22nd Philippine Mathematical Olympiad

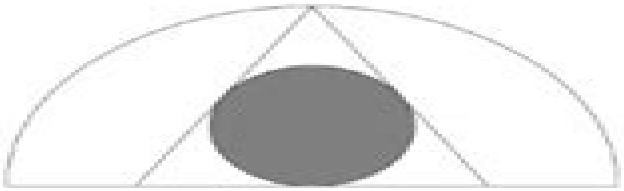
Area Stage, 16 November 2019

PART I. Give the answer in the simplest form that is reasonable. No solution is needed. Figures are not drawn to scale. Each correct answer is worth three points.

1. If the sum of the first 22 terms of an arithmetic progression is 1045 and the sum of the next 22 terms is 2013, find the first term.

2. How many positive divisors do 50,400 and 567,000 have in common?

3. In the figure below, an equilateral triangle of height 1 is inscribed in a semicircle of radius 1. A circle is then inscribed in the triangle. Find the fraction of the semicircle that is shaded.



4. Determine the number of ordered quadruples (a, b, c, d) of odd positive integers that satisfy the equation $a + b + c + d = 30$.

5. Suppose a real number $x > 1$ satisfies

$$\log_{\sqrt{3}}(\log_3 x) + \log_3(\log_{27} x) + \log_{27}(\log_{\sqrt{3}} x) = 1.$$

Compute $\log_3(\log_3 x)$.

6. Let $f(x) = x^2 + 3$. How many positive integers x are there such that x divides $f(f(f(x)))$?

7. In $\triangle XYZ$, let A be a point on (segment) YZ such that XA is perpendicular to YZ. Let M and N be the incenters of triangles XYA and XZA, respectively. If $YZ = 28$, $XA = 24$, and $YA = 10$, what is the length of MN?

8. Find the largest three-digit integer for which the product of its digits is 3 times the sum of its digits.

9. A wooden rectangular brick with dimensions 3 units by a units by b units is painted blue on all six faces and then cut into $3ab$ unit cubes. Exactly 1/8 of these unit cubes have all their faces unpainted. Given that a and b are positive integers, what is the volume of the brick?

10. In square $ABCD$ with side length 1, E is the midpoint of AB and F is the midpoint of BC. The line segment EC intersects AF and DF at G and H, respectively. Find the area of quadrilateral $AGHD$.

Elementary Math Olympiad 2 Triangle Problem

J Rink

Elementary Math Olympiad 2 Triangle Problem:

MATHEMATICAL OLYMPIAD IN CHINA PEIJIE LIU,2018-01-16 This book introduces the development of the International Mathematical Olympiad in China from 1986 to 2013 especially the questions and answers of all the previous International Mathematical Olympiad since 1986 This book is suitable for the students who want to participate in high school International Maths Olympic tutors and fans of general mathematics This reprint has been authorized by Harbin Institute of Technology Press in North America *The Colorado Mathematical Olympiad and Further Explorations* Alexander Soifer,2011-04-13 This updated printing of the first edition of Colorado Mathematical Olympiad the First Twenty Years and Further Explorations gives the interesting history of the competition as well as an outline of all the problems and solutions that have been created for the contest over the years Many of the essay problems were inspired by Russian mathematical folklore and written to suit the young audience for example the 1989 Sugar problem was written in a pleasant Lewis Carroll like story Some other entertaining problems involve olde Victorian map colourings King Authur and the knights of the round table rooks in space Santa Claus and his elves painting planes football for 23 and even the Colorado Springs subway system

Mathematical Olympiad Challenges Titu Andreescu,Razvan Gelca,2013-12-01 Mathematical Olympiad Challenges is a rich collection of problems put together by two experienced and well known professors and coaches of the U S International Mathematical Olympiad Team Hundreds of beautiful challenging and instructive problems from algebra geometry trigonometry combinatorics and number theory were selected from numerous mathematical competitions and journals An important feature of the work is the comprehensive background material provided with each grouping of problems The problems are clustered by topic into self contained sections with solutions provided separately All sections start with an essay discussing basic facts and one or two representative examples A list of carefully chosen problems follows and the reader is invited to take them on Additionally historical insights and asides are presented to stimulate further inquiry The emphasis throughout is on encouraging readers to move away from routine exercises and memorized algorithms toward creative solutions to open ended problems Aimed at motivated high school and beginning college students and instructors this work can be used as a text for advanced problem solving courses for self study or as a resource for teachers and students training for mathematical competitions and for teacher professional development seminars and workshops **Complex Numbers from A to ... Z** Titu Andreescu,Dorin Andrica,2014-02-17 Learn how complex numbers may be used to solve algebraic equations as well as their geometric interpretation Theoretical aspects are augmented with rich exercises and problems at various levels of difficulty A special feature is a selection of outstanding Olympiad problems solved by employing the methods presented May serve as an engaging supplemental text for an introductory undergrad course on complex numbers or number theory **International Mathematical Olympiad: 1991-2004** István Reiman,2005 The famed International Mathematical Olympiad has been challenging students worldwide for over 40 years Since the first competition

in Romania in 1959 with only seven countries participating it has expanded to attract competitors from over 80 countries representing all five continents This third volume features every question from 1991 2004 along with comprehensive solutions and multiple answers where applicable A fantastic selection of mathematical puzzles this fully updated three volume series will be of interest to serious mathematicians and enthusiasts alike Istvan Reiman s compilation of logic puzzles and questions will tease the intellect of all those with a mathematical mind Istvan Reiman was formerly Leader of the Chair of Geometry at the Budapest University of Technology He has been guiding the Youth Mathematical Circle of the J Bolyai Mathematical Society and directing the preparation of Hungarian students for the annual International Maths Olympiad for 40 years **Mathematical Education** ,1987 *Mathematical Gems from Elementary Combinatorics, Number Theory, and Geometry* Ross Honsberger,1973 *The Arithmetic Teacher* ,1990 **Colorado Mathematical Olympiad** Alexander Soifer,1994 Math Horizons ,1997 **Crux Mathematicorum with Mathematical Mayhem** ,2006 Problem solving journal at the senior secondary and university undergraduate levels for those who practice or teach mathematics Primarily educational in purpose it also serves those who read it for professional cultural and recreational reasons *Mathematics Magazine* ,1990 **Subject Guide to Books in Print** ,1996 **Mathematical Reviews** ,1997 Teaching in the Standards-based Classroom ,2001 Virtually every national standards document every state framework and every local set of standards calls for fundamental changes in what and how teachers teach The challenge for teachers is to implement the vision for mathematics and science classrooms called for in the standards This issue describes that vision and suggests ways to use the standards mandated in your school to improve your practice to help you teach in your standards based classroom **Analele Universității Din Craiova** ,2006 The Mathematical Gazette ,1991 Congressus Numerantium ,1998 Crux Mathematicorum ,1985 **ENC Focus** ,2000

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