

Name: _____ Score: _____ / 45

PLEASE DO NOT FILL IN THE "SCORE" BLANK!

Grade: _____ Team: _____

This is a round consisting of 9 problems that is to be done in 35 minutes. The problems are split into 3 themes.

No aids are permitted aside from pencils, pens, and scratch paper. In particular, no calculators or other computers are permitted. Communication with other people is not permitted.

Record your answers in the box corresponding to the correct problem. Only answers printed in the boxes below will be scored.

Your Answers

Mother	Chess	Macmatics
1.	1.	1.
2.	2.	2.
3.	3.	3.

Mother

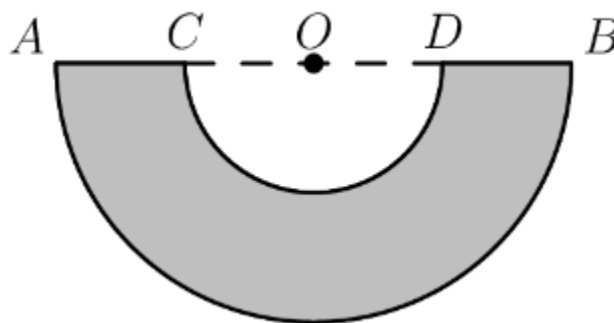
1. If I have a mother and a father, and each of my parents have a mother and a father, how many mothers are there in my family tree, starting from the generation of my great-great-great-great-great-grandparents?
2. Noelle is 50% Martian: her father is a Martian while her mother is human. Noelle's husband, Percy, has four grandparents, three of which are pure Martian and one being fully human. Noelle and Percy have a daughter named Marcy. What percent Martian is Marcy? Give an answer between 0 and 100 in decimal form.
3. Graham cares for his mother, Gretchen, who is twice his age. Graham's granddaughter Grace's age is the square root of the sum of his grandson Griffin's age and two. Coincidentally, Graham's age is also Griffin's age times eight plus two. The product of Griffin and Grace's ages is 21. How old is Gretchen?

Chess

1. Magnus wants to paint each square of his 8x8 chessboard white or black. How many ways can he color his chessboard? If the answer can be expressed as $2^{(2^a)}$, find a .
2. Macnus is very silly, and he wants to replace all of his 16 pieces with macaroni. In each round, he chooses one of his chess pieces at random, and replaces it with a piece of macaroni. (A macaroni is not considered a piece, and he begins with 2 rooks.) What is the probability that both rooks have not been replaced with macaroni after 5 rounds?
3. On the floor, Hikaru found 6 pawns, 2 knights, and 1 bishop. In how many unique orders can he arrange these pieces in a line?

Macmatics

1. One day, when eating macaroni for lunch, Mr. Mac was bored, so he cut one of his macaroni into the cross section below. If $AB = 8$ millimeters and $CD = 4$ millimeters, the area of the macaroni-shaped shaded region, in square millimeters, can be expressed as $n\pi$, where n is a positive integer. Find n .



2. In an infinitely large tank containing infinitely many fish, there are five types of fish: salmon, cod, trout, tuna, and Mr. Mac's favorite, mackerel. What is the minimum amount of fish Mr. Mac must fish out of the tank to guarantee that he has at least one of the following: 10 salmon, 15 cod, 13 trout, 18 tuna, or 2023 mackerel?

3. Mr. Mac is configuring his home network and is looking at the devices connected to his wifi. He is looking at Mac addresses, where each device has a unique identifier made of 12 digits in hexadecimal. Hexadecimal is a numbering system with digits 0-9, as well as a, b, c, d, e, and f. Therefore, there are 16 different possible distinct digits. Mr. Mac wants to know how many different Mac addresses are possible if no digits are repeated. What is $a - b$ if the total number can be expressed in the form $\frac{a!}{b!}$?