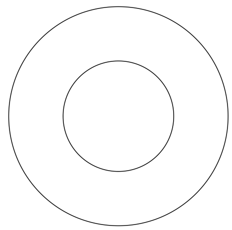
Set 1

1. **(4)** What is the greatest number of regions you can divide a donut shape into using only two lines?



2. **(4)** Find

$$\frac{(x-2)(x-4)(x-6)\cdots(x-100)}{(x+2)(x+4)(x+6)\cdots(x+100)}$$

when $x = 82$.

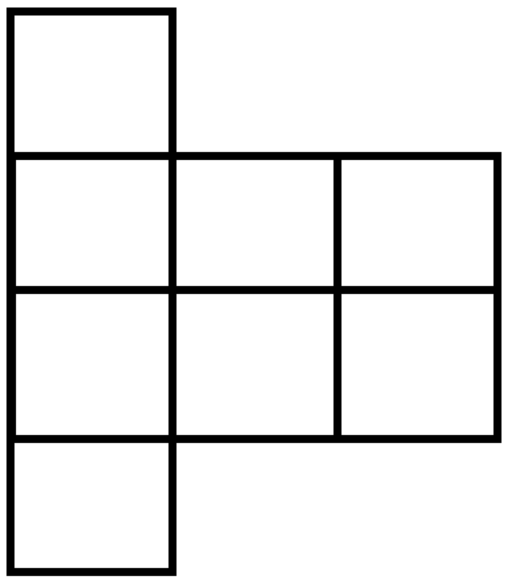
3. **(4)** Kayla the frog notices that the amount of lily pads in his magical pond doubles every day. If it takes 8 days for the lily pads to completely cover the pond, how many days will it take for the lily pads to cover half of the pond?

Team: ____________________

Set 2

1. **(5)** Albert is playing a number game where he tries to reduce a number to 0. He starts off with the number 23 and every turn, he can either add 1 to the number, divide the number by 2, or subtract 3 from the number. What is the smallest number of turns it will take for him to reduce 23 to 0?

2. **(5)** How many ways are there to place the numbers 1-8 in the boxes below such that no boxes connected by an edge or a corner contain adjacent numbers? For example, the numbers 1 and 2 are adjacent, but 2 and 8 are not.



3. **(5)** Jasmine, Jessica, and Juliet go on a vacation together to Detroit. At the end of the vacation, they realize that Jasmine has paid 40% of the total cost of the trip, Jessica has paid exactly \$80, and Juliet has paid half as much as the other two combined. If the total cost of the trip can be written as $\$x$, what is the value of x?

Team: ____________________

Set 3

1. **(6)** Yaozu is walking his dog Fisher along the paths of a park. From his starting position, he walks 20 meters south, 40 meters east, 20 meters south again, 20 meters west, and then returns to his starting point in a straight line. The perimeter of the park is defined by Yaozu's path, what is the area of the park, in square feet?

   ____

2. **(6)** Jasmine is playing a number theory game where she writes down a positive integer only if

   (a) It is less than 1000.

   (b) It has an even number of factors.

   (c) Its factors are all even.

   (d) She excludes 1 as a factor.

   How many numbers does she write down?

   ____

3. **(6)** A circle with center O has a radius of 5. Let P and Q be two points on the edge of the circle exactly 5 units away from each other. What is the measure of $\angle PQO$ in degrees?

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Team: ____________________

Set 4

1. **(7)** Elysia was born 4 years after her older brother, Hubert. In 32 years from now, he will be 15 years older than three-fourths of Elysia's age. What is the product of their current ages?

2. **(7)** Sage has a circular hoop of radius 1 meter. Using a piece of wire, she makes the largest equilateral triangle that can "fall through" the circular hoop. What is the height of this triangle?

3. **(7)** Milo forgot his mother's 9-digit phone number. He does, however, remember two facts about it:

   (a) It can only contain 1's and 2's.

   (b) All of the 1's are to the left of all of the 2's (if there are any).

   Based on this information, what is the greatest number of times Milo must test the phone number before getting it correct?

