



PROBLEMS TO PONDER

The Problems to Ponder Department provides 28 varying, classroom-ready mathematics problems that collectively span the PK-12 grade bands of PK-2, 3-5, 6-8, and 9-12, arranged in the order of grade level. Generally, there are two problems per grade level, or about seven problems per grade band. The problems promote students' engagement in rigorous mathematics. The problems incorporate some of the eight mathematical practices* (<https://www.thecorestandards.org/Math/>) and ask our readers to notice and wonder about the mathematical concepts, strategies and interpretations that they encounter. Answers to all Problems and For Further Thought extensions are available online.

Below are guidelines for authors of questions for the Problems to Ponder department.

- Each problem submission should be an original problem, created by the author. The problem may include an extension, which expands the understanding of the related concept, labeled as "For Further Thought."
- Provide answers and worked solutions for the submitted problems.
- Tag each problem to align with grade-band, grade-level, and content area. For example, a tag for a kindergarten problem might be "Tag: Pk-2; Grade K; Geometry."
- Each problem should evidence equitable pedagogy, allowing access to mathematical learning for students in the denoted grade band.
- Each image that might be included with the submitted problem should be either author-created (please cite the program used to create the image) or an Adobe stock photo (free).**
- Individuals are encouraged to submit a problem or a collection of problems directly to mtlt@nctm.org. If published, the authors of problems will be acknowledged. Associate Editors and Department Editors will assist in reviews and revisions of the submission.

Problem Submission Example:

Question: Sarah has a bag of candy with 20 pieces. She noticed that $\frac{1}{5}$ of the candies in the bag are green. How many candies are not green? If Sarah wants to give the non-green candies equally to her two friends, how many non-green candies will each friend get?

For Further Thought: Sarah's little brother, Iain, eats one of the green candies. How does this affect the fraction of green candies in the bag?



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Tag: 3-5; Grade 3; Numbers and Operations

Answer: There are 16 non-green candies in the bag. Each of Sarah's friends will receive eight of the non-green candies.

FFT: There were four green candies in the bag of 20 candies. Now there are three green candies in the bag of 19 candies; the new fraction is $\frac{3}{19}$. The new fraction is smaller than $\frac{1}{5}$.

SOLUTION (not for publication; included for ease in reviewing):

Question:

Since $\frac{1}{5}$ of the candies are green, the fraction of not-green candies is $1 - \frac{1}{5} = \frac{4}{5}$.

So, the number of non-green candies is $\frac{4}{5} \times 20 = 16$.

If these candies would be divided equally to two friends, each will get 8 ($16 \div 2 = 8$).

FFT:

At first, we need to know the number of green candies: $20 - 16 = 4$ or $1/5 \times 20 = 4$.

Then, if Iain eats one green candy, it will affect both the number of green candies and of the total candies in the bag:

Green candies: $4 - 1 = 3$

Total candies: $20 - 1 = 19$

So, the fraction of green candies in the bag is $3 \div 19 = 3/19$.

One way to compare $3/19$ and $1/5$ is to rewrite the fractions with common denominators and compare their numerators: $(3 \cdot 5)/(19 \cdot 5) = 15/(19 \cdot 5)$ and $(1 \cdot 19)/(5 \cdot 19) = 19/(5 \cdot 19)$. Because 15 is smaller than 19, $3/19$ is smaller than $1/5$.

*The Eight Mathematical Practices are (<https://www.thecorestandards.org/Math/>):

MP1: Make sense of problems and persevere in solving them.

MP2: Reason abstractly and quantitatively.

MP3: Construct viable arguments and critique the reasoning of others.

MP4: Model with mathematics.

MP5: Use appropriate tools strategically.

MP6: Attend to precision.

MP7: Look for and make use of structure.

MP8: Look for and express regularity in repeated reasoning.

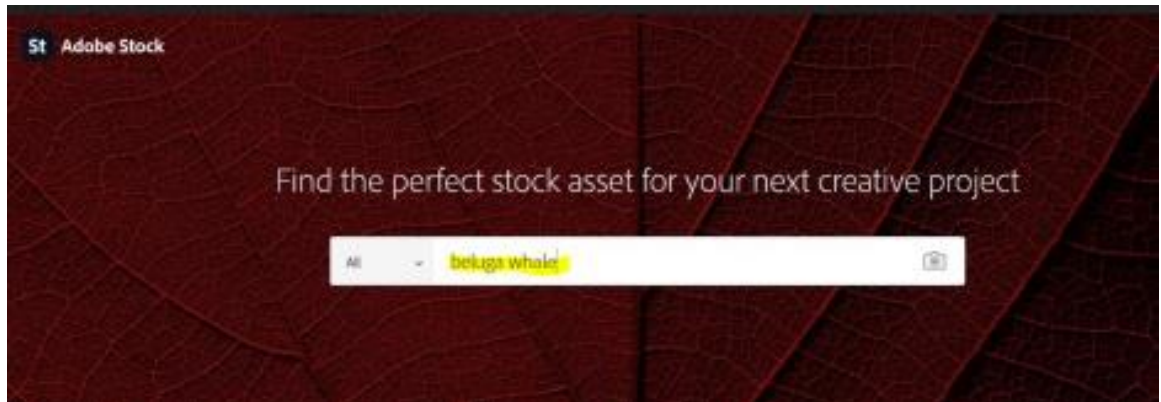
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HOW TO FIND IMAGES FOR PROBLEMS TO PONDER AND GPS DEPARTMENTS

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1. **Access the site to find images** (<https://stock.adobe.com/free>). Use the “Search” function to find what you need. You won't be able to log into the site without a subscription, but you can still search for images.



2. When you find an image you like, click on it to open it. At the bottom left, you will see the Adobe Stock #, as shown here (also found in the image description); please include the stock number in the manuscript text file:



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