

BGSU Mathematics Competition
March 25th 2023 **B** (below Calculus II)

No cell phones are allowed. Show all your work. Justify your answers.

- (1) Two people take turns breaking up a rectangular chocolate bar that is 4×6 squares in size. You can only break the bar along a division between the squares and only in a straight line. So, for example, the first person could break the bar into two 4×3 pieces and the second could break one of the 4×3 pieces into a 4×1 piece and a 4×2 piece. When the bar has been divided into single squares, the person who made the last division wins all the chocolate. Assuming you like chocolate, would you rather go first or second?

- (2) Find the units digit of

$$7^{2023} - 3^{2023}.$$

- (3) Find the sum:

$$S = 3 - 8 + 13 - 18 + 23 - 28 + \dots + 2003 - 2008 + 2013 - 2018 + 2023.$$

- (4) A commuter is in the habit of arriving at his suburban station each evening exactly at 5 PM. His wife always meets the train and drives him home. One day he takes an earlier train, arriving at the station at 4 PM. The weather is pleasant, so instead of telephoning home he starts walking along the route always taken by his wife. They meet somewhere on the way. He gets into the car and they drive home, arriving at their house ten minutes earlier than usual. Assuming that the wife always drives at a constant speed, and that on this occasion she left just in time to meet the 5 PM train, can you determine how long the husband walked before he was picked up?

- (5) Consider a 7×7 checkerboard with the squares at the four corners removed (so that the remaining board has 45 squares). Is it possible to cover this board with 1×3 tiles so that no two tiles overlap? Explain!

- (6) Two missiles speed directly toward each other, one at 9,000 miles per hour and the other at 21,000 miles per hour. They start 1,317 miles apart. Calculate how far apart they are one minute before they collide.

- (7) If $2^x = 10$ and $3^y = \frac{1}{3}$, determine the value of xy .

- (8) Show how to cut a 9×16 rectangle into two pieces that can be assembled into a 12×12 square.

Registration 2023 BGSU Mathematics Competition;

Your NAME:

E-mail:

(Optional)

Math class you are taking this semester/year:

Name of your instructor(s):

1)

2)

3)

4)

5)

6)

7)

8)

Total: