Sample Problems from 2012-13 National and International Mathematics Contests

2012 American Mathematics Contest 8 (grade 8 and below)

#15 The smallest number greater than 2 that leaves a remainder of 2 when divided by 3, 4, 5, or 6 lies between what numbers?

(A) 40 and 50 (B) 51 and 55 (C) 56 and 60 (D) 61 and 65 (E) 66 and 69

#23 An equilateral triangle and a regular hexagon have equal perimeters. If the area of the triangle is 4, what is the area of the hexagon?

(A) 4 (B) 5 (C) 6 (D) $4\sqrt{3}$) (E) $6\sqrt{3}$

2013 MATHCOUNTS Chapter Target Round (grades 6-8)

#6 Alex added the page numbers of a book together and got a total of 888. Unfortunately, he didn't notice that one of the sheets of the book was missing with an odd page number on the front and an even page number on the back. What was the page number on the final page of the book?

#7 A circular spinner has seven sections of equal size, each of which is colored either red or blue. Two colorings are considered the same if one can be rotated to yield the other. In how many ways can the spinner be colored?

2013 American Mathematics Contests 10A & 10B (grade 10 and below)

#14 (10A) A solid cube of side length 1 is removed from each corner of a solid cube of side length 3. How many edges does the remaining solid have?

(A) 36 (B) 60 (C) 72 (D) 84 (E) 108

#25 (10A) All 20 diagonals are drawn in a regular octagon. At how many distinct points in the interior of the octagon (not on the boundary) do two or more diagonals intersect?

(A) 49 (B) 65 (C) 70 (D) 96 (E) 128

2013 American Mathematics Contests 12A and 12B (grade 12 and below)

#15 (12A) Rabbits Peter and Pauline have three offspring--Flopsie, Mopsie, and Cottontail. These five rabbits are to be distributed to four different pet stores so that no store gets both a parent and a child. It is not required that every store gets a rabbit. In how many different ways can this be done?

(A) 96 (B) 108 (C) 156 (D) 204 (E) 372

#22 (12A) A palindrome is a nonnegative integer number that reads the same forwards and backwards when written in base 10 with no leading zeros. A 6-digit palindrome N is chosen uniformly at random. What is the probability that N/11 is also a palindrome?

(A) 8/25 (B) 33/100 (C) 7/20 (D) /256 (E) 11/30

ANSWERS TO THESE EIGHT PROBLEMS ARE ON THE REVERSE SIDE.

2013 American Invitational Mathematics Exam (AMC 10 and 12 Honor Roll)

#7 A rectangular box has width 12 inches, length 16 inches, and height m/n inches, where m and n are relatively prime positive integers. Three faces of the box meet at a corner of the box. The center points of those three faces are the vertices of a triangle with an area of 30 square inches. Find $m+n$.

#12 Let "triangle symbol" PQR be a triangle with <P =75° and <Q = 60°. A regular hexagon ABCDEF with side length 1 is drawn inside "triangle symbol" PQR so that side AB lies on PQ, side CD lies on QR, and one of the remaining vertices lies on RP. There are positive integers a, b, c, and d such that the area of "triangle symbol" PQR can be expressed in the form $(a + b\sqrt{c})/d$, where a and d are relatively prime, and c is not divisible by the square of any prime. Find a + b + c + d.

2012 American Regions Mathematics League (ARML)

<u>Individual Round</u>

#1 Compute the largest prime divisor of 15! - 13!.

<u>Team Round</u>

#5 The graphs of $y = x^2 - |x| - 12$ and $y = |x| - k$ intersect at distinct points A, B, C, and D in order of increasing x-coordinates. If AB = BC = CD, compute k.

2012 William Lowell Putnam Examination (undergraduate students)

Problem B3 (There are 12 problems in all; A1-A6 in the morning, B1-B6 in the afternoon):

In a round-robin tournament each of 2n teams plays every other team over 2n-1 days. Can one necessarily choose one winning team from each day without choosing any team more than once?

2013 Mathematical Contest in Modeling (3-person teams of undergraduate students)

PROBLEM A Title: The Ultimate Brownie Pan

PROBLEM B: Title: Water, Water, Everywhere

The details of these problems and a press release with contest statistics and results can be found by clicking on the blue links that say "Download the complete results..." that you'll find on this page:

http://www.comap.com/undergraduate/contests/mcm/contests/2013/results/

Only 11 out of 5,636 teams worldwide received the top rating of Outstanding--including two teams from the University of Colorado Boulder one from Colorado College!

# # # # # # # # # # # # # #

ANSWERS TO PROBLEMS ON OTHER SIDE:
AMC8 #15 (D), #23 (C)); MATHCOUNTS #6 (42), #7 (20 ways); AMC10 #14 (D), #25 (A); AMC12 #15 (D), #22 (E)

ANSWERS TO AIME AND ARML PROBLEMS ON THIS SIDE:
AIME: #7 (041), #12 (021); ARML: #1 (19), #5 ($10 + 2\sqrt{2}$); Putnam: yes