

**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 squares of any integer and  $B$  be the set of possible unit digits in the cubes of any integer.

set  $A \cap B$  (the complement of  $A$  and  $B$  in  $U$ ). Express your answer using set notation.

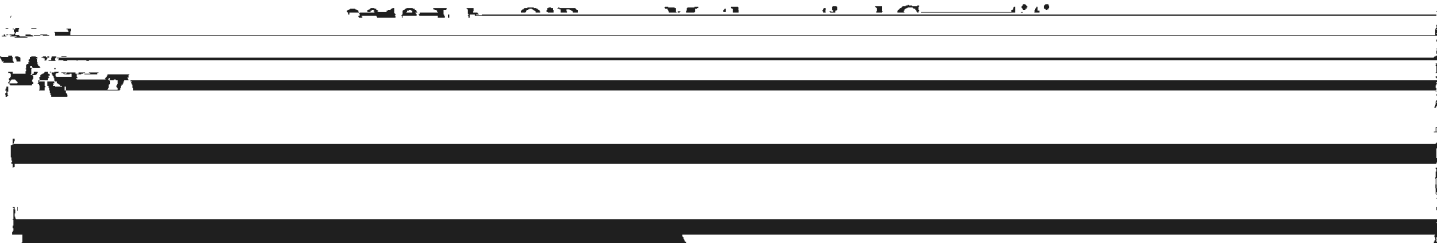
3. Let 2 and 10 be the first and third terms respectively of a sequence.  $k$  represents the 7<sup>th</sup> term if the sequence is arithmetic.  $w$  represents the 7<sup>th</sup> term if the sequence is geometric. Find  $(k+w)$ .
4. Let  $a = |7 - 3\sqrt{6}| - |2\sqrt{6} - 4|$ . Let  $b = \lfloor \sqrt{18} - 2\pi \rfloor$ . 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**

1<sup>st</sup>: 7 points

2<sup>nd</sup>: 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**