Team:

Set 5

1. **(8)** Sarah has six different pairs of socks and 4 different pairs of pants. If she can't wear her pink socks with her blue pants and she can only wear her black socks if she wears her red pants, how many different outfit choices does she have?

   ____

2. **(8)** A certain unfair coin is weighted so that it is twice as likely to land on heads than on tails. If three of such coins are tossed at the same time, the probability of getting exactly two heads can be written as the simplified fraction $\frac{m}{n}$. What is $m+n$?

   ____

3. **(8)** Gavin, Jonathan, and Robert are competing in a 600-meter race. Robert finishes the race 25 seconds faster than Jonathan with a 150-meter lead, and Jonathan finishes the race 20 second faster than Gavin. Assuming that all three competitors run at a constant rate, how many meters are left in Gavin's race when Robert crosses the finish line?

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Team: ____________________

Set 6

1. **(9)** A right rectangular prism has integer side lengths and a volume of 72 cubic units. What is the greatest possible surface area of the prism?

2. **(9)** With tape and scissors, Aarzu makes a paper butterfly by cutting up a circle with radius 6 inches. She first folds the circle in half, then she makes two straight 6-in cuts from the center to the edge of the circle, 15 degrees into the semi-circle from both sides. Without unfolding, she then cuts five full circular holes with radius 1 in out of the new shape. Finally, she unfolds her masterpiece. If the area of her butterfly, in square inches, can be written in the form $x \cdot \pi$, what is the value of x?

3. **(9)** A claw machine at an arcade has 5 stuffed bears, 3 stuffed komodo dragons, and 22 stuffed salamanders. Rosie comes to the arcade to play 4 games every afternoon until the machine runs out, but the janitor comes in every evening to add a package of 3 stuffed animals to whichever kind with the least number. Rosie always goes for the animal with the highest number, re-targeting each game. If numbers are the same, both Rosie and the janitor prefer bears over dragons and dragons over salamanders. Given that Rosie always wins, which animal runs out first? Type 1 for bear, 2 for dragon, and 3 for salamander.

Team: ____________

Set 7

1. **(10)** A circle with a radius of 4 has a center denoted by point P. Points A and B exist outside the circle such that $\angle APB = 60°$. Let the points C and D be the intersections of $\overline{AP}$ and $\overline{BP}$ with the circumference of the circle, respectively. If $\overline{AB}$ is parallel to $\overline{CD}$ and the length of $\overline{AB}$ is equivalent to the length of the circumference, the length of $\overline{BP}$ can be written in the form $x \cdot \pi$. What is the value of x?

____

2. **(10)** Let the number of 4-card hands where no two cards have the same suit or numerical/face value be x. There are four suits (spades, clubs, hearts, diamonds) in a deck, and each suit has 10 numerical cards and 3 face cards. What is the sum of the digits of x?

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3. **(10)** In how many ways can you completely cover a 2 by 3 floor with identical 2 by 1 and 1 by 1 tiles? Configurations created by rotation are considered different configurations.

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Team: ______________________

Set 8

1. **(11)** Let $m = \frac{99999919}{10009}$. What is the sum of the digits of m?

2. **(11)** $\triangle ABC$ is an equilateral triangle with side length 4. Let point M be on $\overline{\mathrm{AB}}$ such that $AM : BM = 1 : 1$, and point N on $\overline{\mathrm{BC}}$ such that $BN : NC = 1 : 2$. The area of $\triangle BNM$ can be written in the simplified and rationalized form $\frac{k\sqrt{m}}{n}$, what is $k + m + n$?

3. **(11)** Gavin's restroom has toilet paper dispensers labeled A and B, each of which can hold one roll of toilet paper. Assume that Gavin obeys the following rules when doing his business:

   (a) He uses exactly $\frac{19}{100}$ rolls of toilet paper for every bathroom trip.

   (b) He only uses toilet paper from dispenser B when the roll in dispenser A runs out.

   (c) If a roll of toilet paper runs out during a bathroom trip, it will be replaced before the next trip.

   One day, Will realizes that he doesn't have enough ($\frac{19}{100}$ rolls of) toilet paper to take care of his business! What is the smallest number of bathroom trips he could have had before this?

Team: ________________