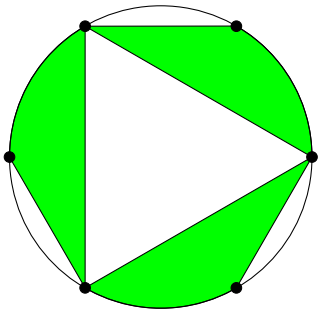
New Zealand Mathematical Olympiad Committee

Maths Workshop

July 2021

Problems

1. What fraction of the circle's area is shaded?



2. How many integers of the form $1444\ldots44$ are perfect squares? (a '1' followed by any number of '4's)

3. We have a sequence of 10 positive integers whose sum is less than 20. Is it possible that no subsequence has sum equal to 10?

4. Let f and g be functions such that $f(x+g(y)) = 2x+y$ for all real x and y. Determine the value of $g(2+f(3))$.

5. Triangle ABC is equilateral. Point P exists somewhere such that $PA = 3$ and $PB = 4$. What is the greatest possible value of length PC?

6. Find all primes p such that $(p-1)!+1$ is a power of p.