2022 John O'Bryan Mathematics Competition
5-Person Team Test

Abbreviated Instructions: Answer each of the following questions using separate sheet's of paper. Questions will not be scored without the following two items:

- Place your team code in the upper right corner of each page that will be turned in.
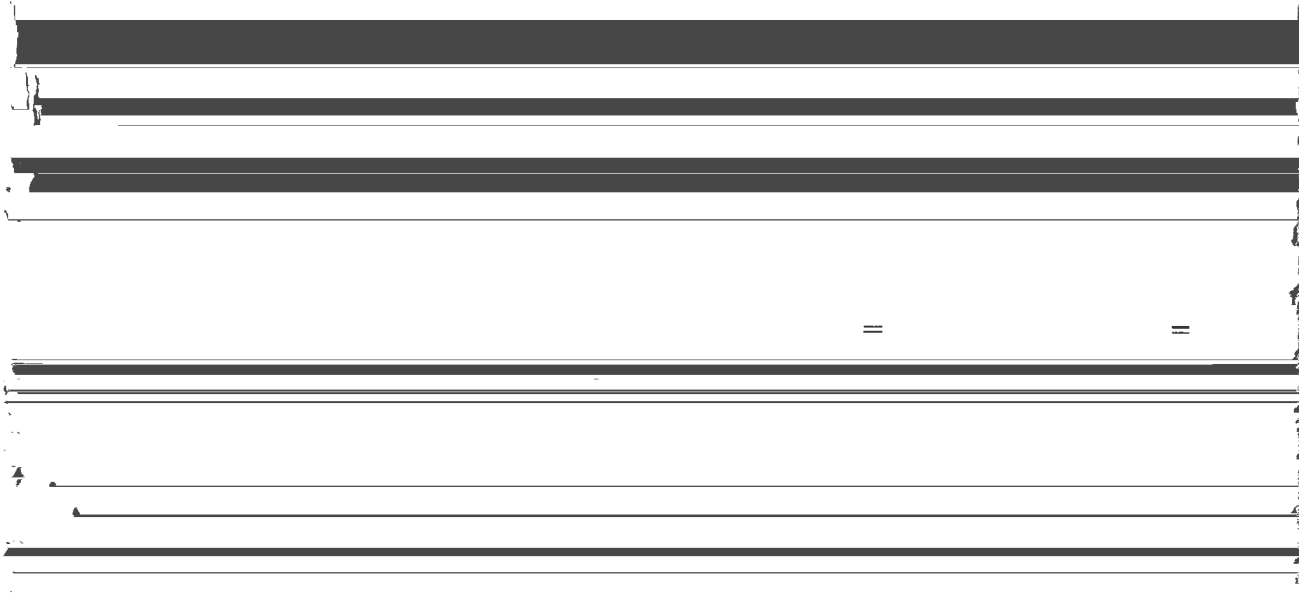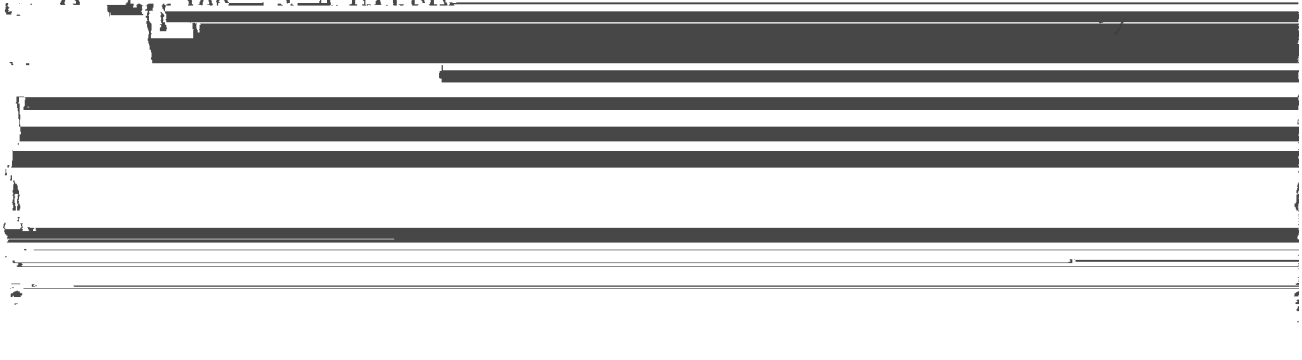- Place question numbers in the upper left corner of each page that will be turned in.

4. Jaden takes a mathematics test consisting of 100 questions, where the answer to each question is either TRUE or FALSE. For every five consecutive questions on the test, the

answers to exactly three of the questions are TRUE. If the answers to Question 1 and

a. Find the number of questions on the test for which the correct answer is TRUE.

b. Find the correct answer to the sixth question on the test.

Directions: Please answer all questions on the answer sheet provided. All answers must be written legibly and in simplest form. Exact answers are to be given unless otherwise specified in the question. No units of measurement are required. Each problem has the same point-value.

1. Determine which of the following five statement(s) is sufficient to deduct that $x > y$.

$$\text{A) } x + 1 = y \qquad \text{B) } x + 2.2 = y \qquad \text{C) } x - 1.3 = y \qquad \text{D) } xy > 0 \qquad \text{E) } xy < 0$$

$x \geq 2$
$x \leq 6$
$y \geq 1$
$y \leq 5$

5. Let $x^2 - 4y^2 = 30$ and $x - 2y = 5$. Determine the value of $(x + 2y)$.

6. The sum of twice a number and three times a second number is 16. The difference between the two numbers is 3. If the first number is greater than the second number, determine the sum of the two numbers.

