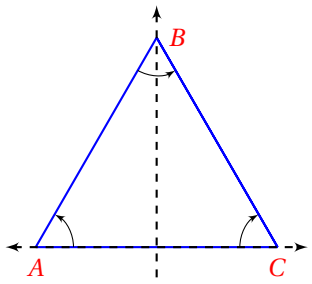
Shapes

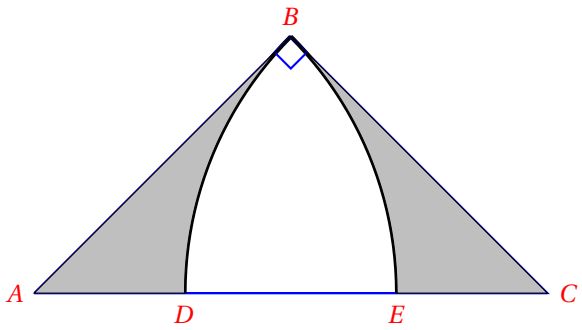
Instructions: Write the exact answer to each question in the corresponding blank. Remember that the winners in this event are those participants who answer the most questions correctly *in a row* beginning with the first question. So, try to get as far as you can without making a mistake!

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



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?



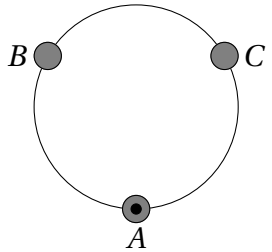
2. _____

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.

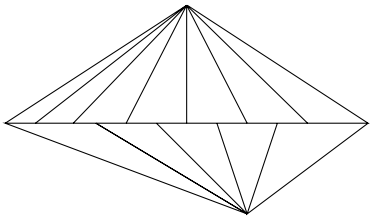
   (c) If the die shows 5 or 6, move one step counterclockwise.



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

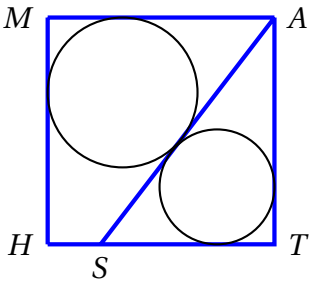
3. _____

4. How many triangles are in the following figure?



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 $\overline{AT} = 1$ and that the ratio $r : s = \frac{5}{4}$, determine the exact length of $\overline{SH}$.



5. _____

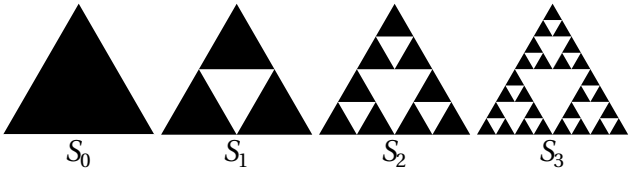
6. The Sierpinski triangle may be constructed from an equilateral triangle by repeated removal of triangular subsets as follows (see picture below):

   (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}?



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.