Shapes

Instructions: Write the exact answer to each question in the corresponding blank. Remember that the winners in this event are those participants who answer the most questions correctly in a row beginning with the first question. So, try to get as far as you can without making a mistake!

1. Triangle $ABC$ shown below is an equilateral triangle. What is the slope of the line segment $BC$?

![Equilateral Triangle](image1)

1. ____________

2. The triangle $ABC$ shown below is an isosceles right triangle with $BC = AB = 2$. A circular arc of radius 2 with center at $C$ meets the hypotenuse at $D$. A circular arc of radius 2 with center at $A$ meets the hypotenuse at $E$. What is the area of the shaded region?

![Isosceles Right Triangle](image2)

2. ____________

3. Points $A$, $B$, and $C$ are arranged clockwise on a circle as shown in the figure below. To start we place a marker on point $A$. We roll a 6-sided die and move the marker as follows:

(a) If the die shows 1 or 2, stay put.

(b) If the die shows 3 or 4, move one step clockwise.

(c) If the die shows 5 or 6, move one step counterclockwise.

What is the probability that after 2020 moves the marker is at point $A$?

![Circle with Points](image3)

3. ____________
4. How many triangles are in the following figure?

![Figure with triangles]

4. ____________

5. In the square $MATH$ a point $S$ is chosen on side $TH$. Then an incircle of radius $r$ is inscribed in quadrilateral $MASH$, and an incircle of radius $s$ is inscribed in triangle $SAT$. Given that $AT = 1$ and that the ratio $r : s = \frac{5}{4}$, determine the exact length of $SH$.

![Square with incircles]

5. ____________

6. The Sierpinski triangle may be constructed from an equilateral triangle by repeated removal of triangular subsets as follows (see picture below):

(a) Start with an equilateral triangle;
(b) Subdivide it into four smaller congruent equilateral triangles and remove the central triangle;
(c) Repeat step 2 with each of the remaining smaller triangles indefinitely.

If the initial equilateral triangle has area 1, how much area has been removed from the original triangle to construct $S_{2020}$?

![Sierpinski triangles]

6. ____________
College of Charleston Math Meet 2020

Shapes Timed Sprint

Name (please print): ________________________________

School: ________________________________

The grading for the Timed Sprints is unusual! Your grade will be the number of questions answered correctly, starting with the first question, before you make a mistake. For example, if you only answer questions 1-4 correctly and questions 7-13 correctly, your grade will be a “4” since you did not get question 5 right. You will have a limited amount of time to work on the sprint. Your paper will be collected at the end of this period.

By my signature below I certify that all of the work completed on this sprint is my own.