Problem 1. All 4 digit numbers with no repeated digits are listed in increasing order, so that 1234 is first and 9876 is last. How many numbers appear before 2014 in this list? The numbers are in base 10 and have no leading zeros.
Problem 2. How many ways can you put the numbers 1, 2, 3, 4, 5 in the five boxes shown so that the numbers in the top row increase from left to right, and the numbers in the left column increase from top to bottom?
Problem 3. Find the smallest positive solution to \( \sin(x) = \sin(x + \frac{\pi}{6}) \).
**Problem 4.** On the written test you’ll take later today, you’ll have 25 questions. You’ll get 10 points for each problem answered correctly, 2 points for each question left unanswered, and 0 points for each question answered incorrectly. How many different scores are possible?
Problem 5. Begin with a cone whose radius equals its height. Cut it open and roll it flat to form a pacman shape. What is the measure of the angle $\theta$ in radians?
Problem 6. The digital root of a positive integer is obtained by summing its decimal digits, then the decimal digits of the result, and repeating the process until one is left with a single digit number. What is the digital root of $2^{2014}$?
Problem 7. Amber wants to decorate a necklace with 3 colored beads: She has 3 red beads, 3 black beads, and 3 silver beads. How many different ways can she decorate the necklace?
**Problem 8.** Erect a pole of length 1 perpendicular to the surface of a sphere of radius 1, then shine a light so that the shadow of the pole on the sphere is as long as possible. How long is the shadow?
Problem 9. Seven years ago, my cat was 4 times as old as my dog. Six years ago, my cat was 3 times as old as my dog. How long ago was my cat twice as old as my dog?
Problem 10. Start with a triangle $\triangle ABC$. Extend $AB$ (in the $B$ direction) until its length doubles. Do the same with $BC$ (in the $C$ direction) and $CA$ (in the $A$ direction). Connect the new endpoints of the extended sides to form a new triangle $\triangle DEF$. If the area of $\triangle ABC$ is 1, what is the area of $\triangle DEF$?