2018 John O'Bryan Mathematical Competition
Questions for the Two-Person Speed Event

Calculators ma not be used on the first four uestions

1. Let $k = \frac{x}{y}$ if $3^{x+4y} = \left(\frac{1}{9}\right)^{y-2x}$. Let $w = ab$ if $(a+b)^2 = 25$ and $a^2 + b^2 = 13$. Find the reduced, simplified form of $(k + w)$.

2. Define the universal set $U = \{0,1,2,3,4,5,6,7,8,9\}$. Let A be the set of possible unit digits in the square of any integer and B be the set of possible unit digits in the [illegible] set $A \cap B$ (the complement of A and B in U). Express your answer using set notation.

3. Let 2 and 10 be the first and third terms respectively of a sequence. k represents the 7^{th} term if the sequence is arithmetic. w represents the 7^{th} term if the sequence is geometric. Find $(k + w)$.

4. Let $a = |7 - 3\sqrt{6}| - |2\sqrt{6} - 4|$. Let $b = \lfloor \sqrt{18} - 2\pi \rfloor$. Find the exact value of $(a + b)$. Express your answer as a simplified radical expression. (Note: $\lfloor x \rfloor$ represents the greatest integer, or floor, function of x.)

Calculators ma be used on the remainin uestions

5. If $p < q < r$ are the lengths of the three sides of a triangle whose area is 1, let k be the exact

Name: **ANSWERS** Team Code:

[redacted]

1.	**8**	
2.	**{2,3,7,8}**	**Must be in set notation; any order.**
3.	**276**	
4.	$-6+\sqrt{6}$ **or** $\sqrt{6}-6$	**Must be one of these exact answers.**
5.	**200**	
6.	**22**	
7.	**876.6**	
8.	**0.551**	
T1.	**(–1, –24)**	**Must be this ordered pair.**
T2.	**13**	

Calculators are not allowed to be used on the first four questions!

This competition consists of eight competitive rounds. Correct answers will receive the following scores:

1st: 7 points
2nd: 5 points
All Others: 3 points

There is a three minute time limit on each round. You may submit only one answer each round. To submit your answer, fold this sheet **lengthwise** and hold it high in the air so that a proctor may check your answer.