

2016 Math League Summer Tournament

Math League Press, P.O. Box 17, Tenafly, New Jersey 07670-0017

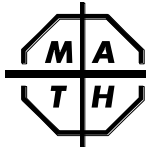
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July, 2016

Relay Questions for Grades 8 & 9 **Calculators are PROHIBITED**

Relay Round #1

- 1-1. If $x^2 - 2x = 25$, what is the value of $x^4 - 4x^3 + 4x^2 + 43$?
- 1-2. Let $n = \text{TNYWR}$. How many different ordered pairs of positive integers (a,b) satisfy $a^2 - b^2 = n$?
- 1-3. Let $n = \text{TNYWR}$. In the plane, (x,y) is called a *lattice point* if both of its coordinates are integers. How many lattice points lie in the interior of the region bounded by the coordinate axes and the line $y = (-7/4)x + n + 6$?
- 1-4. Let $n = \text{TNYWR}$. If x and y are real numbers, what is the least possible value of the sum $|x^8 - (n + 23)x^4 + 259| + \sqrt{y^2 + 6y + n + 4}$?
- 1-5. Let $n = \text{TNYWR}$. In trapezoid $ABCD$, where \overline{AB} is parallel to \overline{CD} , the diagonals are perpendicular and intersect at E . If $AE = 6$, $BE = 8$, and $CE = 3n$, what is the altitude of trapezoid $ABCD$?



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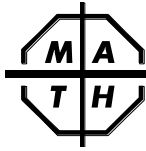
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Relay Round #2

- 2-1. What is the only integer N between 100 and 200 whose hundreds digit is A , whose tens digit is B , and whose units digit is C that has the property that $A! + B! + C! = N$? [Note: $1! = 1$ and, for every positive integer $n > 1$, $n! = n \cdot (n - 1)!]$
- 2-2. Let $n = \text{TNYWR}$. Of the N positive integers $\leq n^2$, how many can be written as the product of exactly two consecutive integers?
- 2-3. Let $n = \text{TNYWR}$. From a square piece of tin whose area is n , I remove 4 square corners, each of area 4. I fold up the sides of the piece of tin that remains and I form an open top square box. What is the volume of this box?
- 2-4. Let $n = \text{TNYWR}$. What is the length of the hypotenuse of an isosceles right triangle whose perimeter is $8 + \sqrt{n}$?
- 2-5. Let $n = \text{TNYWR}$. If a and b are positive integers, what is the greatest value of a that satisfies

$$\frac{1}{a} + \frac{1}{b} = \frac{2}{n}?$$



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Relay Round #3

- 3-1. What is the area of the triangle whose side-lengths are 2, 6, and $4\sqrt{2}$?
- 3-2. Let $n = \text{TNYWR}$. What is the sum of the length and width of a rectangle of area 16 whose diagonal has length n ?
- 3-3. Let $n = \text{TNYWR}$. The school math team consists of 4 students to be chosen from the n students who want to be on the team. How many different ways can the team be chosen if student Jerry must be on the team?
- 3-4. Let $n = \text{TNYWR}$. Two trains travel on parallel tracks and approach each other from opposite directions. Train A 's rate is $(n - 5)$ km/hour, and train B 's rate is $(2n - 10)$ km/hour. A passenger seated on train A sees the front of train B pass him at 1:00 PM. If the rear of train B passes him 1 minute later, how long is train B , in km?
- 3-5. Let $n = \text{TNYWR}$. How many positive integers $\leq 50n$ have **no** divisor that is the square of an integer greater than 1?