DUSO Mathematics League 2015 - 2016

Contest #1.   **Calculators are not permitted on this contest.**

Part I.   **ALGEBRA I**   *Time Limit: 10 minutes*

The word "compute" calls for an exact answer in simplest form.

1 - 1. Compute the greatest value of x that solves $5 + 4x \geq 7x - 9$.

1 - 2. The sum of three unit fractions, $\frac{1}{p} + \frac{1}{q} + \frac{1}{r}$, is equal to $\frac{451}{903}$. The sum $p + q + r$ is as small as possible. If p, q, and r are positive integers, compute $p + q + r$.

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Part II.   **GEOMETRY**   *Time Limit: 10 minutes*

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1 - 3. Given parallelogram $GRAM$ with $m\angle A = 112°$. Point T lies on $\overrightarrow{MG}$ such that G is between M and T and $GR = GT$. Segment $\overline{TR}$ is drawn. Compute $m\angle TRA$.

1 - 4. In regular octagon $MATRICES$, $MA = 2$. Compute the area of square $ARCS$.

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Part III.   **ALGEBRA II / ADVANCED TOPICS**   *Time Limit: 10 minutes*

The word "compute" calls for an exact answer in simplest form.

1 - 5. The solutions to $x^3 - 2x^2 - 9x + 18 = 0$ are a, b, and c. Compute $a^2 + b^2 + c^2$.

1 - 6. Let p and q be real numbers with $p < q$. Suppose that $p^2 - 9p = 4$ and $q^2 - 9q = 4$. Compute $\frac{1}{q} - \frac{1}{p}$.

R-1. If Sally subtracts 2 from her locker number, and then multiplies the result by 3, and then adds 5, the result is 2015. What is Sally's locker number?

R-2. *Let N be the number you will receive.* The line $2x + 3y = N$ has an x-intercept of A and a y-intercept of B. Compute $A + B$.

R-3. *Let N be the number you will receive.* In a rectangle, the sum of two lengths and a width is 820. The sum of two widths and a length is N. Compute the perimeter of the rectangle.

R-4. *Let N be the number you will receive.* In a video game, getting 1 red turtle, 2 green turtles, and 3 blue turtles earns 1050 points. In the same game, getting 3 red turtles, 4 green turtles, and 1 blue turtle earns 910 points. In the same game, earning 5 red turtles, 3 green turtles, and 5 blue turtles earns N points. If Jimmy gets 1 red turtle, 1 green turtle, and 1 blue turtle, how many points does he earn?

R-5. *Let N be the number you will receive.* The line $-16x + 40y = N$ passes through many points in the second quadrant, but only some of those have integer coordinates. Compute the number of points in the second quadrant that have integer coordinates and are also on the line $-16x + 40y = N$.