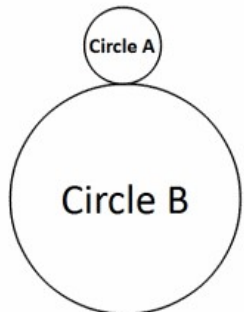


BGSU Mathematics Competition  
April 2nd 2022 **A** (above Calculus II)

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

- (1) Circle  $A$  has radius 1 and circle  $B$  has radius 3. Circle  $A$  rolls around circle  $B$  one trip back to its starting point. How many times will circle  $A$  revolve in total?



- (2) Solve for  $x$

$$\sin\left(\frac{5\pi x}{4}\right) = x^2 - 4x + 5.$$

(Hint: Complete the square on the RHS, and use the fact that  $\sin(a)$  cannot be larger than 1)

- (3) Find the units digit of  $3^{2022} - 2^{2022}$ .
- (4) David drives from his home to the airport to catch a flight. He drives 35 miles in the first hour, but realizes that he will be 1 hour late if he continues at this speed. He increases his speed by 15 miles per hour for the rest of the way to the airport and arrives 30 minutes early. How many miles is the airport from his home?
- (5) Claire adds the degree measures of the interior angles of a convex polygon and arrives at a sum of 2017. She then discovers that she forgot to include one angle. What is the degree measure of the forgotten angle?
- (6) At a gathering of 30 people, there are 20 people who all know each other and 10 people who know no one. People who know each other hug, and people who do not know each other shake hands. How many handshakes occur?
- (7) The region consisting of all points in three-dimensional space within 3 units of line segment  $AB$  has volume  $216\pi$ . What is the length  $AB$ ?
- (8) Let  $N = 12345\dots424344$  be the 79-digit number that is formed by writing the integers from 1 to 44 in order, one after the other. What is the remainder when  $N$  is divided by 45?

**Registration 2022 BGSU Mathematics Competition;**

**Your NAME:**

E-mail:

(Optional)

Math class you are taking this semester/year:

Name of your instructor(s):

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1)

2)

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4)

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Total: