

# MBMT Geometry Round – Germain

April 16, 2023

Full Name \_\_\_\_\_

Student ID Number \_\_\_\_\_

**DO NOT BEGIN UNTIL YOU ARE  
INSTRUCTED TO DO SO.**

This round consists of **8** questions. You will have **30** minutes to complete the round. Each question is *not* worth the same number of points. Questions answered correctly by fewer competitors will be weighted more heavily. Please write your answers in a reasonably simplified form.

- \_\_\_\_\_ 1 An equilateral triangle and a square have the same perimeter. If the side length of the equilateral triangle is 8, what is the square's side length?
- \_\_\_\_\_ 2 What is the maximum possible number of sides and diagonals of equal length in a quadrilateral?
- \_\_\_\_\_ 3 Patrick is rafting directly across a river 20 meters across at a speed of 5 m/s. The river flows in a direction perpendicular to Patrick's direction at a rate of 12 m/s. When Patrick reaches the shore on the other end of the river, what is the total distance he has traveled?
- \_\_\_\_\_ 4 Quadrilateral  $ABCD$  has side lengths  $AB = 7$ ,  $BC = 15$ ,  $CD = 20$ , and  $DA = 24$ . It has a diagonal length of  $BD = 25$ . Find the measure, in degrees, of the sum of angles  $ABC$  and  $ADC$ .
- \_\_\_\_\_ 5 What is the largest  $P$  such that any rectangle inscribed in an equilateral triangle of side length 1 has a perimeter of at least  $P$ ?
- \_\_\_\_\_ 6 A circle is inscribed in an equilateral triangle with side length  $s$ . Points  $A, B, C, D, E, F$  lie on the triangle such that line segments  $AB, CD$ , and  $EF$  are parallel to a side of the triangle, and tangent to the circle. If the area of hexagon  $ABCDEF = \frac{9\sqrt{3}}{2}$ , find  $s$ .
- \_\_\_\_\_ 7 Let  $\triangle ABC$  be such that  $\angle A = 105^\circ$ ,  $\angle B = 45^\circ$ ,  $\angle C = 30^\circ$ . Let  $M$  be the midpoint of  $A, C$ . What is  $\angle MBC$ ?
- \_\_\_\_\_ 8 Points  $A, B$ , and  $C$  lie on a circle centered at  $O$  with radius 10. Let the circumcenter of  $\triangle AOC$  be  $P$ . If  $AB = 16$ , find the minimum value of  $PB$ .

The circumcenter of a triangle is the intersection point of the three perpendicular bisectors of the sides.