7. Circle P has diameter $\overline{AB}$. $\triangle ABC$ is isosceles with base $\overline{BC}$ intersecting the circle at point D. $AC = 4$ and $DC = 1$. Determine the numeric area of $\triangle ABC$. Give your answer as a radical expression (in the form $a\sqrt{b}$), where b is a whole number as small as possible.

8. In a circle with center C, minor arc $\frown AB$ has length $\frac{8\pi}{9}$. $\angle ACB = 40°$. Determine the radius of the circle C.

9. Let $k = \sqrt{110 + \sqrt{110 + \sqrt{110 + \sqrt{110 \ldots}}}}$. Determine the exact value of k.

10 Let b and c be integers with $g(x) = x^2 + bx + c$ and $f(x) = x^2 + cx + b$. Determine the sum $(b + c)$ when $g(c) = f(b)$ and $c \neq b$.

11. A square with numeric area k is inscribed in a semicircle (two vertices of the square lie on the semicircle
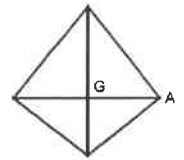
2022 John O'Bryan Mathematical Competition
Freshman/Sophomore Individual Test

Note: All answers must be written legibly in the correct blanks on the answer sheet and in simplest form. Exact answers are to be given unless otherwise specified in the question. No units of measurement are required. Each problem has the same point-value.

1.   11.

2.   12.

3.   13.

4.   14.

5.   15.

6.   16.

7.   17.

8.   18.

9.   19.

10.   20.

Name: _____ANSWERS_____ Team Code: _____

2022 John O'Bryan Mathematical Competition
Freshman-Sophomore Individual Test

Note: All answers must be written legibly and in simplest form. Exact answers are to be given unless otherwise specified in the question. No units of measurement are required. Each problem has the

1.

2. 640

3. $\dfrac{1}{18}$ reduced common fraction.

4.

5. 6

6. 7

7. $\sqrt{15}$ Must be this exact answer.

8. 4

9. 11

10. -1

11.

12. 4850

13. 11

14.

15. $2\sqrt{61}$ Must be this exact answer.

16. $\dfrac{1}{2}$ Must be this reduced common fraction.

17. 8

18. 1.457   Must be this decimal.

19. 88.443   Must be this decimal.

20. 3560

Directions: Please answer all questions on the answer sheet provided. All answers must be written legibly and

A

$$- = -$$

M

G

S

in simplest form. Exact answers are to be given unless otherwise specified in the question. No units of

14. In a geometric sequence $a_1 = 5$ and $r = 10$. Determine the value of a_5.

Name: _____   Team Code: _____

2022 John O'Bryan Mathematical Competition
Junior/Senior Individual Test

Note: All answers must be written legibly in the correct blanks on the answer sheet and in simplest form.
Exact answers are to be given unless otherwise specified in the question. No units of measurement

1. _____   11. _____

2. _____   12. _____

3. _____   13. _____

4. _____   14. _____

5.   15.

6.   16.

7.   17.

8.   18.

9.   19.

10.   20.

2022 John O'Bryan Mathematical Competition
Junior-Senior Individual Test

Note: All answers must be written legibly and in simplest form. Exact answers are to be given unless otherwise specified in the question. No units of measurement are required. Each problem has the same point-value (1 point).

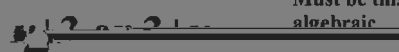$\sqrt{15}$ — Must be this radical expression.

3. 24

13. -3/2 — Must be this reduced fraction.

14.

5. $2\sqrt{61}$ — Must be this radical expression.

15. 3560

6. 2

16. 0 or zero

7. 8

17. 5/2

8. −15

18. 0.375 or .375 — Must be this decimal.

9. $i - 1$ or $\sqrt{-1} - 1$ — Must be one of these.

19. 2:5 — Must be this exact ratio.

10. 14

20. — Must be this

Calculators may not be used on the first four questions
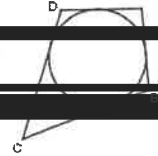
1. A system of equations has $x^2 - 4y^2 = 30$ and $x - 2y = 5$ and $k = x + 2y$.
   Quadrilateral $ABCD$ is circumscribed about a circle with side lengths $BC = 20$ and
   $AD = 17$. The perimeter of the quadrilateral is w. Determine the value of $k + w$.

2022 John O'Bryan Mathematical Competition
Two-Person Speed Event

Note: All answers must be written legibly and in simplest form. Exact answers are to be given unless

1.

2.

6.

7.

8.

SCORE

T1.

T2.

2022 John O'Bryan Mathematical Competition
Answers for the Two-Person Speed Event

Note: All answers must be written legibly and in simplest form. Exact answers are to be given unless otherwise specified in the question. No units of measurement are required. Each problem has the same point-value.

SCORE

1. _____ **80** _____

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

2. _____ **-9** _____

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

3. _____ **90** _____ "Degrees" optional

1st: 7 points
2nd: 5 points

4. _____ **9** _____

5. _____ **294** _____

There is a three minute time limit

6. _____ **1000** _____

7. _____ $\dfrac{7}{128}$ _____ Must be this reduced common fraction

8. _____ **23** _____

SCORE

T1. _____ **69** _____

T2. _____ **24** _____