Ginger, Julio and Dawn decided to play marbles. Fred emptied his bag of marbles and divided them equally among the four players. Everyone got at least one marble. There was one marble left over.

At that moment Jake arrived and asked to play. They gathered up all Fred's marbles and divided them equally among the five kids. There was still one marble left over.

Just then Maria joined them, so they gathered all the marbles again and divided them equally six ways. There was still one marble left over.

What is the fewest number of marbles that Fred could have had in his bag?



**Extra:** What is the fewest number of marbles Fred could have had in his bag if Dawn had not been there at all? How did your answer compare with your original answer? Why do you think that is so?

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Learn more about the PoWs in Booth 2425 or at [http://mathforum.org/problems\\_puzzles\\_landing.html](http://mathforum.org/problems_puzzles_landing.html)

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The Math Fundamentals Problem of the Week Scoring Rubric — **Marble Mayhem** (posted 17 March 2008)  
 For each category, choose the level that *best describes* the student's work.

	Novice	Apprentice	Practitioner	Expert
<b>Problem Solving</b>				
<b>Interpretation</b>	Does not show much understanding of the problem.	Shows some understanding of the math in the problem. Completes part of the problem.	Understands the division concept of equal sharing. Understands the multiple concept (repeated addition of same number). Understands one marble left over. Understands "fewest" requirement. Answers the main question.	Solves the main problem correctly. Understands and solves the Extra. Achieves at least Practitioner in Strategy.
<b>Strategy</b> (NB: based on their interpretation of the problem)	Does not know how to set up the problem. OR Shows no evidence of strategy. OR Strategy didn't work.	Tries a strategy that makes sense, but isn't enough to solve the whole problem, OR doesn't apply it systematically. OR Verifies a correct answer, but fails to explain how they found it.	Picks a sound strategy. Approaches the problem systematically, achieving success through skill and understanding, not luck. Chosen strategy accounts for any answer(s) that changed after checking our answers.	Does <b>one or more</b> of these: Uses two different strategies. Uses a good Extra strategy. Uses an unusual or sophisticated strategy, e.g., effective and appropriate use of technology or algebra.
<b>Accuracy</b> (NB: based on chosen strategy)	Has made many errors. OR Shows no math.	Some work is accurate. May have one or two errors. OR Shows very little arithmetic.	Work on main problem is accurate and contains no arithmetic or record keeping mistakes.	Not available for this problem.
<b>Communication</b>				
<b>Completeness</b> (NB: an incorrect solution can be complete)	Writes very little to explain how the answer was achieved.	Describes the steps but does not include calculations or numbers. OR Shows calculations without rationale or explanation.	Explains most of the steps taken to solve the problem and the rationale for them, with enough detail for another student to understand. Includes key calculations with rationale. Explains/show why the answer must be the "fewest" possible. Explanation accounts for any answer(s) that changed after checking our answers.	Explains strategy for Extra. Does <b>one or more</b> of these: Includes useful extensions and further explanation of concepts or patterns. Provides exceptional insight into the problem.
<b>Clarity</b> (NB: incomplete and incorrect solutions can be explained clearly)	Explanation is very difficult to read and follow.	Explanation isn't totally unclear, but another student wouldn't be able to follow it easily. Spelling errors/typos make it hard to understand.	Attempts to make explanation readable by a peer. Uses level-appropriate math language and notation, including units: marbles, children. Shows effort to use good organization, formatting, spelling, grammar, typing. Errors don't interfere with readability.	Formatting makes ideas exceptionally clear. Answer is very readable and appealing, might include a helpful table. (A table alone doesn't qualify for Expert status.)
<b>Reflection</b> (See list below.)	Does nothing reflective.	Includes one reflective thing.	Includes two reflective things.	Includes 3 or more reflective things or does an exceptional job with 2 of them.
	<b>The items to the right are considered reflective, and could be in the solution OR in the comment they leave after viewing our answer:</b>	<ul style="list-style-type: none"> <li>Revises and improves the submission.</li> <li>Checks the answer using a different method.</li> <li>Explains a hint she/he would give someone.</li> </ul>	<ul style="list-style-type: none"> <li>Reflects on the reasonableness of the answer.</li> <li>Connects the problem to prior knowledge/experience.</li> <li>Describes any errors made and how she/he found and corrected them.</li> </ul>	<ul style="list-style-type: none"> <li>Comments on AND explains the ease or difficulty of the problem.</li> <li>Explains where she/he is stuck.</li> <li>Summarizes the process used.</li> </ul>