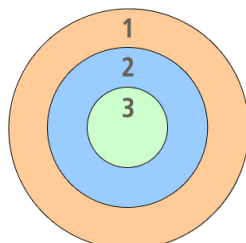


# CCA MATH BONANZA

## Team Round

1. An archery target can be represented as three concentric circles with radii 3, 2, and 1 which split the target into 3 regions, as shown in the figure below. What is the area of Region 1 plus the area of Region 3?



2. How many ways are there to rearrange the letters of the word *RAVEN* such that no two vowels are consecutive?
3. A tortoise is given an 80-second head start in a race. When Achilles catches up to where the tortoise was when he (Achilles) began running, he finds that while he is now 40 meters ahead of the starting line, the tortoise is now 5 meters ahead of him. At this point, how long will it be, in seconds, before Achilles passes the tortoise?

4. Evaluate the continued fraction

$$1 + \frac{2}{2 + \frac{2}{2 + \dots}}$$

5. Emily Thorne is throwing a Memorial Day Party to kick off the Summer in the Hamptons, and she is trying to figure out the seating arrangement for all of her guests. Emily saw that if she seated 4 guests to a table, there would be 1 guest left over (how sad); if she seated 5 to a table, there would be 3 guests left over; and if she seated 6 to a table, there would again be 1 guest left over. If there are at least 100 but no more than 200 guests (because she's rich and her house is 20000 square feet), what is the greatest possible number of guests?
6. A semicircle is inscribed in right triangle  $ABC$  with right angle  $B$  and has diameter on  $AB$ , with one end on point  $B$ . Given that  $AB = 15$  and  $BC = 8$ , determine the radius of the semicircle.
7. At a party, five of Ryan's friends arrive, each hanging their coats on the coat rack. When they leave, Ryan hands out coats in a random order to his friends. What is the probability that at least half of them receive the right coat? (Half of them is 3 or more)
8. Triangle  $ABC$  is equilateral with side length  $\sqrt{3}$  and circumcenter at  $O$ . Point  $P$  is in the plane such that  $(AP)(BP)(CP) = 7$ . Compute the difference between the maximum and minimum possible values of  $OP$ .
9. The Fibonacci numbers are defined as the sequence  $F_n$  with  $F_0 = 1, F_1 = 1$  and  $F_{n+2} = F_{n+1} + F_n$ . How many ways can 10 be written as an ordered sum of numbers found in the Fibonacci sequence? For example, 3 can be written as  $1 + 1 + 1, 2 + 1, 1 + 2$ , and 3, for a total of 4 ways.
10. If  $\cos 2^\circ - \sin 4^\circ - \cos 6^\circ + \sin 8^\circ + \dots + \sin 88^\circ = \sec \theta - \tan \theta$ , compute  $\theta$  in degrees.