

DUSO Mathematics League 2015 - 2016

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. Factor over the integers:  $2x^2 - x - 15$

3 - 2. Compute the sum of the arithmetic series  $5 + 8 + 11 + \cdots + 2015$ .

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Part II.

GEOMETRY

Time Limit: 10 minutes

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

3 - 3. Under a reflection in a line,  $(2, 6)$  has the image  $(6, 0)$ . The equation of the line is  $y = mx + b$ . Compute the ordered pair  $(m, b)$ .

3 - 4. In parallelogram  $GRAM$ , the diagonals cross at  $P$ , the angle bisector of  $\angle RGM$  intersects  $\overline{MA}$  at  $S$ , and the perpendicular from  $M$  to  $\overline{GS}$  intersects  $\overline{GS}$  at  $U$ . If  $GM = 11$  and  $GR = 17$ , compute  $UP$ .

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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.

3 - 5. For various integers  $k$ , the equation  $2x^2 - 5x + k = 0$  has two distinct real roots. Compute the greatest such integer  $k$ .

3 - 6. Jimmy chooses four letters at random from the letters in the word ADDITION. Compute the number of distinct ways in which he may do this. Note: the set  $\{A, D, D, I\}$  is not distinct from the set  $\{I, D, D, A\}$ .

**R-1.** In a triangle of perimeter 2016, the three sides have measures  $x$ ,  $2x - 672$ , and  $3x - 1344$ . Compute the degree measure of the greatest angle in the triangle.

**R-2.** Let  $N$  be the number you will receive. In parallelogram  $SCAM$ , angles  $S$  and  $C$  differ by  $N^\circ$ . If angle  $C$  is obtuse, compute the number of degrees in the measure of angle  $A$ .

**R-3.** Let  $N$  be the number you will receive. Jimmy, Timmy, and Kimmy are playing a game. Their total score is  $N$  points. Timmy has the average score of the three players. Kimmy beat Jimmy by 10 points. Compute Jimmy's score.

**R-4.** Let  $N$  be the number you will receive. In a room with  $N$  people, every child shakes hands with every adult once. A total of 54 handshakes take place. There are more children than adults in the room. Compute the number of children.

**R-5.** Let  $N$  be the number you will receive. Old Mother Hubbard had  $N$  children, and the difference between the ages of any two consecutive children is 2 years. The sum of their ages is 234 years. How old is the oldest child?