

DUSO Mathematics League 2015 - 2016

Contest #4.

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.

4 - 1. A maple tree is 6 yards tall and grows at the rate of 1 feet per year. An oak tree is 4 yards tall and grows at the rate of 2 feet per year. Compute the number of years after which the two trees are the same height.

4 - 2. Compute the values of x that satisfy the following equation:

$$(2x - 1)^2 + (3x + 2)^2 = (5x + 1)^2$$

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Part II.

GEOMETRY

Time Limit: 10 minutes

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4 - 3. Timmy added $\sin 38^\circ + \cos 81^\circ$. Jimmy added $\sin A^\circ + \cos B^\circ$ and got the same answer. If $A \neq 38$, $B \neq 81$, and A and B are first quadrant angles, compute $A + B$.

4 - 4. To make a logo, Lenny colors in the rectangle with opposite vertices $(5, 6)$ and $(-5, 2)$ and also the circle with equation $x^2 + y^2 = 16$. Note that the logo is symmetric with respect to the y -axis. Compute the total area colored.

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Part III.

ALGEBRA II / ADVANCED TOPICS

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4 - 5. In $\triangle BIG$, $BI = 12$, $IG = 8$, and $m\angle I = 60^\circ$. Compute the perimeter of $\triangle BIG$.

4 - 6. Compute the value of x that solves the system of equations: $(\log_5 9)x + (\log_7 2)y = \log_5 27$ and $(\log_2 7)x - (\log_3 5)y = \log_2 49$

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TEAM ROUND

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T-1. A lattice point is a point whose coordinates are integers. How many lattice points satisfy $x^2 + y^2 < 25$?

T-2. Many positive integers have 14 positive integer factors. If they were to be listed in increasing order, the second number in the list would be N . Compute N .

T-3. Compute all real values of x that solve
 $(\sqrt{x+3} - \sqrt{1-x})^3 - (\sqrt{x+3} - \sqrt{1-x})^2 + 4(\sqrt{x+3} - \sqrt{1-x}) = 12$.

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