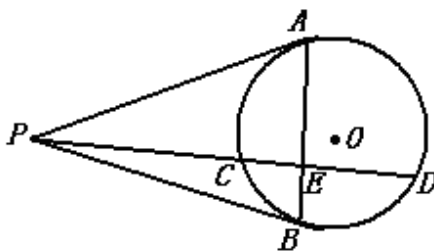


The following problems represent part of a complete set of sample problems (1/5 of Team Round, 1/3 of Relay Round, and 1/4 of Individual Round). Teams that have completed the registration process will receive a complete set of sample problems and solutions.

Middle School Level:

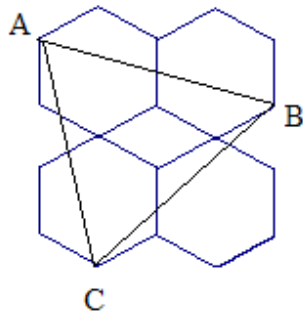
I. Team Round

- Let the values of a be selected, in order, from $\frac{1}{1000}, \frac{1}{999}, \dots, \frac{1}{3}, \frac{1}{2}, 0, -\frac{1}{2}, -\frac{1}{3}, \dots, -\frac{1}{999}, -\frac{1}{1000}$ and let $b = \frac{a}{a + \frac{2}{5}}$ be the corresponding 1999 values. Also, let $c = \frac{b}{b + \frac{2}{5}}$ be the subsequent 1999 values. Then among the 3998 values for b and c , there are _____ negative values.
- A (500x500) matrix has 500 x 500 distinct numbers. Now pick the largest number from each row and form a 500 number set. Let A be the smallest number from that set. Similarly, pick the smallest number from each column and form another 500 number set. Let B be the largest number from that set. Suppose $A \neq B$. Then _____ would be the larger of these two numbers.
- Given four points $A(4, 1)$, $B(1, 2)$, C on the y -axis, and D on the x -axis. Suppose $ABCD$ forms a convex quadrilateral. Then, among all such quadrilaterals, the minimum perimeter would be _____.
- Given PA and PB as two tangent lines to Circle O and PCD as a secant line that intersects AB at E as in the figure. The size relationship between the proportions $\frac{PC}{PD}$ and $\frac{CE}{ED}$ is $\frac{PC}{PD}$ _____ $\frac{CE}{ED}$. (Use $<$, $>$, or $=$)



II. Relays Round:

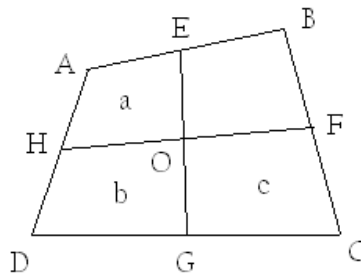
- Four equal sized regular hexagons with length of 1 are joined together as shown in the figure. If A , B , and C are 3 vertices of these hexagons, then area of $\triangle ABC$ is _____.



2. Let T = the answer passed from your teammate . If one acute angle of a right triangle is 15° and the sum of the lengths of the two sides that are adjacent to the right angle is T , then the hypotenuse has a length of _____.

III. Individual Round

- A store is purchasing a product to sell. This product is costing the store \$8 each. If the store sells this product for \$10 each, then it can sell 100 of this product. In general, if the sale price goes up by $a\%$, then the sale will go down by also $a\%$. To get the largest profit, the store should set the sales price at \$_____ each.
- Let $E, F, G,$ and H be the midpoints of the four sides of a convex quadrilateral $ABCD$ as in the figure below. If the three quadrilaterals $AEOH, DHOG,$ and $OFCG$ have areas of $a, b,$ and $c,$ respectively, then the area of quadrilateral $EBFO$ is _____.



- The integer portion of the value of $\frac{2011^{2011} + 2010^{2010}}{2011^{2011} - 2010^{2010}}$ is _____.
- In the table below, the numbers on the right and the numbers on the bottom represent the sum of the 4 numbers in their corresponding rows and columns. Each of the letters are rational number. Then the product $abcdefg =$ _____.

a	b	c	d	10
e	b	f	d	18
b	c	b	c	10
e	b	g	a	17
16	11	17	11	

Answers

Team Round

Problem	1	2	3	4
Answer	1990	A	$\sqrt{10} + \sqrt{34}$	=

Relays Round

Problem	1	2
Answer	$\frac{13\sqrt{3}}{4}$	$\frac{13}{4}\sqrt{2}$

Individual Round

Problem	1	2	3	4
Answer	14	$a + c - b$	1	5040