

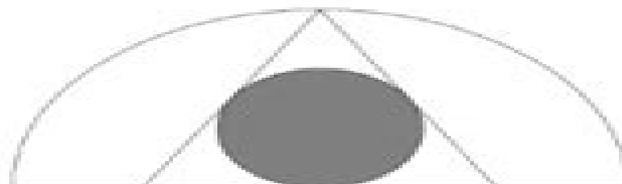


# 22nd Philippine Mathematical Olympiad

*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

$$\log_{\frac{27}{25}}(\log_3 x) + \log_3(\log_{27} x) + \log_{27}(\log_{\frac{25}{27}} x) = 1.$$

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

**Thomas Griffiths**



**Elementary Math Olympiad 2 Triangle Problem:**

## **Elementary Math Olympiad 2 Triangle Problem** Book Review: Unveiling the Power of Words

In a global driven by information and connectivity, the power of words has are more evident than ever. They have the capability to inspire, provoke, and ignite change. Such could be the essence of the book **Elementary Math Olympiad 2 Triangle Problem**, a literary masterpiece that delves deep to the significance of words and their effect on our lives. Compiled by a renowned author, this captivating work takes readers on a transformative journey, unraveling the secrets and potential behind every word. In this review, we shall explore the book is key themes, examine its writing style, and analyze its overall effect on readers.

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