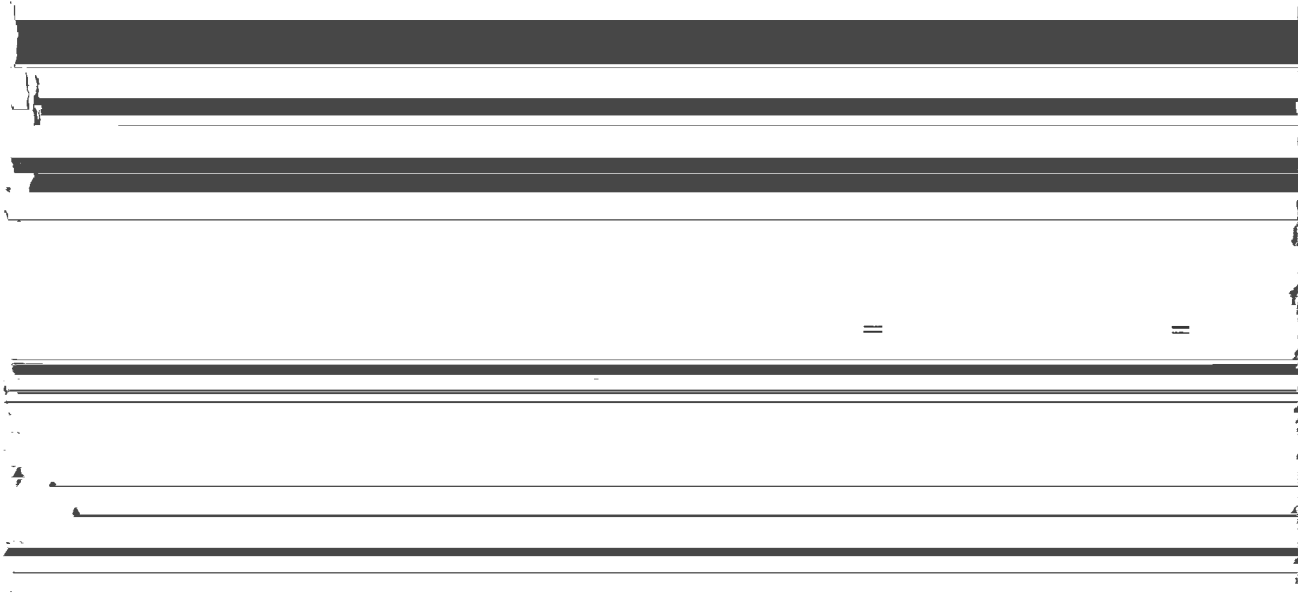
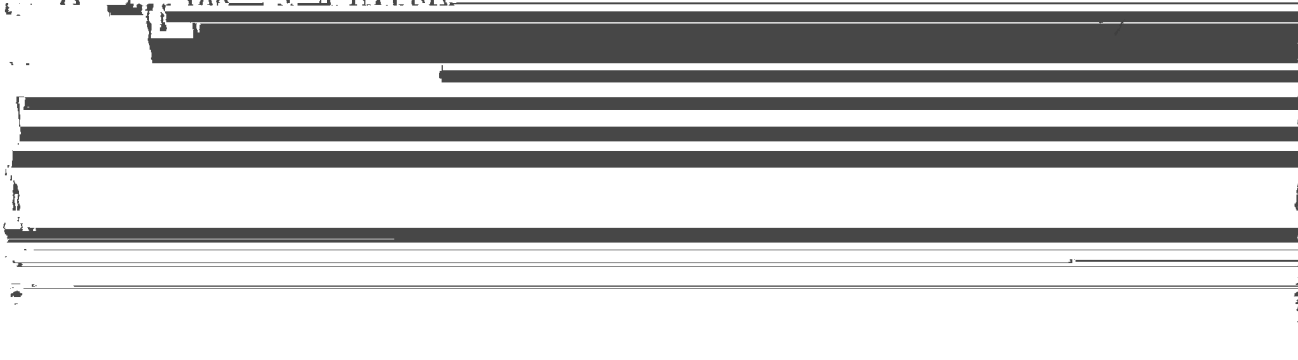




4. Jaden takes a mathematics test consisting of 100 questions, where the answer to each question is either TRUE or FALSE. For every five consecutive questions on the test, the



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.



**2022 John O'Bryan Mathematical Competition  
Freshman-Sophomore Individual 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.

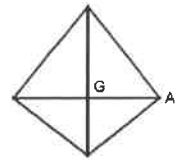
1. Determine which of the following five statement(s) is sufficient to deduct that  $x > y$ .

- A)  $x + 1 = y$     B)  $x + 2.2 = y$     C)  $x - 1.3 = y$     D)  $xy > 0$     E)  $xy < 0$

