DUSO Mathematics League 2012 - 2013

Contest #3. **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.

3 - 1. Compute the value of $\dfrac{(6000)(0.0004)}{(400000)(0.02)}$ and express your answer in scientific notation.

3 - 2. If 3 people can pack 4 large boxes in 5 hours, how many people are necessary to pack 6 large boxes in 9 minutes? Assume all boxes are the same and all people work at the same pace.

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

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

3 - 3. Consider parallelogram $ABCD$ of area 78. Let point E be a point in the interior of $ABCD$, 1 unit away from the midpoint of $\overline{BC}$. Compute the sum of the areas of $\triangle AED$ and $\triangle BEC$.

3 - 4. In $\triangle TRI$, $TR = 6$, $RI = 4$, and $TI = 5$. Segment RX is drawn with X on $\overline{TI}$ such that $TX = 3$ and $XI = 2$. Compute RX.

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

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

3 - 5. The middle term in the expansion of $(m + n)^{10}$ is Am^5n^5. Compute A.

3 - 6. An arithmetic series begins $1 + ...$ The sum of the first twelve terms is three times the sum of the first eight terms. Compute the third term of the series.

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R-1. In base N, 36_N has the same value as 113_5. Compute N.

R-2. *Let N be the number you will receive.* Jimmy's Gymnastics Class has some boys and some girls. At the start of the class, the number of boys is less than the number of girls. Then, N more boys come to the class, and the 24 total students are evenly split between boys and girls. Compute the ratio of boys to girls at the beginning of the class in simplest form.

R-3. *Let N be the number you will receive.* The acute angles of a right triangle are in the ratio N. If the smaller angle is increased by 50%, the larger acute angle will have to decrease by $X\%$ to keep the triangle a right triangle. Compute X.

R-4. *Let N be the number you will receive.* In an infinite geometric series, the first term is 7000. Each term after the first term is $N\%$ of the previous term. Compute the sum of the infinite series.

R-5. *Let N be the number you will receive.* The volume of a rectangular prism is N cubic cm. The surface area of the prism is 2800 square cm. If the dimensions of the prism are $10 < B < C$, compute (B, C).