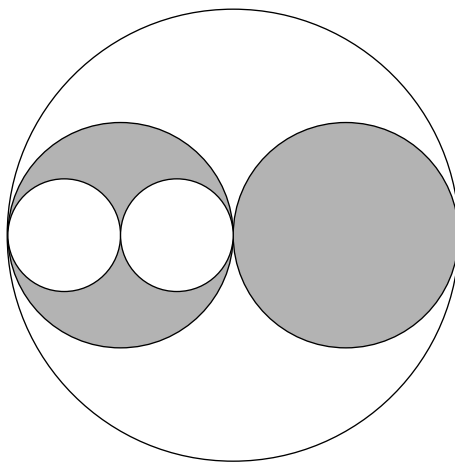


Time Limit: 30 minutes.

Instructions: For this test, work in teams of up to four to solve 10 short answer questions. All answers must be expressed as integers unless specified otherwise. Only answers written inside their appropriate space on the answer sheet will be graded.

No calculators.

- The figure below shows a large white circle, with two gray circles with equal area inscribed in its interior. In one of these gray circles, two white circles with equal area are inscribed in its interior. The fraction of this large white circle that is shaded can be expressed as $\frac{x}{y}$, where x and y are relatively prime. What is $x + y$?



- The value of $1 + \frac{1}{1 + \frac{2}{2+3}}$ is m/n , where m and n are relatively prime positive integers. Find $m+n$.
- Find $\left(\frac{2^2+2}{2^2-2}\right)\left(\frac{3^2+3}{3^2-3}\right)\cdots\left(\frac{30^2+30}{30^2-30}\right)$
- Let $\triangle ABC$ be a triangle and let D be the midpoint of BC such that $BC = 14$, $AD = 8$, and $AC = 8$. Suppose $\triangle ABD$ is rotated about point A such that D goes to C and B goes to a point E . BE can be represented in the form $\frac{a\sqrt{b}}{c}$, where a and c are relatively prime positive integers and b is not divisible by the square of any prime. Find $a + b + c$.
- What is the 10th smallest positive integer m such that $m^3 + 3m^2$ is a perfect square?
- Fibo the dog enjoys playing in the mud and playing in puddles. Everytime Fibo plays in the mud, his filthiness level increases by 2, and every time he plays in the puddle, his filthiness level decreases by 1. Fibo currently has a filthiness level of 1. How many ways are there for Fibo to play in the mud or puddles 6 times total such that he never becomes fully clean (that is, he never reaches filthiness level 0)?
- A geometric sequence with n terms has first term 1 and constant ratio 2. Find the minimum n such that the sum of the geometric sequence is divisible by 67.
- What is the maximum possible number of disjoint regions formed by 8 circles, 10 lines, and 3 squares?
- The value of $2^{12} + 5^8 + (2^6 \cdot 5^4)$ can be written as the product of one unique pair of three digit positive integers. Find the larger of these two positive integers.
- How many strings of length 5 consisting of the digits 5, 6, 7, 8, 9 are there such that the least common multiple of any two adjacent terms in the string is less than 45? For example, 75886 is a valid string, while 59865 is not a valid string.