2. Jedyn just completed a 4-point test. On the first day, he scored 521. On the second day, he scored 11. On the third day, he scored 11. On the fourth day, he scored 11. On the fifth day, he scored 11. On the sixth day, he scored 11. On the seventh day, he scored 11. On the eighth day, he scored 11. On the ninth day, he scored 11. On the tenth day, he scored 11. On the eleventh day, he scored 11. On the twelfth day, he scored 11. On the thirteenth day, he scored 11. On the fourteenth day, he scored 11. On the fifteenth day, he scored 11. On the sixteenth day, he scored 11. On the seventeenth day, he scored 11. On the eighteenth day, he scored 11. On the nineteenth day, he scored 11. On the twentieth day, he scored 11. On the twenty-first day, he scored 11. On the twenty-second day, he scored 11. On the twenty-third day, he scored 11. On the twenty-fourth day, he scored 11. On the twenty-fifth day, he scored 11. On the twenty-sixth day, he scored 11. On the twenty-seventh day, he scored 11. On the twenty-eighth day, he scored 11. On the twenty-ninth day, he scored 11. On the thirtieth day, he scored 11. On the thirty-first day, he scored 11. On the thirty-second day, he scored 11. On the thirty-third day, he scored 11. On the thirty-fourth day, he scored 11. On the thirty-fifth day, he scored 11. On the thirty-sixth day, he scored 11. On the thirty-seventh day, he scored 11. On the thirty-eighth day, he scored 11. On the thirty-ninth day, he scored 11. On the fortieth day, he scored 11. On the forty-first day, he scored 11. On the forty-second day, he scored 11. On the forty-third day, he scored 11. On the forty-fourth day, he scored 11. On the forty-fifth day, he scored 11. On the forty-sixth day, he scored 11. On the forty-seventh day, he scored 11. On the forty-eighth day, he scored 11. On the forty-ninth day, he scored 11. On the fiftieth day, he scored 11. On the fifty-first day, he scored 11. On the fifty-second day, he scored 11. On the fifty-third day, he scored 11. On the fifty-fourth day, he scored 11. On the fifty-fifth day, he scored 11. On the fifty-sixth day, he scored 11. On the fifty-seventh day, he scored 11. On the fifty-eighth day, he scored 11. On the fifty-ninth day, he scored 11. On the sixtieth day, he scored 11. On the sixty-first day, he scored 11. On the sixty-second day, he scored 11. On the sixty-third day, he scored 11. On the sixty-fourth day, he scored 11. On the sixty-fifth day, he scored 11. On the sixty-sixth day, he scored 11. On the sixty-seventh day, he scored 11. On the sixty-eighth day, he scored 11. On the sixty-ninth day, he scored 11. On the seventieth day, he scored 11. On the seventy-first day, he scored 11. On the seventy-second day, he scored 11. On the seventy-third day, he scored 11. On the seventy-fourth day, he scored 11. On the seventy-fifth day, he scored 11. On the seventy-sixth day, he scored 11. On the seventy-seventh day, he scored 11. On the seventy-eighth day, he scored 11. On the seventy-ninth day, he scored 11. On the eightieth day, he scored 11. On the eighty-first day, he scored 11. On the eighty-second day, he scored 11. On the eighty-third day, he scored 11. On the eighty-fourth day, he scored 11. On the eighty-fifth day, he scored 11. On the eighty-sixth day, he scored 11. On the eighty-seventh day, he scored 11. On the eighty-eighth day, he scored 11. On the eighty-ninth day, he scored 11. On the ninetieth day, he scored 11. On the ninety-first day, he scored 11. On the ninety-second day, he scored 11. On the ninety-third day, he scored 11. On the ninety-fourth day, he scored 11. On the ninety-fifth day, he scored 11. On the ninety-sixth day, he scored 11. On the ninety-seventh day, he scored 11. On the ninety-eighth day, he scored 11. On the ninety-ninth day, he scored 11. On the hundredth day, he scored 11.

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  $\cap AB$  has length  $\frac{8\pi}{9}$ .  $\angle ACB = 40^\circ$ . Determine the radius of the circle  $C$ .
9. Let  $k = 110 + 110 + 110 + 110 \dots$ . 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)



**Name:**

**Team Code:**

**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.

11.

2.

640

12.

4850

3.



13.

11

4.

$\frac{1}{18}$

reduced common fraction.

14.



Must be this algebraic

5.

6

15.

$2\sqrt{61}$

Must be this exact answer.

6.

7

16.

$\frac{1}{2}$

Must be this reduced common fraction.

7.

$\sqrt{15}$

Must be this exact answer.

17.

8

8.

4

18.

1.457

Must be this decimal.

9.

11

19.

88.443

Must be this decimal.

10.

-1

20.

3560

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

Directions: Please answer all questions on this page. All answers must be written in the space provided.

A

— = —

M

G

S

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

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

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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. \_\_\_\_\_

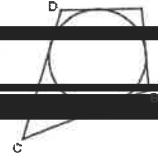
**2022 John O'Bryan Mathematical Competition  
Junior-Senior Individual Test**

**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).

- |     |                          |                                  |     |               |                                |
|-----|--------------------------|----------------------------------|-----|---------------|--------------------------------|
| 1.  | $\sqrt{15}$              | Must be this radical expression. | 11. | 18            |                                |
| 2.  | 14                       |                                  | 12. | 11            |                                |
| 3.  | 24                       |                                  | 13. | $-3/2$        | Must be this reduced fraction. |
| 4.  | 3                        |                                  | 14. | 5             |                                |
| 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. | $10/10$       | Must be this                   |

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

\*\*\*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  $k + w$ .

$$3x - 4y = 3$$



Names: \_\_\_\_\_

School: \_\_\_\_\_

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.

1. 80 \_\_\_\_\_ SCORE \_\_\_\_\_

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

2. -9 \_\_\_\_\_ SCORE \_\_\_\_\_

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

3. 90 \_\_\_\_\_ SCORE \_\_\_\_\_

1<sup>st</sup>: 7 points  
2<sup>nd</sup>: 5 points  
All Others: 3 points

4. 9 \_\_\_\_\_ SCORE \_\_\_\_\_

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. 294 \_\_\_\_\_ SCORE \_\_\_\_\_

6. 1000 \_\_\_\_\_ SCORE \_\_\_\_\_

7.  $\frac{7}{128}$  \_\_\_\_\_ SCORE \_\_\_\_\_

Must be this reduced common fraction

8. 23 \_\_\_\_\_ SCORE \_\_\_\_\_

T1. 69 \_\_\_\_\_ SCORE \_\_\_\_\_

T2. 24 \_\_\_\_\_ SCORE \_\_\_\_\_