

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

*****Calculators may not be used on the first four questions*****

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 square of any integer.

[Redacted area containing multiple horizontal lines for writing answers]

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 7th term if the sequence is arithmetic. w represents the 7th term if the sequence is geometric. Find $(k+w)$.

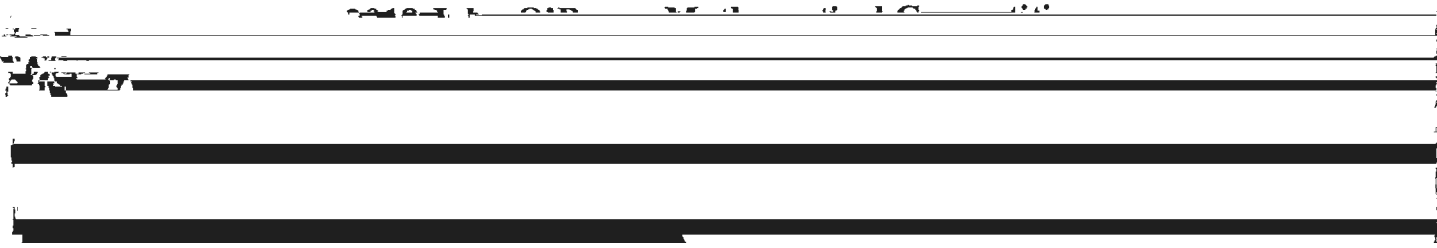
4. Let $a = |7 - 3\sqrt{6}| - |2\sqrt{6} - 4|$. Let $b = \lfloor \sqrt{18} - 2\pi \rfloor$. Find the exact value of $(a+b)$. Express your answer as a simplified radical expression. (Note: $\lfloor x \rfloor$ represents the greatest integer, or floor, function of x .)

*****Calculators may be used on the remaining questions*****

5. If $v < a < r$ are the lengths of the three sides of a triangle whose area is 1. Let k be the exact

Name: **ANSWERS**

Team Code:



1.

8

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

2.

{2,3,7,8}

Must be in set notation; any order.

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

3.

276

1st: 7 points

2nd: 5 points

All Others: 3 points

4.

$-6 + \sqrt{6}$ or $\sqrt{6} - 6$

Must be one of these exact answers.

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.

5.

200

6.

22

7.

876.6

8.

0.551

T1.

(-1, -24)

Must be this ordered pair.

T2.

13